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Grade thresholds – November 2017

Cambridge IGCSE Computer Science (0478)

Grade thresholds taken for Syllabus 0478 (Computer Science) in the November 2017 examination.

		minimum raw mark required for grade:						
	maximum raw mark available	A	B	C	D	E	F	G
Component 11	75	48	40	33	28	23	18	13
Component 12	75	49	41	34	28	23	18	13
Component 13	75	48	40	33	28	23	18	13
Component 21	50	31	23	16	12	9	6	3
Component 22	50	34	26	19	15	11	7	3
Component 23	50	31	23	16	12	9	6	3

Grade A* does not exist at the level of an individual component.

The maximum total mark for this syllabus, after weighting has been applied, is **125**.

The overall thresholds for the different grades were set as follows.

Option	Combination of Components	A*	A	B	C	D	E	F	G
AX	11, 21	93	78	63	49	40	32	24	16
AY	12, 22	97	82	67	53	43	34	25	16
AZ	13, 23	93	78	63	49	40	32	24	16

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COMPUTER SCIENCE **0478/11**

Paper 1 **October/November 2017**

MARK SCHEME

Maximum Mark: 75

Published

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[Turn over

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Question	Answer	Marks
1(a)	Output	**1**
1(b)	1 mark for each correct conversion *E* | *0* | *4* **1 1 1 0 | 0 0 0 0 | 0 1 0 0**	**3**
1(c)	Any **one** from: – Hexadecimal codes can fit in a smaller display rather than a full text based message – Smaller amount of memory needed to store the hex error messages than text based	**1**
1(d)	1 mark for correct sensor, 1 mark for corresponding use Possible examples could include: – Temperature (sensor) – To monitor the temperature of the water – Pressure (sensor) – To monitor the level of water in the washing machine – Motion (sensor) – To monitor whether the drum is still in motion – pH (sensor) – To monitor the level of water hardness/detergent present in the water	**6**

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Question	Answer	Marks
2	1 mark for each correct file format e.g. File type: File format Pictures: .JPEG Text: .doc, .txt, .rtf, .docx, .odt .pdf Sound: .mp3, .wav, .aif, .flac, .mid Video: .mp4, .flv, .wmv	**3**

Question	Answer	Marks
3(a)	– Part 1 (access) protocol – Part 2 domain (name) – Part 3 filename	**3**
3(b)	**Four** from: – IP address is used to identify a device (on the Internet / network) – IP address is allocated by the network/ ISP – Can be used in place of URL – IP addresses can be IPv4 or IPv6 – IP address can be static … – ... meaning it doesn't change each time it is connected to the Internet – IP address can be dynamic …. – … meaning that it can change each time a device is connected to the Internet – Any valid example (e.g. xxx.xxx.xxx.xxx or xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx)	**4**

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Question	Answer	Marks
4	1 mark for each correct line up to a total of 5 marks 	**5**

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Question	Answer	Marks
5(a)	1 mark for each correct logic gate	4

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Question	Answer	Marks
5(b)	1 mark for correct logic gate symbol: Any **four** from: – similar to an OR gate – It has (at least) two inputs – Output will be high/1 if both inputs are different – Output will be high/1 if either input is high – Output will be low/0 if both inputs are high – Output will be low/0 if both inputs are low	**5**

Question	Answer	Marks
6	Any **six** from: 2D – (Scanner) shines a light onto the surface of a document // Light moves across document – Reflected light is captured – Uses mirrors and lenses – Captured image is converted into a digital file – Produces a 2D digital image 3D – Scanners shines a laser (or light) over the surface of a 3D object – Records measurements of the geometry/dimensions of the object – Measurements are converted to digital file – Produces a 3D digital model	**6**

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Question	Answer	Marks
7	1 mark for each correct tick	6

Statement	true (✓)	false (✓)
Firewalls can monitor incoming and outgoing traffic.	✓	
Firewalls operate by checking traffic against a set of rules.	✓	
Firewalls cannot block access to a certain website.		✓
Firewalls can be software and hardware.	✓	
Firewalls can act as intermediary servers.		✓
Firewalls can block unauthorised traffic.	✓	

Question	Answer	Marks
8(a)	Any **three** from: – Human error (e.g. deleting/overwriting data) – Physical damage – Power failure/surge – Hardware failure – Software crashing	3
8(b)	Any **three** from: – Online shopping // Online payment systems // Online booking – Email – Cloud based storage – Intranet/extranet – VPN – VoIP // video conferencing – Instant messaging (IM) // social networking // online gaming	3

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Question	Answer	Marks
8(c)	1 mark for identifying, 1 mark for description – Strong password – To make it difficult to hack an account – Biometric device – To use data that is difficult to fake as a password – TLS // Encryption – To make data meaningless if intercepted – To encrypt data that is exchanged (TLS only) – More secure than SSL (TLS only) – Anti-spyware (software) – To find and remove any spyware that is installed on a computer – To help stop key loggers recording key presses – Firewall – To help prevent unauthorised access to an account – Blocks any requests that do not meet/match the criteria – Authentication (card reader at home)/mobile security code app/two-step verification – To add another level of identification of the user – Use of drop-down boxes (or equivalent) – So key loggers cannot record the key presses – Proxy server – To divert an attack away from the main system	**6**

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Question	Answer	Marks
9(a)	Any **four** from: – (Red) laser is used – (Laser beams) shines onto surface of the disk – It is rotated (at a constant speed) to be read – Surface is covered in a track (that spirals from the centre) – Data is represented on the surface using pits and lands – Pits and lands represent binary values – Pits reflect light back differently (to the area in between/land) – Optical device can determine the binary value from the light reflection	**4**
9(b)	1 mark for calculation, 1 mark for correct answer: – 1000 × 16 – 16000/8 – Answer is **2000** bytes	**2**
9(c)	**Four** from: (Max 2 for either primary or secondary) – Primary RAM and ROM – Secondary HDD and SSD – Primary is directly accessible by CPU – Secondary is not directly accessible by CPU – Primary is internal to computer – Secondary can be internal **or** external to the computer – Primary stores boot up instructions **and** can hold data whilst being processed – Secondary stores files/software – Primary has faster access speed – Secondary has a slower access speed – Primary has both volatile **and** non-volatile – Secondary is non-volatile	**4**

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Question	Answer	Marks
10	1 mark for each correct tick	6

Statement	true (✓)	false (✓)
Assembly language uses mnemonic codes.	✓	
Assembly language programs do not need a translator to be executed.		✓
Assembly language is a low-level programming language.	✓	
Assembly language is specific to the computer hardware.	✓	
Assembly language is machine code.		✓
Assembly language is often used to create drivers for hardware.	✓	

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COMPUTER SCIENCE **0478/12**

Paper 1 **October/November 2017**

MARK SCHEME

Maximum Mark: 75

Published

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Question	Answer	Marks
1	1 mark per correct instruction: 9 – LEFT 1 – DOWN C – OPEN 3 – CLOSE F – UP	**5**

Question	Answer	Marks
2	1 mark for each correct category: *HDD* – Secondary *RAM* – Primary *ROM* – Primary *CD-ROM* – Off-line *SSD* – Secondary *DVD-RAM* – Off-line	**6**

Question	Answer	Marks
3(a)	Any **four** from (**Max 2** per number system) : • A binary number system is a base-2 system • A denary number system is a base-10 system • A binary number system uses 0 and 1 values • A denary number system uses 0 to 9 values • A binary number system has units/ placeholders/column headings that increase by the power of 2 • A denary number system has units/ placeholders/column headings that increase by the power of 10 • Binary has more digit <u>for the same value</u>// Denary has less digits <u>for the same value</u>	**4**

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Question	Answer	Marks
3(b)	**Five** from: • Correct column headings / place holders by example • Correctly place a 1 or a 0 for each column • Identify the columns to be added • Add together the (denary) values identified … • … this will give a total which is the denary number/answer • Answer is 10	**5**

Question	Answer	Marks
4(a)(i)	**Method 1** / Tick (✓) / **Method 2** / Tick (✓) Serial / ✓ / Simplex / Parallel / / Half-duplex / / / Duplex / ✓	**2**
4(a)(ii)	Any **four** from (**Max 3** for serial): • Serial has <u>less/lower</u> interference • Serial is (more) reliable/accurate <u>over distances</u> • In serial the bits won't be skewed • In serial it is easier to collate the bits together again after transmission • Duplex transmits data in both directions <u>at the same time</u> • simplex/half-duplex/remaining methods won't allow read and write at same time	**4**

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Question	Answer	Marks
4(b)	1 mark for error checking method, 2 marks for description: Checksum • A value is calculated from the data // Description of calculation • Value is transmitted with data • Value is recalculated after transmission • If the values match the data is (more likely to be) accurate Parity check • A parity bit is transmitted with each byte of data • Odd or even (parity can be used) • Counts / checks number of 1's // counts / checks to see if 1's are even // counts / checks to see if 1's are odd • (Each byte is) checked after transmission to see if it matches the odd/even parity used Automatic Repeat Request (ARQ) • Uses acknowledgement and timeout • When a device detects an error in data transmission it asks for the packet to be resent / no error detected, positive acknowledgment sent • The sending device resends the packet after the request to resend/ timeout received • This process is continuous until the packet received is correct/until the ARQ limit is reached Echo (check) • Copy of data is sent back to sender • Data is compared to see if it matches • If it does not match error detected	**6**

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Question	Answer	Marks
5(a)	Any **four** from: • Data / files • Stored in a text file • Downloaded to a user's computer when a website is visited // webserver sends to web browser • Stored on a user's computer • Stored by a browser • Detected by the website when it is visited again	**4**
5(b)	Any **two** from: e.g. • To store personal information/data • To store login details • To save items in an online shopping basket • To track/save internet surfing habits // to track website traffic • To carry out targeted advertising • To store payment details • To customise a webpage // to store user preferences • Store progress in online games/quizzes	**2**

Question	Answer	Marks
6	1 mark for each correct term, in this order: • Interrupt • Compiler • ALU/Arithmetic and Logic Unit • ARQ/Automatic repeat request	**4**

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Question	Answer	Marks
7	1 mark for each correct logic gate with the correct input(s)	7

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Question	Answer	Marks
8(a)	1 mark for correct calculation method, 1 mark for correct answer: • 2048/1024 (or 1024 × 2) • 2 GB	**2**
8(b)	• Instructions/programs/data • … currently in use	**2**
8(c)	Any **three** from: • RAM is volatile, ROM is non-volatile • RAM is temporary, ROM is (semi) permanent • RAM normally has a larger capacity than ROM • RAM can be edited ROM cannot be edited // Data can be read from and written to RAM, ROM can only be read from.	**3**

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Question	Answer	Marks
9(a)	• It is an input device • It measures/takes (physical) readings of the surrounding environment / environment by example / physical properties	**2**
9(b)	1 mark for each sensor, 2 marks for each description: Moisture (sensor) • To measure the water content of the soil • To alert when the soil is too dry or too wet/needs watering pH (sensor) • To measure how acidic/alkaline the soil is • To alert when there may be something polluting the soil Light (sensor) • To measure the brightness of the environment • To alert when the fruit has too little/too much light Temperature (sensor) • To measure the temperature of the environment • To alert when it is too hot/too cold for the fruit to grow Gas (sensor) • To measure the amount of CO2/oxygen present • To alert when too much CO2/oxygen present Humidity (sensor) • To measure the water content in the air • To alert when the air is too dry Infra-red / motion (sensor) • To measure level of infra-red/microwaves deflected • To alert to any intruders e.g. animals stealing the fruit	**6**

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Question	Answer	Marks
10(a)	Any **three** from: • It is a (security) protocol • It encrypts data (sent over the web/network) • It is the updated version of SSL • It has two layers • It has a handshake layer • It has a record layer	**3**
10(b)	1 mark for each correct application, examples could include: • Online banking • Online shopping // Online payment systems • Email • Cloud based storage • Intranet/extranet • VPN • VoIP • Instant messaging (IM) // social networking	**3**

Question	Answer	Marks
11	1 mark for each correct missing word, in the correct order: • Plagiarism • Free software • Freeware • Shareware • Ethics	**5**

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COMPUTER SCIENCE **0478/13**

Paper 1 **October/November 2017**

MARK SCHEME

Maximum Mark: 75

Published

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Question	Answer	Marks
1(a)	Output	**1**
1(b)	1 mark for each correct conversion *E* | *0* | *4* **1 1 1 0 | 0 0 0 0 | 0 1 0 0**	**3**
1(c)	Any **one** from: – Hexadecimal codes can fit in a smaller display rather than a full text based message – Smaller amount of memory needed to store the hex error messages than text based	**1**
1(d)	1 mark for correct sensor, 1 mark for corresponding use Possible examples could include: – Temperature (sensor) – To monitor the temperature of the water – Pressure (sensor) – To monitor the level of water in the washing machine – Motion (sensor) – To monitor whether the drum is still in motion – pH (sensor) – To monitor the level of water hardness/detergent present in the water	**6**

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Question	Answer	Marks
2	1 mark for each correct file format e.g. **File type** / **File format** Pictures: .JPEG Text: .doc, .txt, .rtf, .docx, .odt .pdf Sound: .mp3, .wav, .aif, .flac, .mid Video: .mp4, .flv, .wmv	**3**

Question	Answer	Marks
3(a)	– Part 1 (access) protocol – Part 2 domain (name) – Part 3 filename	**3**
3(b)	**Four** from: – IP address is used to identify a device (on the Internet / network) – IP address is allocated by the network/ ISP – Can be used in place of URL – IP addresses can be IPv4 or IPv6 – IP address can be static … – ... meaning it doesn't change each time it is connected to the Internet – IP address can be dynamic …. – … meaning that it can change each time a device is connected to the Internet – Any valid example (e.g. xxx.xxx.xxx.xxx or xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx:xxxx)	**4**

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Question	Answer	Marks
4	1 mark for each correct line up to a total of 5 marks 	**5**

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Question	Answer	Marks
5(a)	1 mark for each correct logic gate	4

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Question	Answer	Marks
5(b)	1 mark for correct logic gate symbol: Any **four** from: – similar to an OR gate – It has (at least) two inputs – Output will be high/1 if both inputs are different – Output will be high/1 if either input is high – Output will be low/0 if both inputs are high – Output will be low/0 if both inputs are low	**5**

Question	Answer	Marks
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Question	Answer	Marks
7	1 mark for each correct tick	6

Statement	true (✓)	false (✓)
Firewalls can monitor incoming and outgoing traffic.	✓	
Firewalls operate by checking traffic against a set of rules.	✓	
Firewalls cannot block access to a certain website.		✓
Firewalls can be software and hardware.	✓	
Firewalls can act as intermediary servers.		✓
Firewalls can block unauthorised traffic.	✓	

Question	Answer	Marks
8(a)	Any **three** from: – Human error (e.g. deleting/overwriting data) – Physical damage – Power failure/surge – Hardware failure – Software crashing	3
8(b)	Any **three** from: – Online shopping // Online payment systems // Online booking – Email – Cloud based storage – Intranet/extranet – VPN – VoIP // video conferencing – Instant messaging (IM) // social networking // online gaming	3

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Question	Answer	Marks
8(c)	1 mark for identifying, 1 mark for description – Strong password – To make it difficult to hack an account – Biometric device – To use data that is difficult to fake as a password – TLS // Encryption – To make data meaningless if intercepted – To encrypt data that is exchanged (TLS only) – More secure than SSL (TLS only) – Anti-spyware (software) – To find and remove any spyware that is installed on a computer – To help stop key loggers recording key presses – Firewall – To help prevent unauthorised access to an account – Blocks any requests that do not meet/match the criteria – Authentication (card reader at home)/mobile security code app/two-step verification – To add another level of identification of the user – Use of drop-down boxes (or equivalent) – So key loggers cannot record the key presses – Proxy server – To divert an attack away from the main system	**6**

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Question	Answer	Marks
9(a)	Any **four** from: – (Red) laser is used – (Laser beams) shines onto surface of the disk – It is rotated (at a constant speed) to be read – Surface is covered in a track (that spirals from the centre) – Data is represented on the surface using pits and lands – Pits and lands represent binary values – Pits reflect light back differently (to the area in between/land) – Optical device can determine the binary value from the light reflection	**4**
9(b)	1 mark for calculation, 1 mark for correct answer: – 1000 × 16 – 16000/8 – Answer is **2000** bytes	**2**
9(c)	**Four** from: (Max 2 for either primary or secondary) – Primary RAM and ROM – Secondary HDD and SSD – Primary is directly accessible by CPU – Secondary is not directly accessible by CPU – Primary is internal to computer – Secondary can be internal **or** external to the computer – Primary stores boot up instructions **and** can hold data whilst being processed – Secondary stores files/software – Primary has faster access speed – Secondary has a slower access speed – Primary has both volatile **and** non-volatile – Secondary is non-volatile	**4**

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Question	Answer	Marks
10	1 mark for each correct tick	6

Statement	true (✓)	false (✓)
Assembly language uses mnemonic codes.	✓	
Assembly language programs do not need a translator to be executed.		✓
Assembly language is a low-level programming language.	✓	
Assembly language is specific to the computer hardware.	✓	
Assembly language is machine code.		✓
Assembly language is often used to create drivers for hardware.	✓	

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COMPUTER SCIENCE **0478/21**

Paper 2 **October/November 2017**

MARK SCHEME

Maximum Mark: 50

Published

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Question	Answer	Marks

1(a)(i)	1 mark per bullet:
	
	• At least one array declaration
	• At least one array has an appropriate name
	
	• All arrays with appropriate names
	
	Many correct answers, they must be meaningful. These are examples only.
	
	`Array_2Seater[ ]`
	`Array_4Seater[ ]`
	`Array_Historic[ ]`
		3

1(a)(ii)	1 mark per bullet: • Name of variable • Purpose of variable • Name of constant • Purpose of constant Many correct answers, they must be meaningful. These are examples only. Variable `NumFlights` to store the number of flights in a day Constant `FlightCost2Seat30` to store the cost of a 30 minute flight in a 2 seater plane	**4**

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Question	Answer	Marks

1(b)	Any **five** from:
	
	• Prompt for plane
	• Input plane
	• Prompt for another input length of flight along with the input.
	• Attempt at calculation of maximum number of flights in a day
	• Using correct values for maximum number of flights (from calculation or otherwise)
	• Calculation/determination of cost of a single flight for selected plane and duration
	• Calculation of income that can be generated for one combination of plane and flight
	• Output of total possible income for one combination of plane and flight with message(s)
	
	Algorithm example:
	
	`OUTPUT "Please Enter Type of Plane"`
	`OUTPUT "1: 2 Seater"`
	`OUTPUT "2: 4 Seater"`
	`OUTPUT "3: Historic"`
	`INPUT PlaneType`
	`OUTPUT "Please Enter Length of Flight"`
	`INPUT FlightLength`
	`CASE FlightLength of`
	`  30: OUTPUT "Maximum number of flights is 10"`
	`  60: OUTPUT "Maximum number of flights is 6"`
	`OTHERWISE OUTPUT "Invalid length of flight"`
	`ENDCASE`
	
	`CASE PlaneType of`
	`  1: Price30 ← 100; Price60 ← 150`
	`  2: Price30 ← 120; Price60 ← 200`
	`  3: Price30 ← 120; Price60 ← 500`
	`OTHERWISE OUTPUT "Invalid type of plane"`
	`ENDCASE`
	
	`CASE FlightLength of`
	`  30: OUTPUT "Total Possible Income is ", Price30 * 10`
	`  60: OUTPUT "Total Possible Income is ", Price60 * 6`
	`ENDCASE`
		5

1(c)	1 mark for each correct point related to the inputs for **Task 1** • Description of how the program would validate the input • Description/identification of input(s) • Type of validation check • Checking inputs against stored data/maxima/correct data • Dry-running the program • Use of test data • Identification of types of test data • Example(s) of test data	**4**

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Question	Answer	Marks
1(d)	Any **four** from: • Input timeslot • Check 3 types of plane • Methodology for checking time slot • Identify any planes available • Output plane(s) available • Output if no planes available	**4**

Question	Answer	Marks
2	1 mark for each error identified plus suggested correction (the corrected lines must be written in full) Line 4 **correct line** `WHILE Number <= 99 OR Number > 1000` Line 7 **correct line** `Num[Index] = Number` Line 9 **correct line** `NEXT (Index)` Line 10 **correct line** `PRINT Count`	**4**

Question	Answer	Marks
3(a)	1 mark per bullet: • Validation checks whether data to be entered is possible/sensible // computer check • Verification checks that data entered is the data that was intended to be entered // can be a human check // matches the source	**2**
3(b)	1 mark for each valid point **Either** • Double Entry // suitable practical example • the data will be entered twice • compared by the computer or by a human • if a discrepancy is found, the data entry operator is asked to re-enter the data **Or** • Visual Verification // suitable practical example • the data will be compared to the source 'document' • compared by a human • if a discrepancy is found, the data is re-entered	**2**

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Question	Answer	Marks
3(c)	1 mark for explanation and 1 mark for an expansion • Library routine is a list of instructions // block of code // subroutine • … that is used often … • … which is given a name • … and which can be called from other programs • Library routines make writing programs easier and faster as the code is already written • Library routines make program testing easier as the code has already been tested and debugged	**2**

Question	Answer	Marks
4(a)	1 mark for each correct line **Pseudocode description** / **Pseudocode statement** A loop that will iterate at least once. → FOR…TO…NEXT A conditional statement to deal with many possible outcomes. → CASE…OF…OTHERWISE…ENDCASE A loop that will iterate a set number of times. → IF…THEN…ELSE…ENDIF A conditional statement with different outcomes for true and false. → WHILE…DO…ENDWHILE REPEAT…UNTIL	**4**

4(b)	1 mark per bullet:
	
	• Appropriate loop controls
	• Read from array
	• Print from array (the last two points can be in one statement)
	
	Note reading and printing **MUST** be within the same loop
	
	Example algorithm:
	
	`Count ← 0`
	`WHILE Count < 50 DO`
	`  OUTPUT Name[Count]`
	`  Count ← Count + 1`
	`ENDWHILE`
		3

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(a)</td><td>
<table>
<tr><th>Flag</th><th>Count</th><th>Name[1]</th><th>Name[2]</th><th>Name[3]</th><th>Name[4]</th><th>Temp</th></tr>
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1 mark for data type, purpose + example data

Example 1:
Field Name: SPECIESID
Data Type: Alphanumeric
Purpose: Primary key
Example Data: SP06583

Example 2:
Field name: NUMBER
Data Type: Integer
Purpose: To record how many of that species there are at the park
Example Data: 30</td><td>2</td></tr>
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Question	Answer	Marks
6(b)		**4**

Field:	Species	Classification	Diet	Legs	
Table:	LIVESTOCK	LIVESTOCK	LIVESTOCK	LIVESTOCK	
Sort:	Ascending/ Descending				
Show:	☑	☐	☐	☐	☐
Criteria:		“Mammal”	“Herbivore”	4	
or:					
	(1 Mark)	(1 Mark)	(1 Mark)	(1 Mark)	

1 mark per completely correct column.

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Cambridge International General Certificate of Secondary Education

COMPUTER SCIENCE **0478/22**

Paper 2 **October/November 2017**

MARK SCHEME

Maximum Mark: 50

Published

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Question	Answer	Marks
1(a)(i)	1 mark for appropriate variable name, 1 mark for appropriate data type, 1 mark for appropriate use. Many correct answers, they must be meaningful. These are examples only. – `HireTotal`, integer, running total of money taken (for the day) – `HoursHired`, real, running total of hours hired for the day – `Returned`, real, hour and fraction of hour when next returned	**3**
1(a)(ii)	1 mark for appropriate constant name, 1 mark for appropriate value. Many correct answers, they must be meaningful. These are examples only. – `HourPrice, 20.00` – `HalfHourPrice 12.00`	**2**
1(b)	1 mark for validation check, all checks must be different, 1 mark for the reason and 1 mark for the test data. The only inputs for task 1 can be length of hire, money taken, time of hire and time of return. There are many possible correct answers these are examples only. Validation check – range check for time of hire Reason – cannot be hired before 10:00 returned after 17:00 Test data – 12:00, 19:00 Validation check – type check for money taken Reason – must be a numeric value Test data – 20.00, bob	**6**

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Question	Answer	Marks

1(c)	– any loop for 10 boats (1 mark)
	
	Four from:
	– Initialisation
	– check `HoursHired` against `MaxHoursHired` …
	… store the `BoatNumber`
	… update `MaxHoursHired` if greater
	– check if `HoursHired = 0` …
	… if so add 1 to `NumberBoatsUnused`
	– update daily totals (for hours and money)
	– output report with messages (including totals for hours and money, and number of boats unused and the most used boat).
	Max 4 marks
	
	Example:
	`MaxHoursHired ← 0`
	`TotalHoursHired ← 0`
	`TotalMoney ← 0`
	`NumberBoatsUnused ← 0`
	`FOR BoatNumber ← 1 to 10`
	`  TotalMoney ← TotalMoney + Money(BoatNumber)`
	`  TotalHoursHired ← TotalHoursHired + HoursHired(BoatNumber)`
	`  IF HoursHired(BoatNumber) = 0`
	`  THEN NumberBoatsUnused ← NumberBoatsUnused + 1`
	`  ENDIF`
	`  IF HoursHired(BoatNumber) > MaxHoursHired`
	`  THEN`
	`  MostUsed ← BoatNumber`
	`  MaxHoursHired ← HoursHired(BoatNumber)`
	`  ENDIF`
	`NEXT BoatNumber`
	`PRINT "Boats were hired for ", TotalHoursHired, " hours"`
	`PRINT "Total amount of money taken was ", TotalMoney`
	`PRINT NumberBoatsUnused, " boats were not used"`
	`Print "Boat number ", MostUsed, " was used most"`
		5

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Question	Answer	Marks

1(d)	Maximum 4 marks in total for question part
	
	e.g.
	Explanation (may include reference to program statements)
	– check all boats for…
	– … return time < current time // current booking slot available or return time > current time// current booking slot not available
	– keep a running total of those available
	– display number of boats
	
	Example:
	`FOR BoatNumber ← 1 to 10` loop to check for all boats
	`  IF ReturnTime(BoatNumber) <= CurrentTime` check return time against current time
	`  THEN BoatsAvailable ← BoatsAvailable + 1` keep a running total
	`  ENDIF`
	`NEXT BoatNumber`
	`PRINT "Number of boats available ", BoatsAvailable` display number of boats
		4

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Question	Answer	Marks

2	1 mark for each, there may be other solutions, award full marks for any working solution
	
	any **six** from:
	initialise total (outside loop)
	Input number of numbers (outside loop with validation)
	Loop using input value
	Input number (inside loop)
	Update Total (inside loop)
	Calculate average
	Print average and total (outside loop)
	
	Sample algorithm:
	`INPUT NumberCount`
	`Total ← 0`
	`FOR Count ← 1 TO NumberCount`
	`  INPUT Number`
	`  Total ← Total + Number`
	`NEXT`
	`Average ← Total/NumberCount`
	`  PRINT Total, Average`
		6

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Question	Answer	Marks
3	1 mark for each correct line, max **3** marks. 	**3**

Question	Answer	Marks

4	2 marks for identification, 1 mark for description, 1 mark for reason.
	
	Identification:
	`CASE …`
	`… OF … OTHERWISE … (ENDCASE)` or
	`… OF … (OTHERWISE) … ENDCASE`
	
	Description:
	– a statement that allows for multiple selections // not any of the above
	
	Reason:
	– to simplify pseudocode/ make pseudocode more understandable etc.
		4

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Question	Answer	Marks
5(a)		**5**

Accept	Reject	Count	Sack	OUTPUT
0	0	0		
1		1	50.4	
2		2	50.3	
	1	3	49.1	
3		4	50.3	
4		5	50.0	
5		6	49.5	
6		7	50.2	
7		8	50.3	
8		9	50.5	
	2	10	50.6	8 2

← (1 mark) →← (1 mark) →← (1 mark) →← (1 mark) →← (1 mark) →

5(b)	– change to `Is Count = 50?` – remove `IS Sack > 50.5?`	**2**

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Question	Answer	Marks
6(a)	– 1 mark for each field suitable name, 1 mark for appropriate data type and appropriate data sample The following are examples there are many different correct answers. – Engine Number, text, 21012 – Class, text, P6 – Service Date, date, 4/3/2017	**6**
6(b)	– Engine Number // Correct field number	**1**
6(c)		**3**

Field:	Engine Number	Class	Service Date	
Table:	TRAIN	TRAIN	TRAIN	
Sort:				
Show:	☑	☐	☐	☐
Criteria:		Like ‘P*’ // Like ‘P?’	<10/11/2016	
or:				
	(1 mark)	(1 mark)	(1 mark)	

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COMPUTER SCIENCE **0478/23**

Paper 2 **October/November 2017**

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Question	Answer	Marks

1(a)(i)	1 mark per bullet:
	
	• At least one array declaration
	• At least one array has an appropriate name
	
	• All arrays with appropriate names
	
	Many correct answers, they must be meaningful. These are examples only.
	
	`Array_2Seater[ ]`
	`Array_4Seater[ ]`
	`Array_Historic[ ]`
		3

1(a)(ii)	1 mark per bullet: • Name of variable • Purpose of variable • Name of constant • Purpose of constant Many correct answers, they must be meaningful. These are examples only. Variable `NumFlights` to store the number of flights in a day Constant `FlightCost2Seat30` to store the cost of a 30 minute flight in a 2 seater plane	**4**

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Question	Answer	Marks

1(b)	Any **five** from:
	
	• Prompt for plane
	• Input plane
	• Prompt for another input length of flight along with the input.
	• Attempt at calculation of maximum number of flights in a day
	• Using correct values for maximum number of flights (from calculation or otherwise)
	• Calculation/determination of cost of a single flight for selected plane and duration
	• Calculation of income that can be generated for one combination of plane and flight
	• Output of total possible income for one combination of plane and flight with message(s)
	
	Algorithm example:
	
	`OUTPUT "Please Enter Type of Plane"`
	`OUTPUT "1: 2 Seater"`
	`OUTPUT "2: 4 Seater"`
	`OUTPUT "3: Historic"`
	`INPUT PlaneType`
	`OUTPUT "Please Enter Length of Flight"`
	`INPUT FlightLength`
	`CASE FlightLength of`
	`  30: OUTPUT "Maximum number of flights is 10"`
	`  60: OUTPUT "Maximum number of flights is 6"`
	`OTHERWISE OUTPUT "Invalid length of flight"`
	`ENDCASE`
	
	`CASE PlaneType of`
	`  1: Price30 ← 100; Price60 ← 150`
	`  2: Price30 ← 120; Price60 ← 200`
	`  3: Price30 ← 120; Price60 ← 500`
	`OTHERWISE OUTPUT "Invalid type of plane"`
	`ENDCASE`
	
	`CASE FlightLength of`
	`  30: OUTPUT "Total Possible Income is ", Price30 * 10`
	`  60: OUTPUT "Total Possible Income is ", Price60 * 6`
	`ENDCASE`
		5

1(c)	1 mark for each correct point related to the inputs for **Task 1** • Description of how the program would validate the input • Description/identification of input(s) • Type of validation check • Checking inputs against stored data/maxima/correct data • Dry-running the program • Use of test data • Identification of types of test data • Example(s) of test data	**4**

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Question	Answer	Marks
1(d)	Any **four** from: • Input timeslot • Check 3 types of plane • Methodology for checking time slot • Identify any planes available • Output plane(s) available • Output if no planes available	**4**

Question	Answer	Marks
2	1 mark for each error identified plus suggested correction (the corrected lines must be written in full) Line 4 **correct line** `WHILE Number <= 99 OR Number > 1000` Line 7 **correct line** `Num[Index] = Number` Line 9 **correct line** `NEXT (Index)` Line 10 **correct line** `PRINT Count`	**4**

Question	Answer	Marks
3(a)	1 mark per bullet: • Validation checks whether data to be entered is possible/sensible // computer check • Verification checks that data entered is the data that was intended to be entered // can be a human check // matches the source	**2**
3(b)	1 mark for each valid point **Either** • Double Entry // suitable practical example • the data will be entered twice • compared by the computer or by a human • if a discrepancy is found, the data entry operator is asked to re-enter the data **Or** • Visual Verification // suitable practical example • the data will be compared to the source 'document' • compared by a human • if a discrepancy is found, the data is re-entered	**2**

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Question	Answer	Marks
3(c)	1 mark for explanation and 1 mark for an expansion • Library routine is a list of instructions // block of code // subroutine • … that is used often … • … which is given a name • … and which can be called from other programs • Library routines make writing programs easier and faster as the code is already written • Library routines make program testing easier as the code has already been tested and debugged	**2**

Question	Answer	Marks
4(a)	1 mark for each correct line **Pseudocode description** / **Pseudocode statement** A loop that will iterate at least once. → FOR…TO…NEXT A conditional statement to deal with many possible outcomes. → CASE…OF…OTHERWISE…ENDCASE A loop that will iterate a set number of times. → IF…THEN…ELSE…ENDIF A conditional statement with different outcomes for true and false. → WHILE…DO…ENDWHILE REPEAT…UNTIL	**4**

4(b)	1 mark per bullet:
	
	• Appropriate loop controls
	• Read from array
	• Print from array (the last two points can be in one statement)
	
	Note reading and printing **MUST** be within the same loop
	
	Example algorithm:
	
	`Count ← 0`
	`WHILE Count < 50 DO`
	`  OUTPUT Name[Count]`
	`  Count ← Count + 1`
	`ENDWHILE`
		3

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Purpose: Primary key
Example Data: SP06583

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Field name: NUMBER
Data Type: Integer
Purpose: To record how many of that species there are at the park
Example Data: 30</td><td>2</td></tr>
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Question	Answer	Marks
6(b)		**4**

Field:	Species	Classification	Diet	Legs	
Table:	LIVESTOCK	LIVESTOCK	LIVESTOCK	LIVESTOCK	
Sort:	Ascending/ Descending				
Show:	☑	☐	☐	☐	☐
Criteria:		“Mammal”	“Herbivore”	4	
or:					
	(1 Mark)	(1 Mark)	(1 Mark)	(1 Mark)	

1 mark per completely correct column.

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COMPUTER SCIENCE **0478/21**

Paper 2 Problem-solving and Programming **October/November 2017**

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In preparation for the examination candidates should attempt the following practical tasks by **writing and testing a program or programs**.

A small airfield operates a flying club where people can take a short flight to see if they would like flying lessons. The owner of the airfield has asked you to write a program to organise the flight bookings. The airfield operates three different planes and offers either a 30 minute or a 60 minute flight.

The following table shows the tariff:

Length of Flight	2 Seater Plane	4 Seater Plane	Historic Plane
30 minutes	$100	$120	$300
60 minutes	$150	$200	$500

After each flight, 30 minutes must be allowed for refuelling and safety checks before the next flight can take off. All planes offer both 30 minute and 60 minute flights, but, for the purpose of this activity, they will not be mixed on a given day, e.g. the 2 seater will offer 30 minute flights ONLY on one day and 60 minute flights ONLY on another day.

Write and test a program for the owner of the airfield.

- Your program must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Work out the maximum income.

Assume that the flights take place between 08:00 and 18:00. Write a program that will work out the maximum income that can be generated by each plane in a day for each type of flight. The program should allow you to:

- input the type of plane
- input the length of flight
- calculate the maximum number of flights in a day
- output the total possible income per day for the choice of plane and length of flight

TASK 2 – Record bookings.

Write a program to store bookings for each plane and to allow you to find which planes are available at a given time slot during the day. The program should calculate the actual number of flights taken by each plane in that day.

TASK 3 – Work out income.

Modify TASK 2 so that it will calculate the total amount of money taken in a day for each plane, as well as the overall daily total for all three planes, and output the results.

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COMPUTER SCIENCE **0478/22**

Paper 2 Problem-solving and Programming **October/November 2017**

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In preparation for the examination candidates should attempt the following practical tasks by **writing and testing a program or programs**.

The owner of a river boat hire company wants to calculate the daily profits from hiring out 10 rowing boats on the river. Boats are numbered 1 to 10. Boats can be hired for use between 10:00 and 17:00 every day.

Write and test a program for the owner.

- Your program must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – calculate the money taken in a day for one boat.

The cost of hiring a boat is $20 for one hour or $12 for half an hour. When a boat is hired the payment is added to the money taken for the day. The running total of hours hired that day is updated and the time when the boat must be returned is stored. At the end of the day the money taken and the total hours hired is output.
No boat can be hired before 10:00 or returned after 17:00.

TASK 2 – find the next boat available.

Extend TASK 1 to work for all 10 rowing boats. Use the data stored for each boat to find out how many boats are available for hire at the current time. If no boats are available show the earliest time that a boat will be available for hire.

TASK 3 – calculate the money taken for all the boats at the end of the day.

At the end of the day use the data stored for each boat to calculate the total amount of money taken and the total number of hours boats were hired that day. Find out how many boats were not used that day and which boat was used the most. Provide a report for the owner to show this information.

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30 minutes	$100	$120	$300
60 minutes	$150	$200	$500

After each flight, 30 minutes must be allowed for refuelling and safety checks before the next flight can take off. All planes offer both 30 minute and 60 minute flights, but, for the purpose of this activity, they will not be mixed on a given day, e.g. the 2 seater will offer 30 minute flights ONLY on one day and 60 minute flights ONLY on another day.

Write and test a program for the owner of the airfield.

- Your program must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Work out the maximum income.

Assume that the flights take place between 08:00 and 18:00. Write a program that will work out the maximum income that can be generated by each plane in a day for each type of flight. The program should allow you to:

- input the type of plane
- input the length of flight
- calculate the maximum number of flights in a day
- output the total possible income per day for the choice of plane and length of flight

TASK 2 – Record bookings.

Write a program to store bookings for each plane and to allow you to find which planes are available at a given time slot during the day. The program should calculate the actual number of flights taken by each plane in that day.

TASK 3 – Work out income.

Modify TASK 2 so that it will calculate the total amount of money taken in a day for each plane, as well as the overall daily total for all three planes, and output the results.

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/11**

Paper 1 Theory **October/November 2017**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

READ THESE INSTRUCTIONS FIRST

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DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

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1 A washing machine has a small display screen built into it.

One use of the display screen is to show an error code when a problem has occurred with a washing cycle.

(a) State whether the display screen is an **input**, **output** or **storage device**.

.....[1]

(b) The display screen shows a hexadecimal error code:

E04

This error code means that the water will not empty out of the washing machine.

Convert this error code to binary.

[3]

(c) State why hexadecimal is used to display the error code.

.....

.....

.....

.....[1]

(d) Identify **three** sensors that could be used in the washing machine.

State what each sensor could be used for.

Sensor 1 .....

Use .....

.....

Sensor 2 .....

Use .....

.....

Sensor 3 .....

Use .....

.....[6]

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2 Data files are stored in different file formats.

Complete the table by providing a suitable file format for each file type. The first one has been done for you.

File type	File format
Pictures	.JPEG
Text	
Sound	
Video	

[3]

3 (a) An example of a Uniform Resource Locator (URL) is:

http://www.cle.org.uk/Index.htm

Part 1 Part 2 Part 3

Identify the **three** parts that make up this URL.

Part 1 .....

Part 2 .....

Part 3 .....

[3]

(b) Describe what is meant by an Internet Protocol (IP) address.

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.....[4]

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4 **Six** components of a computer system and **six** descriptions are shown.

Draw a line to match each component with the most suitable description.

Component	Description
Arithmetic Logic Unit (ALU)	Used to connect together the internal components of the CPU.
Buses	Used to carry out calculations on data.
Control Unit (CU)	Used to temporarily hold data and instructions during processing.
Immediate Access Store (IAS)	Used to allow interaction with the computer.
Input/Output	Used to hold data and instructions before they are processed.
Registers	Used to manage the flow of data through the CPU.

[5]

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5 **(a)** Draw a logic circuit for the logic statement:

X = 1 if ((A is 1 AND B is 1) OR (A is NOT 1 AND C is 1))

[4]

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(b) Draw the symbol for an **XOR** gate and explain the function of this logic gate.

Explanation .....

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.....[5]

6 Describe the operation of a 2D scanner and a 3D scanner.

2D .....

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3D .....

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.....

.....

[6]

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7 **Six** statements about firewalls are shown.

Tick (✓) to show whether each statement is **true** or **false**.

Statement	**true** (✓)	**false** (✓)
Firewalls can monitor incoming and outgoing traffic.		
Firewalls operate by checking traffic against a set of rules.		
Firewalls cannot block access to a certain website.		
Firewalls can be software and hardware.		
Firewalls can act as intermediary servers.		
Firewalls can block unauthorised traffic.		

[6]

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8 **(a)** Data is valuable. It needs to be kept secure and it can easily be damaged.

Give **three** different ways that data can be accidentally damaged.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(b) The Secure Socket Layer (SSL) protocol can be used to securely transmit data in online banking.

State **three** other different applications that use SSL.

Application 1 .....

Application 2 .....

Application 3 .....

[3]

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(c) Online banking is increasing in popularity.

Online banking can be a risk as it can raise a number of security issues. SSL can be used as a security method to make online banking safer.

Identify and describe **three** other security methods that could be used to make online banking safer.

Security method 1 .....

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Security method 2 .....

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Security method 3 .....

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[6]

Need a home tutor? Visit smiletutor.sg

9 **(a)** Optical storage media can be used to store data.

Describe how the data is read from a Compact Disc (CD).

.....

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.....[4]

(b) Kamil wants to store a 16-bit colour image file. The image size is 1000 pixels.

Calculate the size of the file.

Give your answer in **bytes**. Show your working.

Working .....

.....

.....

.....

Answer ..... **bytes**

[2]

(c) Describe the differences between primary and secondary storage.

.....

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.....[4]

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10 **Six** statements about assembly language are shown.

Tick (✓) whether the statement is **true** or **false**.

Statement	**true** (✓)	**false** (✓)
Assembly language uses mnemonic codes.		
Assembly language programs do not need a translator to be executed.		
Assembly language is a low-level programming language.		
Assembly language is specific to the computer hardware.		
Assembly language is machine code.		
Assembly language is often used to create drivers for hardware.		

[6]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/12**

Paper 1 Theory **October/November 2017**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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Answer **all** questions.
No marks will be awarded for using brand names of software packages or hardware.

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[Turn over

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1 A robot arm in a factory is programmed to move products.

The binary instructions to operate the robot arm are:

Operation	Binary Instruction			
UP	1	1	1	1
DOWN	0	0	0	1
LEFT	1	0	0	1
RIGHT	0	1	1	0
OPEN	1	1	0	0
CLOSE	0	0	1	1

The instructions are entered as hexadecimal values.

An operator enters the values:

9 1 C 3 F

Convert the values and write down the operation (e.g. RIGHT) carried out by the robot arm.

9 .....

1 .....

C .....

3 .....

F .....

[5]

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2 Storage devices and storage media can be categorised as primary, secondary or off-line.

Write **primary**, **secondary** or **off-line** next to each storage device or medium to indicate its most suitable category.

HDD .....

RAM .....

ROM .....

CD-ROM .....

SSD .....

DVD-RAM .....
[6]

3 **(a)** Explain the differences between the binary number system and the denary number system.

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.....[4]

(b) Explain the process of converting the binary number 1010 into a denary number.

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.....[5]

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4 A file server is used as a central data store for a network of computers.

Rory sends data from his computer to a file server that is approximately 100 metres away.

It is important that the data is transmitted accurately. Rory needs to be able to read data from and write data to the file server at the same time.

(a) **(i)** Use ticks (✓) to identify the most suitable data transmission methods for this application.

Method 1	Tick (✓)	**Method 2**	Tick (✓)
Serial		Simplex	
Parallel		Half-duplex	
		Duplex	

[2]

(ii) Explain why your answer to **part (a)(i)** is the most suitable data transmission.

.....

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.....[4]

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(b) Identify and describe **two** methods of error checking that can be used to make sure that the data stored after transmission is accurate.

Method 1 .....

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Method 2 .....

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[6]

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5 Raj is using the Internet to do some online shopping. He visits a website that tells him that it uses cookies.

(a) Explain what is meant by the term **cookies**.

.....

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.....[4]

(b) Give **two** examples of the use of cookies.

Example 1 .....

.....

.....

Example 2 .....

.....

.....
[2]

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6 Selma writes the following **four** answers in her Computer Science examination.

State which computer terms she is describing.

"It is a signal. When the signal is received it tells the operating system that an event has occurred."

Selma is describing .....

"It takes source code written in a high level language and translates it into machine code. It translates the whole of the source code at once."

Selma is describing .....

"The part of the central processing unit (CPU) that carries out calculations."

Selma is describing .....

"When data is transmitted, if an error is detected in the data received a signal is sent to ask for the data to be retransmitted. This continues until the data received is correct."

Selma is describing .....
[4]

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7 Draw a logic circuit to represent the logic statement:

X = 1 if (A is NOT 1 AND B is 1) AND (A is NOT 1 AND C is NOT 1) OR (B is 1 AND C is 1)

[7]

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8 **(a)** A computer has 2048 MB of RAM.

How many GB of RAM does the computer have?

Show your working.

.....

.....

.....

.....GB [2]

(b) Describe **one** item that is stored in RAM.

.....

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.....[2]

(c) Explain **three** ways that RAM is different to ROM.

1 .....

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.....

2 .....

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3 .....

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[3]

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9 Anna has a farm that grows fruit.

She has a system that monitors the conditions for growing the fruit.

Sensors are used in this system.

(a) Explain what is meant by the term **sensor**.

.....

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.....[2]

(b) State **two** sensors that could be used in this system and describe how they could be used.

Sensor 1 .....

Use .....

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Sensor 2 .....

Use .....

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[6]

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10 **(a)** Describe what is meant by Transport Layer Security (TLS).

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.....[3]

(b) Name **three** different applications of TLS.

1 .....

2 .....

3 .....
[3]

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11 Complete the paragraphs choosing the correct five terms from the list. Each term can only be used once:

- Ethics
- Freeware
- Free Software
- Hacking
- Malware
- Plagiarism
- Shareware
- Virus

Taking another person's work from the Internet and claiming it as your own is called ..... . It is possible to protect your work online with copyright.

One product that people may want to protect is software. ..... does allow a person to share, copy and change software freely, but ..... does not allow a person to do this legally. Software that has a licence allowing free use for a trial period is called ..... . The name given to this area of Computer Science is ..... .

[5]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

3002984728

COMPUTER SCIENCE **0478/13**

Paper 1 Theory **October/November 2017**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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Answer **all** questions.
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The maximum number of marks is 75.

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1 A washing machine has a small display screen built into it.

One use of the display screen is to show an error code when a problem has occurred with a washing cycle.

(a) State whether the display screen is an **input**, **output** or **storage device**.

.....[1]

(b) The display screen shows a hexadecimal error code:

E04

This error code means that the water will not empty out of the washing machine.

Convert this error code to binary.

[3]

(c) State why hexadecimal is used to display the error code.

.....

.....

.....

.....[1]

(d) Identify **three** sensors that could be used in the washing machine.

State what each sensor could be used for.

Sensor 1 .....

Use .....

.....

Sensor 2 .....

Use .....

.....

Sensor 3 .....

Use .....

.....[6]

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2 Data files are stored in different file formats.

Complete the table by providing a suitable file format for each file type. The first one has been done for you.

File type	File format
Pictures	.JPEG
Text	
Sound	
Video	

[3]

3 **(a)** An example of a Uniform Resource Locator (URL) is:

http://www.cie.org.uk/index.htm

Part 1 Part 2 Part 3

Identify the **three** parts that make up this URL.

Part 1 .....

Part 2 .....

Part 3 .....

[3]

(b) Describe what is meant by an Internet Protocol (IP) address.

.....

.....

.....

.....

.....

.....

.....

.....[4]

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4 **Six** components of a computer system and **six** descriptions are shown.

Draw a line to match each component with the most suitable description.

Component	Description
Arithmetic Logic Unit (ALU)	Used to connect together the internal components of the CPU.
Buses	Used to carry out calculations on data.
Control Unit (CU)	Used to temporarily hold data and instructions during processing.
Immediate Access Store (IAS)	Used to allow interaction with the computer.
Input/Output	Used to hold data and instructions before they are processed.
Registers	Used to manage the flow of data through the CPU.

[5]

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5 **(a)** Draw a logic circuit for the logic statement:

X = 1 if ((A is 1 AND B is 1) OR (A is NOT 1 AND C is 1))

[4]

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(b) Draw the symbol for an **XOR** gate and explain the function of this logic gate.

Explanation .....

.....

.....

.....

.....

.....[5]

6 Describe the operation of a 2D scanner and a 3D scanner.

2D .....

.....

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.....

3D .....

.....

.....

.....

.....

.....

[6]

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7 **Six** statements about firewalls are shown.

Tick (✓) to show whether each statement is **true** or **false**.

Statement	**true** (✓)	**false** (✓)
Firewalls can monitor incoming and outgoing traffic.		
Firewalls operate by checking traffic against a set of rules.		
Firewalls cannot block access to a certain website.		
Firewalls can be software and hardware.		
Firewalls can act as intermediary servers.		
Firewalls can block unauthorised traffic.		

[6]

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8 **(a)** Data is valuable. It needs to be kept secure and it can easily be damaged.

Give **three** different ways that data can be accidentally damaged.

1 .....

.....

2 .....

.....

3 .....

.....
[3]

(b) The Secure Socket Layer (SSL) protocol can be used to securely transmit data in online banking.

State **three** other different applications that use SSL.

Application 1 .....

Application 2 .....

Application 3 .....
[3]

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(c) Online banking is increasing in popularity.

Online banking can be a risk as it can raise a number of security issues. SSL can be used as a security method to make online banking safer.

Identify and describe **three** other security methods that could be used to make online banking safer.

Security method 1 .....

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.....

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Security method 2 .....

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Security method 3 .....

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[6]

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9 **(a)** Optical storage media can be used to store data.

Describe how the data is read from a Compact Disc (CD).

.....

.....

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.....[4]

(b) Kamil wants to store a 16-bit colour image file. The image size is 1000 pixels.

Calculate the size of the file.

Give your answer in **bytes**. Show your working.

Working .....

.....

.....

.....

Answer ..... **bytes**

[2]

(c) Describe the differences between primary and secondary storage.

.....

.....

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.....

.....[4]

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10 **Six** statements about assembly language are shown.

Tick (✓) whether the statement is **true** or **false**.

Statement	**true** (✓)	**false** (✓)
Assembly language uses mnemonic codes.		
Assembly language programs do not need a translator to be executed.		
Assembly language is a low-level programming language.		
Assembly language is specific to the computer hardware.		
Assembly language is machine code.		
Assembly language is often used to create drivers for hardware.		

[6]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/21**

Paper 2 Problem-solving and Programming **October/November 2017**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

DO NOT ATTEMPT TASKS 1, 2 AND 3 in the pre-release material; these are for information only.

You are advised to spend no more than **40 minutes** on **Section A** (Question 1).

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 50.

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Section A

You are advised to spend no longer than 40 minutes answering this section.

Here is a copy of the pre-release material.

DO NOT attempt Tasks 1, 2 and 3 now.

Use the pre-release material and your experience from attempting the tasks before the examination to answer Question 1.

Pre-release material

A small airfield operates a flying club where people can take a short flight to see if they would like flying lessons. The owner of the airfield has asked you to write a program to organise the flight bookings. The airfield operates three different planes and offers either a 30 minute or a 60 minute flight.

The following table shows the tariff:

Length of Flight	2 Seater Plane	4 Seater Plane	Historic Plane
30 minutes	$100	$120	$300
60 minutes	$150	$200	$500

After each flight, 30 minutes must be allowed for refuelling and safety checks before the next flight can take off. All planes offer both 30 minute and 60 minute flights, but, for the purpose of this activity, they will not be mixed on a given day, e.g. the 2 seater will offer 30 minute flights ONLY on one day and 60 minute flights ONLY on another day.

Write and test a program for the owner of the airfield.

- Your program must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Work out the maximum income.
Assume that the flights take place between 08:00 and 18:00. Write a program that will work out the maximum income that can be generated by each plane in a day for each type of flight. The program should allow you to:

- input the type of plane
- input the length of flight
- calculate the maximum number of flights in a day
- output the total possible income per day for the choice of plane and length of flight

TASK 2 – Record bookings.
Write a program to store bookings for each plane and to allow you to find which planes are available at a given time slot during the day. The program should calculate the actual number of flights taken by each plane in that day.

TASK 3 – Work out income.
Modify TASK 2 so that it will calculate the total amount of money taken in a day for each plane, as well as the overall daily total for all three planes, and output the results.

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1 **(a)** All variables, constants and other identifiers should have meaningful names.

(i) Declare suitable arrays for each of the planes to store time slots booked.

.....

.....

.....[3]

(ii) Name **one** variable and **one** constant you used for **Task 1** and state the purpose of each one.

Variable .....

Purpose .....

.....

Constant .....

Purpose .....

.....
[4]

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(b) Write an algorithm to complete **Task 1**, using **either** pseudocode, programming statements or a flowchart.

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.....

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(c) Describe how you could validate and test the inputs for **Task 1**.

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(d) Explain how your program checks and displays whether any of the planes are available at a given time of the day (**Task 2**). Any programming statements used must be fully explained.

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Section B

2 This section of program code asks for 80 numbers between 100 and 1000 to be entered. It checks that the numbers are in the correct range, and stores them in an array. It counts how many of the numbers are larger than 500 and then outputs the result when the program is finished.

```
1 Count = 0
2 FOR Index = 1 TO 80
3   INPUT 'Enter a number between 100 and 1000', Number
4   WHILE Number = 99 AND Number = 1001
5     INPUT 'This is incorrect, please try again', Number
6   ENDWHILE
7   Num[80] = Number
8   IF Number > 500 THEN Count = Count + 1
9  UNTIL Index = 80
10 PRINT Index
11 PRINT ' numbers were larger than 500'
```

There are **four** lines of code that contain errors.

State the line number for each error and write the correct code for that line.

Error 1 Line Number .....

Correct Code .....

Error 2 Line Number .....

Correct Code .....

Error 3 Line Number .....

Correct Code .....

Error 4 Line Number .....

Correct Code .....
[4]

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3 (a) Explain the difference between a validation check and a verification check.

.....

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.....[2]

(b) Describe, using an example, how data could be verified on data entry.

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.....[2]

(c) Explain what is meant by the term library routine.

.....

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.....[2]

4 (a) **Four** pseudocode descriptions and **five** pseudocode statements are shown. Draw one line to link each pseudocode description to the correct pseudocode statement. Not all pseudocode statements will be used.

Pseudocode description	Pseudocode statement
A loop that will iterate at least once.	`FOR...TO...NEXT`
A conditional statement to deal with many possible outcomes.	`IF...THEN...ELSE...ENDIF`
A loop that will iterate a set number of times.	`WHILE...DO...ENDWHILE`
A conditional statement with different outcomes for true and false.	`CASE...OF...OTHERWISE...ENDCASE`
	`REPEAT...UNTIL`

[4]

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(b) Write an algorithm in pseudocode, using a single loop, to print 50 names that have been stored in an array.

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.....[3]

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5 The flowchart below represents a program routine.

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(a) The array used in the flowchart contains the following data:

Name[1]	Name[2]	Name[3]	Name[4]
Jamal	Amir	Eve	Tara

Complete the trace table using the data given in the array.

Flag	Count	Name[1]	Name[2]	Name[3]	Name[4]	Temp
		Jamal	Amir	Eve	Tara	

[5]

(b) Describe what the algorithm represented by the flowchart is doing.

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.....[2]

Question 6 begins on Page 12.

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6 A wildlife park has a database table, called LIVESTOCK, to classify and record its animal species. Part of the database table is shown.

Species	Classification	Diet	Legs
Giraffe	Mammal	Herbivore	4
Elephant	Mammal	Herbivore	4
Crocodile	Reptile	Carnivore	4
Ostrich	Bird	Omnivore	2
Gorilla	Mammal	Herbivore	2
Bear	Mammal	Omnivore	4
Rhinoceros	Mammal	Herbivore	4
Hippopotamus	Mammal	Herbivore	4
Flamingo	Bird	Omnivore	2
Lion	Mammal	Carnivore	4
Turtle	Reptile	Omnivore	4
Penguin	Bird	Carnivore	2

(a) Suggest another appropriate field that could be added to this database by stating its name and data type. State its purpose and give an example of the data it could contain.

Field name .....

Data Type .....

Purpose .....

.....

Example of data .....

[2]

(b) Use the query-by-example grid below to provide a list of all four legged mammals that are herbivores, sorted alphabetically by species, with only the species displayed.

Field:					
Table:					
Sort:					
Show:	☐	☐	☐	☐	☐
Criteria:					
or:					

[4]

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Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

3781682019

COMPUTER SCIENCE **0478/22**

Paper 2 Problem-solving and Programming **October/November 2017**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

DO NOT ATTEMPT TASKS 1, 2 AND 3 in the pre-release material; these are for information only.

You are advised to spend no more than **40 minutes** on **Section A** (Question 1).

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 50.

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[Turn over

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Section A

You are advised to spend no longer than 40 minutes answering this section.

Here is a copy of the pre-release material.

DO NOT attempt Tasks 1, 2 and 3 now.

Use the pre-release material and your experience from attempting the tasks before the examination to answer Question 1.

Pre-release material

The owner of a river boat hire company wants to calculate the daily profits from hiring out 10 rowing boats on the river. Boats are numbered 1 to 10. Boats can be hired for use between 10:00 and 17:00 every day.

Write and test a program for the owner.

- Your program must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – calculate the money taken in a day for one boat.

The cost of hiring a boat is $20 for one hour or $12 for half an hour. When a boat is hired the payment is added to the money taken for the day. The running total of hours hired that day is updated and the time when the boat must be returned is stored. At the end of the day the money taken and the total hours hired is output.
No boat can be hired before 10:00 or returned after 17:00.

TASK 2 – find the next boat available.

Extend TASK 1 to work for all 10 rowing boats. Use the data stored for each boat to find out how many boats are available for hire at the current time. If no boats are available show the earliest time that a boat will be available for hire.

TASK 3 – calculate the money taken for all the boats at the end of the day.

At the end of the day use the data stored for each boat to calculate the total amount of money taken and the total number of hours boats were hired that day. Find out how many boats were not used that day and which boat was used the most. Provide a report for the owner to show this information.

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1 **(a)** All variables, constants and other identifiers should have meaningful names.

(i) For **one** variable that you have used to record the information about a single boat in **Task 1**, state the name, data type and its use.

Variable name .....

Data type .....

Use .....
[3]

(ii) State **one** constant and its value that you could have used for **Task 1**.

Constant name .....

Value .....
[2]

(b) Give **two** different validation checks you could have used for data entry in **Task 1**. For each check explain why it could be used and provide a set of data for testing.

Validation check 1 .....

.....

Reason for choice .....

.....

Set of test data .....

.....

Validation check 2 .....

.....

Reason for choice .....

.....

Set of test data .....

.....
[6]

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(c) Write an algorithm to complete **Task 3**, using **either** pseudocode, programming statements **or** a flowchart. You may assume Task 2 has been completed.

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(d) Explain how your program finds out how many boats are available for hire (**Task 2**).
Any programming statements used must be fully explained.

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Section B

2 Write an algorithm using **either** pseudocode **or** a flowchart, to:

- input a positive integer
- use this value to set up how many other numbers are to be input
- input these numbers
- calculate and output the total and the average of these numbers.

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3 The following diagram shows **four** data structures and **four** descriptions.

Draw a line to connect each data structure to the correct description.

Data structure	Description
Constant	A collection of related data
Array	A value that can change whilst a program is running
Table	A value that never changes whilst a program is running
Variable	A series of elements of the same data type

[3]

4 `IF … THEN … ELSE … ENDIF` is one type of conditional statement used when writing pseudocode.

Identify and describe **another** type of conditional statement that you could use when writing pseudocode. Give a reason why you would use this type of conditional statement.

Conditional statement .....

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.....

.....

Description .....

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.....

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Reason .....

.....

[4]

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5 **(a)** This flowchart checks a batch of 10 rice sacks for weight. Sacks should weigh 50 kilograms each. Sacks weighing over 50.5 kilograms or less than 49.5 kilograms are rejected. The number of sacks accepted and the number of sacks rejected is output.

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Complete the trace table for the input data:

50.4, 50.3, 49.1, 50.3, 50.0, 49.5, 50.2, 50.3, 50.5, 50.6

Accept	Reject	Count	Sack	OUTPUT

[5]

(b) The size of the batch has increased to 50 sacks. It has been decided to only reject sacks that are underweight.

State the changes that need to be made to the flowchart.

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.....[2]

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6 A database table, TRAIN, is to be set up for a railway company to keep a record of the engines available for use. Each engine has a unique number made up of 5 digits, nnnnn. The engines are classified as freight (F) or passenger (P) together with a power classification that is a whole number between 0 and 9, for example F8. The railway company keeps a record of the date of the last service for each engine.

(a) Identify the **three** fields required for the database. Give each field a suitable name and data type. Provide a sample of data that you could expect to see in the field.

Field 1 Name .....

Data type .....

Data sample .....

Field 2 Name .....

Data type .....

Data sample .....

Field 3 Name .....

Data type .....

Data sample .....[6]

(b) State the field that you should choose as the primary key.

.....[1]

(c) Using the query-by-example grid below, write a query to identify all passenger engines that have not been serviced in the past 12 months. Only display the engine numbers.

Field:				
Table:				
Sort:				
Show:	☐	☐	☐	☐
Criteria:				
or:				

[3]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/23**

Paper 2 Problem-solving and Programming **October/November 2017**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

DO NOT ATTEMPT TASKS 1, 2 AND 3 in the pre-release material; these are for information only.

You are advised to spend no more than **40 minutes** on **Section A** (Question 1).

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 50.

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Section A

You are advised to spend no longer than 40 minutes answering this section.

Here is a copy of the pre-release material.

DO NOT attempt Tasks 1, 2 and 3 now.

Use the pre-release material and your experience from attempting the tasks before the examination to answer Question 1.

Pre-release material

A small airfield operates a flying club where people can take a short flight to see if they would like flying lessons. The owner of the airfield has asked you to write a program to organise the flight bookings. The airfield operates three different planes and offers either a 30 minute or a 60 minute flight.

The following table shows the tariff:

Length of Flight	2 Seater Plane	4 Seater Plane	Historic Plane
30 minutes	$100	$120	$300
60 minutes	$150	$200	$500

After each flight, 30 minutes must be allowed for refuelling and safety checks before the next flight can take off. All planes offer both 30 minute and 60 minute flights, but, for the purpose of this activity, they will not be mixed on a given day, e.g. the 2 seater will offer 30 minute flights ONLY on one day and 60 minute flights ONLY on another day.

Write and test a program for the owner of the airfield.

- Your program must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Work out the maximum income.
Assume that the flights take place between 08:00 and 18:00. Write a program that will work out the maximum income that can be generated by each plane in a day for each type of flight. The program should allow you to:

- input the type of plane
- input the length of flight
- calculate the maximum number of flights in a day
- output the total possible income per day for the choice of plane and length of flight

TASK 2 – Record bookings.
Write a program to store bookings for each plane and to allow you to find which planes are available at a given time slot during the day. The program should calculate the actual number of flights taken by each plane in that day.

TASK 3 – Work out income.
Modify TASK 2 so that it will calculate the total amount of money taken in a day for each plane, as well as the overall daily total for all three planes, and output the results.

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1 **(a)** All variables, constants and other identifiers should have meaningful names.

(i) Declare suitable arrays for each of the planes to store time slots booked.

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.....[3]

(ii) Name **one** variable and **one** constant you used for **Task 1** and state the purpose of each one.

Variable .....

Purpose .....

.....

Constant .....

Purpose .....

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[4]

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(b) Write an algorithm to complete **Task 1**, using **either** pseudocode, programming statements or a flowchart.

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(c) Describe how you could validate and test the inputs for **Task 1**.

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.....[4]

(d) Explain how your program checks and displays whether any of the planes are available at a given time of the day (**Task 2**). Any programming statements used must be fully explained.

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Section B

2 This section of program code asks for 80 numbers between 100 and 1000 to be entered. It checks that the numbers are in the correct range, and stores them in an array. It counts how many of the numbers are larger than 500 and then outputs the result when the program is finished.

```
1 Count = 0
2 FOR Index = 1 TO 80
3   INPUT 'Enter a number between 100 and 1000', Number
4   WHILE Number = 99 AND Number = 1001
5     INPUT 'This is incorrect, please try again', Number
6   ENDWHILE
7   Num[80] = Number
8   IF Number > 500 THEN Count = Count + 1
9  UNTIL Index = 80
10 PRINT Index
11 PRINT ' numbers were larger than 500'
```

There are **four** lines of code that contain errors.

State the line number for each error and write the correct code for that line.

Error 1 Line Number .....

Correct Code .....

Error 2 Line Number .....

Correct Code .....

Error 3 Line Number .....

Correct Code .....

Error 4 Line Number .....

Correct Code .....
[4]

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3 **(a)** Explain the difference between a validation check and a verification check.

.....

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.....[2]

(b) Describe, using an example, how data could be verified on data entry.

.....

.....

.....[2]

(c) Explain what is meant by the term library routine.

.....

.....

.....[2]

4 **(a)** **Four** pseudocode descriptions and **five** pseudocode statements are shown. Draw one line to link each pseudocode description to the correct pseudocode statement. Not all pseudocode statements will be used.

Pseudocode description	**Pseudocode statement**
A loop that will iterate at least once.	`FOR...TO...NEXT`
A conditional statement to deal with many possible outcomes.	`IF...THEN...ELSE...ENDIF`
A loop that will iterate a set number of times.	`WHILE...DO...ENDWHILE`
A conditional statement with different outcomes for true and false.	`CASE...OF...OTHERWISE...ENDCASE`
	`REPEAT...UNTIL`

[4]

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(b) Write an algorithm in pseudocode, using a single loop, to print 50 names that have been stored in an array.

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5 The flowchart below represents a program routine.

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(a) The array used in the flowchart contains the following data:

Name[1]	Name[2]	Name[3]	Name[4]
Jamal	Amir	Eve	Tara

Complete the trace table using the data given in the array.

Flag	Count	Name[1]	Name[2]	Name[3]	Name[4]	Temp
		Jamal	Amir	Eve	Tara	

[5]

(b) Describe what the algorithm represented by the flowchart is doing.

.....

.....[2]

Question 6 begins on Page 12.

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6 A wildlife park has a database table, called LIVESTOCK, to classify and record its animal species. Part of the database table is shown.

Species	Classification	Diet	Legs
Giraffe	Mammal	Herbivore	4
Elephant	Mammal	Herbivore	4
Crocodile	Reptile	Carnivore	4
Ostrich	Bird	Omnivore	2
Gorilla	Mammal	Herbivore	2
Bear	Mammal	Omnivore	4
Rhinoceros	Mammal	Herbivore	4
Hippopotamus	Mammal	Herbivore	4
Flamingo	Bird	Omnivore	2
Lion	Mammal	Carnivore	4
Turtle	Reptile	Omnivore	4
Penguin	Bird	Carnivore	2

(a) Suggest another appropriate field that could be added to this database by stating its name and data type. State its purpose and give an example of the data it could contain.

Field name .....

Data Type .....

Purpose .....

.....

Example of data .....

[2]

(b) Use the query-by-example grid below to provide a list of all four legged mammals that are herbivores, sorted alphabetically by species, with only the species displayed.

Field:					
Table:					
Sort:					
Show:	☐	☐	☐	☐	☐
Criteria:					
or:					

[4]

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Grade thresholds – March 2018

Cambridge IGCSE Computer Science (0478)

Grade thresholds taken for Syllabus 0478 (Computer Science) in the March 2018 examination.

		minimum raw mark required for grade:						
	maximum raw mark available	A	B	C	D	E	F	G
Component 12	75	53	45	37	32	28	23	18
Component 22	50	36	29	22	18	14	11	8

Grade A* does not exist at the level of an individual component.

The maximum total mark for this syllabus, after weighting has been applied, is **125**.

The overall thresholds for the different grades were set as follows.

Option	Combination of Components	A*	A	B	C	D	E	F	G
AY	12, 22	104	89	74	59	50	42	34	26

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

COMPUTER SCIENCE **0478/12**

Paper 1 **March 2018**

MARK SCHEME

Maximum Mark: 75

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
1	**Description** / **Type of software** Free to download Code can be modified and redistributed Subject to copyright legislation Free software Freeware 1 mark for each 'Type of software' if correct lines are attached to it.	2

Question	Answer	Marks
2(a)	Any **three** from: <u>Scans</u> files for viruses // detects/identifies a virus Can constantly run in background Can run a scheduled scan Can automatically updating virus definitions Can quarantine a virus Can delete a virus Completes heuristic checking Notifies user of a possible virus	3

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Question	Answer	Marks
2(b)	Any **three** from: Use a firewall Use of a proxy server Do not use / download software / files from unknown sources Do not share external storage devices / USB pens Do not open / take care when opening attachments / link Do not connect computer to network / use as stand-alone computer Limiting access to the computer	**3**

Question	Answer	Marks
3(a)	Byte 3 / 10110100	**1**
3(b)	Odd parity used Counted / added the number 1's // Most Bytes have an odd number of 1's Byte 3 has an even number of 1's // Byte 3 didn't follow odd parity	**3**

Question	Answer	Marks
4	Any **six** from: Sensor(s) send data/signals to the microprocessor Analogue signal/data from sensor is converted to digital (using ADC) Microprocessor compares data value against set boundaries / pre-set data If value between 21 and 24 … … no action taken If value > 24 °C / signal is sent from microprocessor… … to turn conditioning unit ON//Set to cold If value is < 21 °C signal is sent from microprocessor… … to turn conditioning unit ON//Set to warm Process is repeated for a continuous operation	**6**

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Question	Answer	Marks
5(a)	One mark for each correct Hexadecimal value C4 | 10 | FE | 09	3
5(b)	Any **two** from: Easier / simpler to remember / write down // quicker to transcribe Less likely to make error Less digits to use	2

Question	Answer	Marks
6	1 mark for suitable example and 1 mark for suitable associated use. Primary RAM … … stores OS when running / data currently in use / instructions currently in use ROM … … stores boot instructions / BIOS Cache … … stores frequently used instructions Secondary HDD / SSD… …stores files / applications (by example) Offline CD/DVD/Blu-ray/Flash Memory/USB stick/Removable HDD/Removable SSD… … stores files / applications (by example)	6

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Question	Answer	Marks
7(a)	4 marks for 8 correct outputs 3 marks for 6 correct outputs 2 marks for 4 correct outputs 1 mark for 2 correct outputs	**4**

A	B	C	**X**
0	0	0	**1**
0	0	1	**0**
0	1	0	**1**
0	1	1	**1**
1	0	0	**0**
1	0	1	**1**
1	1	0	**1**
1	1	1	**1**

7(b) — 1 mark per gate in correct location — **6**

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Question	Answer	Marks
7(c)	4 marks for 8 correct outputs 3 marks for 6 correct outputs 2 marks for 4 correct outputs 1 mark for 2 correct outputs	**4**

A	B	C	**X**
0	0	0	**0**
0	0	1	**0**
0	1	0	**1**
0	1	1	**1**
1	0	0	**0**
1	0	1	**0**
1	1	0	**0**
1	1	1	**0**

Question	Answer	Marks
8(a)		**3**

Descriptions	**Method**		
	Serial	Parallel	
Multiple bits are sent and received at the same time.		✓	[1]
Bits are sent one at a time in a single direction.	✓		[1]
Bits are sent using a single wire. Data can be sent or received, but not at the same time.	✓		[1]

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Question	Answer	Marks
8(b)		3

Descriptions	Type			
	Simplex	Half-duplex	Duplex	
Multiple bits are sent and received at the same time.			✓	[1]
Bits are sent one at a time in a single direction.	✓			[1]
Bits are sent using a single wire. Data can be sent or received, but not at the same time.		✓		[1]

Question	Answer	Marks
9	Max 3 – 1 mark for correct answer and 2 marks for correct calculations. Any **two** from: 16000 × 32 512000 / 1024 Or 16000 × 8 128000 × 32 4096000 / 8 512000 / 1024 **Correct answer:** 500 kB	3

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Question	Answer	Marks
10(a)(i)	10010	**1**
10(a)(ii)	11110001	**1**
10(b)	Any **four** from: The program is stored on a secondary storage device Data and instructions are moved to memory / RAM Data and instructions are stored in the same memory / RAM Data and instructions are moved to registers to be executed Instructions are fetched one at a time	**4**

Question	Answer	Marks
11(a)	Smaller file size reduces download / display time // reduces upload time	**1**
11(b)	Any **four** from: A compression algorithm is used Permanently deleting some data // file cannot be restored to original Colour depth / palette can be reduced Resolution can be reduced // number of pixels can be reduced Less bits will be required for each pixel / colour	**4**

Question	Answer	Marks
12(a)	Quicker to scan … … rather than type into a system Fewer errors … … no human input	**4**

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Question	Answer	Marks
12(b)	Any **four** from: Uses a barcode reader / scanner Reader shines light / red laser at barcode White lines reflect (more) light Sensors / photoelectric cells detect light reflected back Different reflections / bars will convert to different binary values	**4**

Question	Answer	Marks
13	Any **four** from • (Provides an) interface • Loads / opens / installs / closes software • Manages the hardware // manages peripherals // spooling • Manages the transfer of programs into and out of memory • Divides processing time // processor management • Manages file handling • Manages error handling / interrupts • Manages security software • Manages utility software • Manages user accounts • Multitasking // Multiprocessing // Multiprogramming // Time slicing • Batch processing // real time processing	**4**

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Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

7559895684

COMPUTER SCIENCE **0478/12**

Paper 1 Theory **February/March 2018**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

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1 Some types of software can be described as free software or freeware.

Draw lines to link each description to a correct type of software. A description can be linked to more than one type of software.

Description	Type of software
Free to download	Free software
Code can be modified and redistributed	Freeware
Subject to copyright legislation	

[2]

2 David has installed anti-virus software on his computer.

(a) State **three** tasks carried out by anti-virus software.

Task 1 .....

.....

Task 2 .....

.....

Task 3 .....

.....

[3]

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(b) David is still concerned that his computer might get infected by a computer virus.

State **three** other ways in which David can reduce the risk of his computer getting a computer virus.

1 .....

.....

2 .....

.....

3 .....

.....
[3]

3 Parity checks can be used to check for errors during data transmission.

One of the bytes has been transmitted incorrectly.

Byte 1	Byte 2	Byte 3	Byte 4
10110011	10101000	10110100	10110101

(a) State which byte was incorrectly transmitted.

.....[1]

(b) Explain how you identified the incorrectly transmitted byte.

.....

.....

.....

.....

.....

.....[3]

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4 An air conditioning system is used to control the temperature in a hospital.

The air conditioning system uses temperature sensors and a microprocessor.

The temperature must remain between 21 °C and 24 °C.

Describe how the sensors and the microprocessor are used to control the temperature of the hospital.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[6]

5 The IP address of a computer is stored as a set of four 8-bit binary numbers.

The network administrator converts each binary number into hexadecimal.

(a) Complete the table to show the hexadecimal equivalent of the binary IP address.
The first number has already been converted.

Binary IP address

11000100	00010000	11111110	00001001

Hexadecimal

C4			

[3]

(b) Explain why the network administrator uses hexadecimal.

.....

.....

.....

.....[2]

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6 Primary, secondary and off-line are types of storage.

Give an example of each type of storage.

For each example state how it is used.

Primary storage

Example .....

Use .....

.....

Secondary storage

Example .....

Use .....

.....

Off-line storage

Example .....

Use .....

.....

[6]

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7 **(a)** For this logic circuit:

Complete the truth table.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

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(b) For this logic statement:

X = 1 if (B is 1 OR C is NOT 1) AND ((A is NOT 1) AND (B is 1 OR C is 1))

Draw a logic circuit.

[6]

(c) Complete the truth table for the logic statement given in **part (b)**.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

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8 **(a)** **Three** descriptions and **two** methods of data transmission are given.

Tick (✓) the correct box to show the **Method** of data transmission for each description.

Description	**Method**	
	Serial	Parallel
Multiple bits are sent and received at the same time.		
Bits are sent one at a time in a single direction.		
Bits are sent using a single wire. Data can be sent or received, but not at the same time.		

[3]

(b) **Three** descriptions and **three** types of data transmission are given.

Tick (✓) the correct box to show the **Type** of data transmission for each description.

Description	**Type**		
	Simplex	Half-duplex	Duplex
Multiple bits are sent and received at the same time.			
Bits are sent one at a time in a single direction.			
Bits are sent using a single wire. Data can be sent or received, but not at the same time.			

[3]

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9 A 32-second sound clip will be recorded. The sound will be sampled 16000 times a second.

Each sample will be stored using 8 bits.

Calculate the file size in kilobytes. **You must show all of your working.**

File Size ..... kB

[3]

10 The table shows a segment of primary memory from a Von Neumann model computer.

Address	**Contents**
10001	11001101
10010	11110001
10011	10101111
10100	10000110
10101	00011001
10110	10101100

The program counter contains the data 10010.

(a) **(i)** State the data that will be placed in the memory address register (MAR).

.....[1]

(ii) State the data that will be placed in the memory data register (MDR).

.....[1]

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(b) Describe the stored program concept when applied to the Von Neumann model.

.....

.....

.....

.....

.....

.....

.....

.....[4]

11 Miriam needs to use a large high-resolution photo as a thumbnail image on a website.

She will use lossy compression to reduce the file size of the photo to create the thumbnail image.

(a) State why a smaller file size is appropriate for this situation.

.....

.....[1]

(b) Explain how lossy compression reduces the file size.

.....

.....

.....

.....

.....

.....

.....

.....[4]

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12 A hospital stores the results of medical tests on a computer system. Each patient is given a wristband containing a unique barcode. The barcode is used every time the patient has a medical test.

(a) Explain **two** benefits of using barcodes in this situation.

Benefit 1 .....

.....

.....

.....

Benefit 2 .....

.....

.....

.....
[4]

(b) Describe how the barcode is read.

.....

.....

.....

.....

.....

.....

.....

.....[4]

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13 State **four** functions of an operating system.

Function 1 .....

.....

Function 2 .....

.....

Function 3 .....

.....

Function 4 .....

.....

[4]

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COMPUTER SCIENCE **0478/22**

Paper 2 **March 2018**

MARK SCHEME

Maximum Mark: 50

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the March 2018 series for most Cambridge IGCSE®, Cambridge International A and AS Level components and some Cambridge O Level components.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
	Section A	
1(a)(i)	1 mark for name and 1 mark for appropriate data structure from **Task 1** e.g. name `studentName` Data structure Array	**2**
1(a)(ii)	1 mark for name, 1 mark for appropriate value and 1 mark for appropriate use. From any task e.g. Constant name `classSize` Value 30 Use Fixed number of students in a class Variable name `counter` Data type integer Use to count the number of student names entered	**6**
1(b)	1 mark for changing the value of a variable/constant/ counter, 1 mark for change to the program e.g. Value: Change the value of the variable/constant `maxGroupSize` in **Task 2** to 25 Program change: Oversubscribed test will be changed to test for over 50 // second group starts at 26	**2**

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Question	Answer	Marks
1(c)	Any **five** from Initialise subject counts Loop through students Input and store student name… … and input and store two subject choices for that student Update subject counts // update subject lists of student names Error message if subject not found Output total subject counts Prompts for all inputs and messages with all outputs Sample answer for **Task 1**	**5**

```
physics ← 0; chemistry ← 0; history ← 0; geography ← 0; compSci ← 0;
FOR counter ← 1 TO 60
   INPUT name, subject(1), subject(2)
   studentName(counter) ← name
   studentCounter1(counter) ← subject(1)
   studentCounter2(counter) ← subject(2)
   FOR sCount ← 1 TO 2
      CASE subject(sCount) OF
            'Physics': physics ← physics + 1
            'Chemistry': chemistry ← chemistry + 1
            'History': history ← history + 1
            'Geography': geography ← geography + 1
            'Computer Science': compSci ← compSci + 1
      OTHERWISE: PRINT 'Error subject not found'
      ENDCASE
   NEXT
NEXT
PRINT 'Group            Number of Students'
PRINT 'Physics          ',physics
PRINT 'Chemistry        ',chemistry
PRINT 'History          ',history
PRINT 'Geography        ',geography
PRINT 'Computer Science ',compSci
```

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Question	Answer	Marks
1(d)	Any **five** from Explanation for calculation of total number of spare places Check the number of students who have chosen each subject If less than 10 no places available (Otherwise)If less than 20… …Calculate number of spare places (20 – number) If more than 20 and less than 40… …Calculate number of spare places (40 – number) Keep a running total of the total number of spare places	**5**

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Question	Answer	Marks
	Section B	

2(a)	1 mark for each error identified + suggested correction
	`NUMBERS` should be `Number`
	`IF Number > 100` should be `IF Number >= 100`
	`INPUT Number` is missing from inside the loop insert `INPUT Number` after the `IF` statement
	The final `PRINT Number` is not needed remove it
		4

2(b)	One mark for both ends of the range and correct inequality symbols and one mark for the **AND.** The test should be `IF Number >= 100 AND Number <= 200`	**2**

Question	Answer	Marks
3		**4**

Weight	totalWeight	totalNumber	OUTPUT
	0	0	
50	50	1	
70	120	2	
65	185	3	
100	285	4	
95	380	5	
50	430	6	
55	485	7	
85	570	8	
70	640	9	Lift overload, step out

One mark for each correct column.

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Question	Answer	Marks
4	1 mark for value and 1 mark for appropriate reason e.g. Value 1 `2` (1) boundary should be accepted as weight OK (1) Value 2 `two` (1) erroneous/abnormal should be rejected (1)	**4**

Question	Answer	Marks

5	2 marks for appropriate explanation, 1 mark example programming statements showing sequence, 1 mark example programming statement(s) showing selection e.g.
	
	Sequence is the concept of one statement being executed after another(1) whereas selection decides which statement(s) are to be executed depending upon the result of a question (1)
	sequence example (1)
	`PRINT X`
	`PRINT Y`
	Selection example (1)
	`IF X > Y THEN PRINT X ELSE PRINT Y`
		4

Question	Answer	Marks
6(a)	1 mark for appropriate field name and appropriate data type, then 1 mark for appropriate explanation. e.g. Metal, type text(1) a single character/word that can be input accurately/quickly(1) Item, type text (1) a single character/word that can be input accurately/quickly(1) Number in Stock, type number (1) can be used for calculations (1) Price, type currency (1) properly formatted and can be used for calculations (1)	**8**
6(b)	All fields could contain duplicate values	**1**

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Question	Answer	Marks
6(c)		3

Field:	Metal	Item	Number in Stock	Price
Table:	JEWEL	JEWEL	JEWEL	JEWEL
Sort:				
Show:	☐	☐	☑	☑
Criteria:	="silver"	="bracelet"		
or:				

One mark for columns 1 + 2, one mark for columns 3 + 4
One mark for accuracy of syntax and spelling

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COMPUTER SCIENCE **0478/22**

Paper 2 Problem-solving and Programming **February/March 2018**

PRE-RELEASE MATERIAL

No Additional Materials are required.

This material should be given to the relevant teachers and candidates as soon as it has been received at the Centre.

READ THESE INSTRUCTIONS FIRST

Candidates should use this material in preparation for the examination. Candidates should attempt the practical programming tasks using their chosen high-level, procedural programming language.

This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **2** printed pages.

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In preparation for the examination candidates should attempt the following practical tasks by **writing and testing a program or programs**.

Students in a school are allowed to choose extra subjects each year. Students provide the school administrator with their names and their subject choices. Places in subject groups are allocated on a 'first come, first served' basis. There are two classes of 30 students and they can each choose **two** extra subjects from:

- Physics
- Chemistry
- History
- Geography
- Computer Science

The maximum group size for each subject choice is 20 students and the minimum group size is 10 students. If more than 20 students choose a subject then that subject can be split into two groups. Each subject can have no more than two groups. If less than 10 students choose a subject then it is not available that year. A program is required to show a summary of the number of students who have chosen each subject, identify subject group sizes, produce subject group lists and identify problems.

Write and test a program or programs for the school administrator.

- Your program or programs must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Data entry and number of students who have chosen each subject.

The school administrator enters the data for each student. Write a program for TASK 1 to store this data then calculate and output the number of students who have chosen each subject.

TASK 2 – Output subject group lists and identify problems.

Using your results from TASK 1, allocate students to subject groups. Print out list(s) of student names for each viable subject group. Identify any subjects that are over or undersubscribed, identify the students who have been allocated to one subject group only and those who have not been allocated to any group. Print out this information.

TASK 3 – Identify spare places in subject groups.

Using your results from TASK 2, print out the number of spare places for each subject. Any group that has fewer than 20 students has spare places. Calculate the total number of spare places and the total number of unallocated student choices. Show whether the number of spare places available is enough to cover the unallocated choices.

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/22**

Paper 2 Problem-solving and Programming **February/March 2018**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

DO NOT ATTEMPT TASKS 1, 2 AND 3 in the pre-release material; these are for information only.

You are advised to spend no more than **40 minutes** on **Section A** (Question 1).

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 50.

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Section A

You are advised to spend no longer than 40 minutes answering this section.

Here is a copy of the pre-release material.

DO NOT attempt Tasks 1, 2 and 3 now.

Use the pre-release material and your experience from attempting the tasks before the examination to answer Question 1.

Pre-release material

Students in a school are allowed to choose extra subjects each year. Students provide the school administrator with their names and their subject choices. Places in subject groups are allocated on a 'first come, first served' basis. There are two classes of 30 students and they can each choose **two** extra subjects from:

- Physics
- Chemistry
- History
- Geography
- Computer Science

The maximum group size for each subject choice is 20 students and the minimum group size is 10 students. If more than 20 students choose a subject then that subject can be split into two groups. Each subject can have no more than two groups. If less than 10 students choose a subject then it is not available that year. A program is required to show a summary of the number of students who have chosen each subject, identify subject group sizes, produce subject group lists and identify problems.

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- Your program or programs must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

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1 **(a)** All identifiers should have meaningful names.

(i) State the name and data structure that you have used to record student names in **Task 1**.

Name .....

Data structure .....
[2]

(ii) State the name of **one** constant and the name of **one** variable that you could have used in your programmed solution.
State the value that would be assigned to the constant. State the data type for the variable. Explain what each one would be used for in your programmed solution.

Constant name .....

Value .....

Use .....

.....

Variable name .....

Data type .....

Use .....

.....
[6]

(b) Explain how you would change your program for **Task 2** if the maximum group size for each subject is increased to 25.

.....

.....

.....

.....

.....

.....[2]

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(c) Write an algorithm to complete **Task 1**, using **either** pseudocode, programming statements **or** a flowchart.

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.....[5]

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(d) Explain how your program calculates the total number of spare places in **Task 3**. Any programming statements shown in your answer must be fully explained.

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.....[5]

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Section B

2 An algorithm has been written in pseudocode to input some numbers and print out any numbers that are greater than or equal to `100`. The number `999` stops the algorithm.

```
INPUT Number
WHILE NUMBERS <> 999 DO
  IF Number > 100 THEN PRINT Number ENDIF
ENDWHILE
PRINT Number
```

(a) Find the **four** errors in the pseudocode and suggest corrections.

Error 1 .....

Correction .....

.....

Error 2 .....

Correction .....

.....

Error 3 .....

Correction .....

.....

Error 4 .....

Correction .....

.....

[4]

(b) Show, using pseudocode, how you would change the corrected algorithm to print out any numbers between `100` and `200` inclusive.

.....

.....

.....

.....

.....

.....

.....

..... [2]

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3 This flowchart inputs the weight in kilograms of a passenger stepping into a lift. The lift can take a maximum of eight passengers or a maximum weight of 640 kilograms.

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Complete the trace table for the passenger input data:

50, 70, 65, 100, 95, 50, 55, 85, 70, 75

Weight	totalWeight	totalNumber	OUTPUT

[4]

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4 A program checks if the weight of a baby is at least 2 kilograms.

Give, with reasons, **two** different values of test data that could be used for the baby's weight. Each reason must be different.

Value 1 .....

Reason .....

.....

Value 2 .....

Reason .....

.....
[4]

5 Explain the difference between the programming concepts of **sequence** and **selection**. Include an example of a programming statement for each concept in your explanation.

.....

.....

.....

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.....

.....

.....

.....

.....[4]

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6 A database table, JEWEL, is used to keep a record of jewellery for sale in a shop. Each item of jewellery can be made of silver, platinum or gold metal. The shop stocks rings, bracelets and necklaces. The number in stock and the price is also stored.

(a) Identify the **four** fields required for the database. Give each field a suitable name and data type. Explain why you chose the data type for each field.

Field 1 Name ..... Data type .....

Explanation .....

.....

Field 2 Name ..... Data type .....

Explanation .....

.....

Field 3 Name ..... Data type .....

Explanation .....

.....

Field 4 Name ..... Data type .....

Explanation .....

.....

[8]

(b) Explain why none of these fields could be used as a primary key.

.....

.....[1]

(c) Using the query-by-example grid below, write a query to identify the silver bracelets. Only display the number in stock and the price.

Field:				
Table:				
Sort:				
Show:	☐	☐	☐	☐
Criteria:				
or:				

[3]

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Grade thresholds – June 2018

Cambridge IGCSE™ Computer Science (0478)

Grade thresholds taken for Syllabus 0478 (Computer Science) in the June 2018 examination.

		minimum raw mark required for grade:						
	maximum raw mark available	A	B	C	D	E	F	G
Component 11	75	47	36	26	21	15	10	5
Component 12	75	45	35	26	21	15	10	5
Component 13	75	45	35	26	20	15	10	5
Component 21	50	31	23	15	12	10	7	4
Component 22	50	29	21	14	11	9	6	3
Component 23	50	32	25	18	15	12	9	6

Grade A* does not exist at the level of an individual component.

The maximum total mark for this syllabus, after weighting has been applied, is **125**.

The overall thresholds for the different grades were set as follows.

Option	Combination of Components	A*	A	B	C	D	E	F	G
AX	11, 21	95	77	59	41	33	25	17	9
AY	12, 22	90	73	56	40	32	24	16	8
AZ	13, 23	92	76	60	44	35	27	19	11

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COMPUTER SCIENCE **0478/11**

Paper 1 **May/June 2018**

MARK SCHEME

Maximum Mark: 75

Published

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Question	Answer	Marks
1	1 mark for each correct answer, in the given order: – analogue – digital – denary – 10 – binary – 2	**6**

Question	Answer	Marks
2	1 mark for each correct conversion: – 42 – 257 – 542	**3**

Question	Answer	Marks
3	1 mark for correct register, 3 marks for reason: – Register C Any **three** from: – Count the number of 1/0 bits (in each byte/register) – Two bytes/registers have an odd number of 1/0 bits // Two use odd parity – Odd parity must be the parity used – One byte/register has an even number of 1/0 bits // One uses even parity – One with an even number of one bits/even parity is incorrect // Register C should have odd parity	**4**

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Question	Answer	Marks
4(a)	1 mark for each correct answer: Lossy (compression) Lossless (compression)	**2**
4(b)	1 mark for correct compression, 3 marks for description: – Lossless (compression) Any **three** from: – The file can be restored/decompressed to the exact same state it was before compression/ to original – (It is a computer program so) no data can be lost // Lossy would remove data – Will not run correctly (with any other compression) – (Lossless) will give repeating words/sections of word a value// RLE is used // Other valid examples of methods of lossless compression – Value is recorded in an index	**4**

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Question	Answer	Marks
5	1 mark for each correct line, up to a maximum of 5 marks:	5

Component	Description
Immediate access store (IAS)	Holds data and instructions when they are loaded from main memory and are waiting to be processed.
Register	Holds data temporarily that is currently being used in a calculation.
Control unit (CU)	Holds data or instructions temporarily when they are being processed.
Accumulator (ACC)	Manages the flow of data and interaction between the components of the processor.
Arithmetic logic unit (ALU)	Carries out the calculations on data.
Bus	Pathway for transmitting data and instructions.

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Question	Answer	Marks
6(a)	1 mark for each correct logic gate (with the correct direction of input(s))	**6**

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Question	Answer	Marks
6(b)	4 marks for 8 correct outputs 3 marks for 6 or 7 correct outputs 2 marks for 4 or 5 correct outputs 1 mark for 2 or 3 correct outputs	**4**

A	B	C	Working space	X
0	0	0		**1**
0	0	1		**1**
0	1	0		**1**
0	1	1		**1**
1	0	0		**0**
1	0	1		**1**
1	1	0		**1**
1	1	1		**1**

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Question	Answer	Marks
7	Compiler Any **three** from: – Translates high-level language into **machine code/low level language** – Translates (the source code) all in one go/all at once – Produces an executable file – Produces an error report Interpreter Any **three** from: – Translates high-level language into **machine code/low level language** – Translates (the source code) line by line/statement by statement – Stops if it finds an error – Will only continue when error is fixed	**6**

Question	Answer	Marks
8(a)	Any **four** from: – Shines light / (red) laser at barcode – Light is called an illuminator – Light is reflected back // White lines reflect light // Black lines reflect less light/absorbs light – Sensors / photoelectric cells detect the light – Different reflections / bars will give different binary values / digital values // pattern converted to digital values – A microprocessor interprets the data	**4**
8(b)	Any **three** from: – barcode identifies a (unique) product – barcode can be used to look up product (in a database) – data about stock levels can be stored on a system – stock can be automatically deducted from the system – can check stock is below a certain level // check stock level – automatic re-order // Alerts when stock is low – automatically update new stock level – to locate if an item of stock is available in another location	**3**

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Question	Answer	Marks
8(c)	Any **four** from: – (Infrared) rays are sent across screen (from the edges) – Has sensors around edge // Sensors capture beams – (Infrared) rays form a grid across the screen – (Infrared) ray is broken (by a finger blocking a beam) – **Calculation** is made (on where beam is broken) to locate the 'touch' // Co-ordinates are used to locate the touch	**4**
8(d)	Secondary Storage – any **two** from: – Not directly accessed by the CPU – Non-volatile storage – Secondary is internal to the computer/device – An example of secondary storage would be HDD/SSD Off-line storage – any **two** from: – Non-volatile storage – Off-line storage is storage that is removable from a computer/device // not internal // portable – An example of off-line storage would be CD/DVD/USB stick/SD card/magnetic tape/ external HDD/SSD	**4**

Question	Answer	Marks
9	Any **six** from: – Suitable biometric device, such as fingerprint scanner/retina/eye/iris scanner/face recognition/voice recognition/palm scanner // description of use e.g. use fingerprint on device – Sensor (in biometric device) captures/takes data/readings (of user) – Data/readings are converted from analogue to **digital** (using ADC) – Data/reading sent to the microprocessor – Data/readings compared to stored values/data … – … if data/readings **match** user can enter – … if data/readings **do not match** user is declined entry // user asked to try again … – … alert may be sent to security // alarm may sound	**6**

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Question	Answer	Marks
10(a)	Any **four** from: – Structure **and** presentation are defined using (mark-up) tags – Structure **and** presentation dictate the appearance of the website – Structure is used for layout – Example of structure – Presentation is used for formatting / style – Example of formatting – Separate file / CSS can be used for presentation content	**4**
10(b)(i)	1 mark for each correct part – domain (name) – file name/webpage name	**2**
10(b)(ii)	Any **two** from: – Hypertext Transfer Protocol Secure // it is the access protocol // It is a protocol – It means the website uses SSL/TLS – It means data sent (to and from the webserver) is encrypted	**2**
10(c)	Any **two** from e.g. : – To store items that a customer has added to an online shopping basket – To store a customer's credit card details – To store log-in details – To track what product a customer browses // Track music preferences – Targeted advertising // making recommendations – Personalises/customises the experience – Shows who are new and returning customers – To speed up log-in times – To speed up/allow single click purchases – Improves the experience	**2**

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Question	Answer	Marks
10(d)	Any **four** from: – Prevents direct access to the **webserver** // Sits between **user** and **webserver** – If an attack is launched it hits the proxy server instead // can be used to help prevent DDOS // help prevent hacking of **webserver** – Used to direct invalid traffic away from the webserver – Traffic is examined by the proxy server // Filters traffic – If traffic is valid the data from the webserver will be obtained by the user – If traffic is invalid the request to obtain data is declined – Can block requests from certain IP addresses	**4**

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COMPUTER SCIENCE **0478/12**

Paper 1 **May/June 2018**

MARK SCHEME

Maximum Mark: 75

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Question	Answer	Marks
1	1 mark for each unit, in the given order: – nibble – byte – megabyte (MB) – gigabyte (GB)	**4**

Question	Answer	Marks
2(a)	Any **four** from: – Image is converted from <u>analogue</u> to digital (using ADC) – Image is turned into pixels – Each pixel is given a binary value – Pixels form a grid (to create the image) – Each pixel has a colour – Pixels are stored in sequence (in a file) – Meta data is stored (to describe the dimensions/resolution of the image) // It stores the dimensions/colour depth .etc. – An example of a suitable photo file format e.g. JPEG	**4**
2(b)	1 mark for correct compression, 3 marks for explanation: – Lossy Any **three** from: – Lossy would reduce the file size **more** (than lossless) – The **redundant** data can be removed from the files // by example (must be about redundant data) – Images can still be a similar quality – There is no requirement for the files to be exactly the same as original file – Photos can be sent quick**er** // fast**er** to upload // fast**er** to download	**4**

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Question	Answer	Marks
3(a)	1 mark for each correct register Hours: 0 0 0 0 0 0 1 0 Minutes: 0 0 0 1 1 1 1 1 Seconds: 0 0 1 1 1 0 1 0	3
3(b)	1 mark for each correct section: 0 5 : 2 6 : 5 5 Hours Minutes Seconds	3

Question	Answer	Marks
4	1 mark for each correct section: 1 1 0 1 | 0 0 0 0 | 0 0 1 1 ← 1 mark → ← 1 mark → ← 1 mark →	3

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Question	Answer	Marks
5	1 mark for correct register, 3 marks for reason: – Register Y Any **three** from: – Count the number of 1/0 bits (in each byte/register) – Two bytes/registers have an odd number of 1/0 bits // Two have odd parity – Even parity must be the parity used – One byte/register has an even number of 1/0 bits // One uses even parity – The two with an odd number of one bits/odd parity are incorrect // Register X and Z should have even parity	**4**

Question	Answer	Marks
6	1 mark for each correct missing word, in the given order: – fetches – immediate access store // IAS – program counter // PC – memory address register // MAR – memory data register // MDR – executed – arithmetic logic unit // ALU – accumulator // ACC	**8**

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Question	Answer	Marks
7(a)	1 mark for each correct logic gate with correct direct of input(s):	**6**
7(b)	4 marks for 8 correct outputs 3 marks for 6 or 7 correct outputs 2 marks for 4 or 5 correct outputs 1 mark for 2 or 3 correct outputs	**4**

A	B	C	Working space	X
0	0	0		1
0	0	1		1
0	1	0		0
0	1	1		0
1	0	0		1
1	0	1		1
1	1	0		0
1	1	1		0

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Question	Answer	Marks
8	1 mark for correct translator, 3 marks for explanation: – Compiler Any **three** from: – Does not require recompilation // compiled program can be executed without a compiler … – ... therefore, allows faster execution – Provides an executable file … – … therefore, allows him to just send machine code – **Dimitri's friend** does not need translation/compilation **software** to execute the program	**4**

Question	Answer	Marks
9(a)	QR/Quick response	**1**
9(b)	Any **four** from: – Read/scanned using **app** (on mobile device) – It is the **camera** that is used to scan/capture the image – The three large squares are used to define the alignment // uses alignment targets/modules – Black squares reflect less light // white squares reflect more light – The app/device processes the image – Each small square/pixel is converted to a binary value	**4**

Question	Answer	Marks
10(a)	Any **four** from: – Conductive layer – An electrostatic/electric field is created – **Sensor(s)** (around the screen) monitor the electrostatic field – When touched (electrostatic) charge is transferred to finger – Location of touch is **calculated** // Co-ordinates used to **calculate** touch	**4**

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Question	Answer	Marks
10(b)(i)	Any **two** from: – Gloves are not conductive // Gloves are an insulator – Block current/charge from finger / body / person – Stop the electrostatic field being disturbed/changed	**2**
10(b)(ii)	Any **two** from e.g. (1 mark for method, 1 for expansion): – She could use a (conductive) stylus… – … this will allow the charge to be charged/disturbed – She could use capacitive gloves… – … this will allow the charge to be charged/disturbed – She could use a natural language interface/voice operated interface … – … she could give vocal commands to the device	**2**

Question	Answer	Marks
11	Any **six** from: – Suitable sensor (motion/infra-red) – Data converted (from analogue) to digital (using ADC) – Data sent to microprocessor – Data is compared to stored value/range … – … if data matches/out of range data security light turned on … – … waits for suitable period/until no motion detected … – … light turned off – Continuous loop/process	**6**

Question	Answer	Marks
12(a)(i)	Encryption	**1**

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Question	Answer	Marks
12(a)(ii)	Any **five** from: – Her personal details before encryption is the plain text – The plain text/her personal details is encrypted using an encryption algorithm – The plain text/her personal details is encrypted using a key – The encrypted text is cypher/cipher text – The key is transmitted **separately** (from the text) – The key is used to decrypt the cypher text (after transmission)	**5**
12(b)	Any **three** from a single error method: – Checksum – Calculation carried out on data – (checksum/calculated) value sent with data – recalculated after transmission **and** compared to original – If they do not match an error is present – ARQ – uses acknowledgment **and** timeout – A request is sent with data to acknowledge all data is received – Acknowledgement sent back to say all data is received – If no acknowledgement is received in a time frame an error in transmission detected / data automatically resent.	**3**

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COMPUTER SCIENCE **0478/13**

Paper 1 **May/June 2018**

MARK SCHEME

Maximum Mark: 75

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Question	Answer	Marks
1	One mark per each sensor (sensors must be different):	5

Application	Sensor
Weighing a baby in a hospital	Pressure
Turning off a kettle when it boils	Temperature
Controlling an automatic door	Infrared / Light / Pressure
Monitoring the air quality in an aeroplane	Oxygen / Gas / Humidity
Counting cars crossing a bridge	Pressure / Infrared / Magnetic

Question	Answer	Marks
2		2

Three correct lines = 2 marks
Two or one correct line = 1 mark

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Question	Answer	Marks
3	2 marks per issue from: Phishing – Legitimate looking emails sent to use – When user clicks on attachment / link sent to fraudulent website – Asked to reveal/designed to steal sensitive information Pharming – Malicious code loaded on user hard drive – Will redirect URL requests to fraudulent website – Asked to reveal/designed to steal sensitive information Spam – Junk / unwanted email – Sent to large numbers of people – Used for advertising / spreading malware – Fills up mail boxes	**6**

Question	Answer	Marks
4(a)(i)		**4**

Received Byte	Transmitted correctly (✓)	Transmitted incorrectly (✓)
10001011		✓
10101110	✓	
01011101	✓	
00100101	✓	

Question	Answer	Marks
4(a)(ii)	**One** from: – ARQ – Check Sum	**1**

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Question	Answer	Marks
4(b)(i)	– Multiple bits / byte(s) sent at the same time – Using multiple wires	2
4(b)(ii)	Any **one** from e.g.: – Integrated Circuits – Any appropriate CPU buses – Any suitable device connection that uses parallel	1
4(b)(iii)	Two from: – Bits remain synchronised … – … reducing data errors – Only single wire is required … – … more cost effective to install/manufacture	2
4(c)(i)	– Encrypted text is meaningless – Need the key to decrypt the text	2
4(c)(ii)	– Increase length / more bits used for key … – … will generate more possibilities for key / less chance of decryption by brute force method	2

Question	Answer	Marks
5(a)	(0)1101011	1
5(b)	000 100101100 1 mark for three leading zeros, 1 mark for correct binary number	2
5(c)	B3 1 mark for each correct character	2
6(a)	Any **two** from: – A signal sent from a device / software – Requests processor time // Processor stops to service interrupt – Interrupts have different priorities	2

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Question	Answer	Marks
6(b)	Any **three** from e.g.: – Keyboard – Printer – Mouse	**3**

Question	Answer	Marks
7(a)	Any **three** from: – Does not require peripherals (mouse or keyboard) – Number of possible inputs limited / menu driven interface – Less chance of input error – Resistant to weather	**3**
7(b)	– Uses two/multiple layers – When top layer touched / pushed two layers make contact – Circuit is completed when layers touch – Point of contact is determined/calculated	**4**

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Question	Answer	Marks
8(a)		**4**

A	B	C	X
0	0	0	**1**
0	0	1	**1**
0	1	0	**0**
0	1	1	**1**
1	0	0	**0**
1	0	1	**1**
1	1	0	**1**
1	1	1	**1**

All 8 for 4 marks
6 or 7 for 3 marks
4 or 5 for 2 marks
2 or 3 for 1 mark

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Question	Answer	Marks
8(b)	 1 mark per gate with correct inputs	**6**

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Question	Answer	Marks
9		3

Statement	Assembler (✓)	Compiler (✓)	Interpreter (✓)
Translates high-level language into machine code		✓	✓
Provides error diagnostics	✓	✓	✓
Translates whole program to object code in one operation	✓	✓	
Translates and executes one line of code at a time			✓

1 mark for each correct column

Question	Answer	Marks
10	Any **six** from: – Program counter (PC) holds address / location of the instruction – The address held in PC is sent to MAR – Address is sent using address bus – PC is incremented – The instruction is sent from address in memory to MDR – Instruction is transferred using the data bus – Instruction sent to CIR	6

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Question	Answer	Marks
11	Any **three** from: – Optical media – Non-volatile – Offline – Single (continuous spiral) track – Data stored using lands / pits – Read using (red) lasers – Can be read only (R) or read write (RW)	**3**

Question	Answer	Marks
12	256 × 200 = 51 200 $\frac{51\,200 \times 16}{8} = 102\,400$ $\frac{102\,400}{1024} = 100$ Answer 100 kB One mark for correct answer and two marks for correct calculations.	**3**

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Question	Answer	Marks
13	Any **six** from e.g.: – Provide access to the internet / dial up / broadband – Usually charge a monthly fee – Monitor usage – Give users an IP address – Determine bandwidth – Supports domain names – Provide security services – Provide web hosting facilities – Provide access to Email / Mailbox – Provides online data storage	**6**

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Cambridge International General Certificate of Secondary Education

COMPUTER SCIENCE **0478/21**

Paper 2 **May/June 2018**

MARK SCHEME

Maximum Mark: 50

Published

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Question	Answer	Marks
	Section A	
1(a)(i)	Many correct answers, they must be meaningful. The following is an example only: **One** mark per bullet point • Data structure Array • Name `processor` • Data type string • Use to store processors currently available	**4**
1(a)(ii)	**One** mark per bullet point • Data structure given (1) • Data type (1) • Sample data (1) • More than one data structure described (1) Many correct answers, they must be meaningful. The following is an example only: e.g. Three arrays containing string data with name, address and phone number – John Smith, Cambridge, 01223 123456	**4**
1(b)	**One** mark for method, **one** mark for an extension or reason. Many correct answers, an example is given. Use a previously stored number//generates/uses an initial value (1) Update it (by 1) every time an estimate is made (1)	**2**

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Question	Answer	Marks
1(c)	Any **five** from: 1 Initialise (stock level) flag 2 Check stock level for the chosen processor type 3 Only check RAM if processor available // Only check processor if RAM available 4 Check stock level for the chosen type of RAM 5 Finish process if problem with (RAM/Processor) stock levels 6 Identify out of stock (processor/RAM)//Set flag to appropriate value 7 Identify stock level OK//Set flag to appropriate value	**5**

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Question	Answer	Marks

1(c)	Sample answer:
	
	`foundProc ← FALSE`
	`count ← 1`
	`WHILE NOT foundProc AND count <=3 DO`
	`  IF processor(estNo) = proc(count) AND stProc(count) > 0`
	`  THEN`
	`  foundProc ← TRUE`
	`  ENDIF`
	`  count ← count + 1`
	`ENDWHILE`
	`IF foundProc`
	`  THEN`
	`  foundRAM ← FALSE`
	`  IF RAM(estNO) = RAM1 AND stRAM1 >0`
	`  THEN`
	`  foundRAM ← TRUE`
	`  stRAM1 ← stRAM1 - 1`
	`  ENDIF`
	`  IF RAM(estNO) = RAM2 AND stRAM2 >0`
	`  THEN`
	`  foundRAM ← TRUE`
	`  stRAM2 ← stRAM2 - 1`
	`  ENDIF`
	`ENDIF`
	`IF NOT foundProc`
	`  THEN`
	`  OUTPUT "Processor out of stock"`
	`  ELSE`
	`  stProc(count) ← stProc(count) - 1`
	`ENDIF`
	`IF NOT foundRAM`
	`  THEN`
	`  OUTPUT "RAM out of stock"`
	`ENDIF`	

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Question	Answer	Marks
1(d)	**One** mark for each correct point (max 5): Explanation 1 How the number of orders was calculated 2 Deal with the case where the estimate has not been turned into an order 3 Calculating the total number of each component sold 4 Details of method actually used to calculate numbers of components 5 How the total value of all the orders was calculated 6 Display summary 7 Display complete summary of number of orders, total number of components and total value of orders Programming statements can be used but **must be explained** to gain credit.	**5**

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Question	Answer	Marks
	Section B	

2(a)	Any **six** from:
	1 Initialisation of counters for positive numbers and zeros
	2 Appropriate loop for 1000 iterations
	3 Input number inside loop
	4 Test for positive numbers
	5 Update positive number counter
	6 Test for zeros
	7 Update zero counter
	8 Output counters with appropriate messages outside loop
	
	`zero ← 0`
	`posCount ← 0`
	`FOR count ← 1 TO 1000`
	`  INPUT number`
	`  IF number > 0`
	`  THEN posCount ← posCount + 1`
	`  ENDIF`
	`  IF number = 0`
	`  THEN zero ← zero + 1`
	`  ENDIF`
	`NEXT`
	`OUTPUT posCount, " positive numbers"`
	`OUTPUT zero, " zeros"`
		6

2(b)	Reduce the number of iterations to a manageable amount // Simulate the input (e.g. random generation)	**1**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(a)</td><td>
<table>
<tr><th>Digit(1)</th><th>Digit(2)</th><th>Digit(3)</th><th>Digit(4)</th><th>Digit(5)</th><th>Digit(6)</th><th>Digit(7)</th><th>Digit(8)</th><th>Sum</th><th>OUTPUT</th></tr>
<tr><td>5</td><td>7</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>6</td><td>44</td><td>GTIN-8</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>57012346</td></tr>
</table>
<table>
<tr><th>Digit(1)</th><th>Digit(2)</th><th>Digit(3)</th><th>Digit(4)</th><th>Digit(5)</th><th>Digit(6)</th><th>Digit(7)</th><th>Digit(8)</th><th>Sum</th><th>OUTPUT</th></tr>
<tr><td>4</td><td>3</td><td>1</td><td>0</td><td>2</td><td>3</td><td>1</td><td>0</td><td>30</td><td>GTIN-8</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>43102310</td></tr>
</table>
One mark for data entry – both sets of digits 1–7
One mark for both Digit(8)
One mark for each Sum (max Two)
One mark for both OUTPUT
</td><td>5</td></tr>
<tr><td>3(b)</td><td>
Any three from
1 Change first loop to 8 iterations
2 Check that the input <code>Digit(8)</code> is equal to the calculated <code>Digit(8)</code>…
3 … if equal output check digit correct
4 … otherwise output check digit incorrect

Or

1 Change first loop to 8 iterations
2 Put all 8 digits through the algorithm to calculate <code>Sum</code> …
3 … if <code>MOD(Sum,10)</code> is equal to zero, check digit correct
4 … otherwise output check digit incorrect
</td><td>3</td></tr>
</table>

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Question	Answer	Marks
4	**One** mark for each (max **three**) *10.00* boundary/erroneous data // the price should be rejected // value is out of range *9.99* boundary/extreme/normal data // the prices should be accepted // value is within normal range *ten* erroneous/abnormal data // input should be rejected // value is wrong type	**3**

Question	Answer	Marks
5	There are many possible answers. e.g.: Totalling is used to sum a list of numbers (1) Counting is used to find how many numbers/items there are in a list. (1) Totalling example (1) e.g. `Total = Total + Number` Counting example (1) e.g. `Counter = Counter + 1`	**4**

Question	Answer	Marks
6(a)	Fields 5 Records 8	**2**
6(b)	Any **two** from: Length check Type check Presence check Format check	**2**

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Question	Answer					Marks
6(c)	Field:	Type	Sold Out	Date	Title	4
	Table:	PERFORMANCE	PERFORMANCE	PERFORMANCE	PERFORMANCE	
	Sort:					
	Show:	☐	☐	☑	☑	
	Criteria:	Like “Jazz”	False			
	or:					
	One mark per correct column.					

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COMPUTER SCIENCE **0478/22**

Paper 2 **May/June 2018**

MARK SCHEME

Maximum Mark: 50

Published

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Question	Answer	Marks
	Section A	
1(a)(i)	Variable name, data type and use **one** mark, max **two** Several correct answers, the names chosen must be meaningful. Variables must relate to task 2 Example Name `totalMilk` Data type integer/real Use to store the total volume of the milk for the week (to the nearest whole litre) (1) Name `weeklyAverage` Data type integer/real Use to store the average yield per week (1)	**2**
1(a)(ii)	**One** mark per bullet point. • Data structure(s) given (1) • Data type (1) • Sample data (1) • More than one data structure <u>described</u> (1) Example A real array for each milking and an array of strings for the identity codes. There would be 14 arrays for the milking e.g. `mondayMorning, mondayEvening` Sample data for a cow could be 123, 23.5, 22.7	**4**
1(b)	Entering/selecting the identity code (1) method to ensure it is not a duplicate (1) Example Enter new identity code number Check if already in the list of code numbers	**2**

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Question	Answer	Marks

1(c)	Any **five** from:
	1 Initialisation for total weekly volume
	2 loop control
	3 calculation of running total for yield
	4 calculation of average yield
	5 output total and average yield per week with message outside loop
	6 value(s) rounded
	
	Sample answer
	`total ← 0`
	`FOR counter ← 1 TO numCows`
	`  total ← total + mondayMorning(counter)`
	`  total ← total + mondayEvening(counter)`
	`  total ← total + tuesdayMorning(counter)`
	`  total ← total + tuesdayEvening (counter)`
	`  total ← total + wednesdayMorning(counter)`
	`  total ← total + wednesdayEvening (counter)`
	`  total ← total + thursdayMorning(counter)`
	`  total ← total + thursdayEvening (counter)`
	`  total ← total + fridayMorning(counter)`
	`  total ← total + fridayEvening (counter)`
	`  total ← total + saturdayMorning(counter)`
	`  total ← total + saturdayEvening (counter)`
	`  total ← total + sundayMorning(counter)`
	`  total ← total + sundayEvening(counter)`
	`NEXT counter`
	`Average ← ROUND(total/numCows)`
	`OUTPUT "Total volume of milk for week ", ROUND(total)`
	`OUTPUT "Average weekly yield ", average`
		5

1(d)(i)	Explanation Any **five** from: 1 Check each cow 2 Initialise day counter to zero 3 Check every day of the week 4 If daily yield is less than 12 … 5 … add one to day counter 6 If day counter >= 4 … 7 … identify/output identity code number(s)	**5**
1(d)(ii)	Explanation • Add new storage space to store code numbers for example new array/table/list • Add extra code to store these values if the condition was met	**2**

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Question	Answer	Marks
	Section B	
2(a)	**One** mark per correct pair of actions, process, Input/Output, Tests (apart from START and END) max 3 **One** mark complete Flowlines, **one** mark working flowlines, **one** mark correct use flowchart symbols 	**6**
2(b)	Any **two** from: • Use another counter/variable • Update this counter/variable when the number is less than zero/count all numbers **and** subtract the positive numbers • Output this counter/variable at the end // Output both counters at the end	**2**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(a)</td><td>
<table>
<tr><th>Number1</th><th>Number2</th><th>Sign</th><th>Answer</th><th>OUTPUT</th></tr>
<tr><td>5</td><td>7</td><td>+</td><td>12</td><td>12</td></tr>
<tr><td>6</td><td>2</td><td>-</td><td>4</td><td>4</td></tr>
<tr><td>4</td><td>3</td><td>*</td><td>12</td><td>12</td></tr>
<tr><td>7</td><td>8</td><td>?</td><td>0</td><td></td></tr>
<tr><td>0</td><td>0</td><td>/</td><td>(0)</td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
</table>
← 1 mark → ← 1 mark → ← 1 mark →
</td><td>3</td></tr>
<tr><td>3(b)</td><td>
<code>CASE Sign OF … ENDCASE</code> (1)
List +, -, *, / with correct assignments (1)
<code>OTHERWISE Answer ← 0</code> (1)
Example
<pre>CASE Sign OF
    '+' : Answer ← Number1 + Number2
    '–' : Answer ← Number1 - Number2
    '*' : Answer ← Number1 * Number2
    '/' : Answer ← Number1 / Number2
    OTHERWISE Answer ← 0
ENDCASE</pre>
</td><td>3</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(a)</td><td>
Max **4** in total
Any **3** from:

To ensure no changes are made on input / <u>accuracy of transcription</u>
Because the details do not have fixed, values or lengths to validate
Because there is no clear set of rules that can be used for validation

Any **3** from:

The programmer could ask the contributor to type in each detail twice …
… and then check that both values are equal
… If they are not equal then the input should be rejected
The programmer could ask the contributor to check the details on the screen …
… and confirm that they are correct / same as the original
… or change them

</td><td>4</td></tr>
<tr><td>4(b)</td><td>
One mark for email and **one** mark for password
Email – check for @ / format check / no spaces /valid characters // presence check // length check (not more than 254 characters) // uniqueness check

Password – length check / numbers and letters etc. // uniqueness check not been used before // presence check
</td><td>2</td></tr>
</table>

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Question	Answer	Marks
5	**One** mark per value and reason, max **3** Example 1.00 – boundary rejected//rejected (underweight) // out of range(1) 1.02 – normal // valid // accepted weight in range (1) 1.10 – abnormal // erroneous // invalid // rejected (overweight) (1)	**3**

Question	Answer	Marks
6(a)	Fields 5	**1**
6(b)	**One** mark description of new code that will allow more than 1000 values **One** mark for example matching candidate's description Example Use a new character instead of N TT345	**2**
6(c)		**4**

Field:	At Risk	Age in Years	Type	Map Position
Table:	TREES	TREES	TREES	TREES
Sort:				
Show:	☐	☐	☑	☑
Criteria:	True	>100		
or:				

One mark per correct column

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COMPUTER SCIENCE **0478/23**

Paper 2 **May/June 2018**

MARK SCHEME

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Question	Answer	Marks
	Section A	

1(a)(i)	**One** mark for any meaningful array name related to Task 1 × 2 e.g.
	
	`Tickets`
	`EntryTime`
	
	One mark for correct data type **AND** use related to Task 1 × 2 e.g.
	
	… integer to store the ticket numbers
	… real to store the entry times
		4

1(a)(ii)	**One** mark for any meaningful name for a constant **AND** value related to Task 3 × 2 e.g.
	
	`MaxTime`
	`8`
	`MaxFine`
	`100`
	
	One mark for correct use related to Task 3 × 2 e.g.
	
	…to store the maximum number of hours allowed in the car park
	…to store the current value of the fine for staying too long (in $)
		4

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Question	Answer	Marks

1(b)	Any **six** from:
	• Initialisation of ticket numbers and arrays
	• Loop for day's transactions
	• Check for entry
	• Output of free spaces before entry
	• Suitable input prompts to select on entry
	• Relevant Inputs (to get ticket and to input time)
	• Recording of entry time and ticket number in arrays
	• Generate next ticket number
	• Update and display number of car park spaces available after entry
	
	`Ticket_Number ← 1 //This number would not reset each day`
	`Ticket_Array[1:100]`
	`Entry_Time[1:100]`
	`Spaces ← 100`
	`Count ← 1 //This number would reset each day`
	
	`WHILE Count > 1 DO`
	`  OUTPUT "Available Spaces" Spaces`
	`  INPUT "Press enter to get ticket", Entry`
	`  OUTPUT "Next Ticket Number", Ticket_Number`
	`  INPUT "Current time", Current_Time`
	`  Ticket_Array[Count] ← Ticket_Number`
	`  Entry_Time[Count] ← Current_Time`
	`  Ticket_Number ← Ticket_Number + 1`
	`  Spaces ← Spaces - 1`
	`  Count ← Count + 1`
	`ENDWHILE`
		6

1(c)	Any **four** from: • Explanation of how the checking of the length of stay was done • Correct comparison to check length of stay against maximum • Explanation of how the extra charge is calculated • Correct calculation to work out the regular parking charge • Explanation of suitable output to show parking charge and extra charge if appropriate	**4**
1(d)	**One** mark for each correct test data item and related reason for **Task 1** (Answers **MUST** relate to pre-release task) e.g. Test data: –102 Reason: To check that negative values for ticket numbers are rejected Test data: 85 Reason: To check that normal ticket number data is accepted	**2**

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Question	Answer	Marks
	Section B	
2(a)	**One** mark for description **one** mark for example e.g. To test if the data entered is possible / reasonable … … A range check tests that data entered fits within specified values. Allow any correct validation check as an example	**2**
2(b)	**One** mark for description **one** mark for example e.g. To test if the data input is the same as the data that was intended to be input … … A double entry check expects each item of data to be entered twice and compares both entries to check they are the same. Allow any correct verification check as an example	**2**

Question	Answer	Marks

3	**One** mark for each correct answer
	
	`Counter = 0`
	`FOR Count = 1 TO 30`
	`Total = Total + Number`
	`NEXT Count`
		4

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Question	Answer	Marks
4(a)	Any **two** from: • Expects a number to be input • Checks if the number is greater than 100 • Outputs the result of the test • Specific output example	**2**
4(b)(i)	**One** mark for correct answer e.g. Use a (condition controlled) loop	**1**

4(b)(ii)	**One** mark for each point
	• Initialisation of Number variable
	• Correct loop statements
	• Correct INPUT and OUTPUT
	e.g.
	`INPUT Number`
	`WHILE Number > 100 DO`
	`  OUTPUT "The number is too large"`
	`  INPUT Number`
	`ENDWHILE`
	`OUTPUT "The number is acceptable"`
	or
	`INPUT Number`
	`REPEAT`
	`  IF Number > 100`
	`  THEN`
	`  OUTPUT "The number is too large"`
	`  ENDIF`
	`  INPUT Number`
	`UNTIL Number <= 100`
	`OUTPUT "The number is acceptable"`
		3

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(a)</td><td>
<table>
<tr><th>Max</th><th>Counter</th><th>Num</th><th>OUTPUT</th></tr>
<tr><td>–1000.00</td><td>0</td><td>6.30</td><td></td></tr>
<tr><td>6.30</td><td>1</td><td>18.62</td><td></td></tr>
<tr><td>18.62</td><td>2</td><td>50.01</td><td></td></tr>
<tr><td>50.01</td><td>3</td><td>3.13</td><td></td></tr>
<tr><td>50.01</td><td>4</td><td>2.05</td><td></td></tr>
<tr><td>50.01</td><td>5</td><td>50.10</td><td></td></tr>
<tr><td>50.10</td><td>6</td><td>40.35</td><td></td></tr>
<tr><td>50.10</td><td>7</td><td>30.69</td><td></td></tr>
<tr><td>50.10</td><td>8</td><td>0.85</td><td></td></tr>
<tr><td>50.10</td><td>9</td><td>17.30</td><td></td></tr>
<tr><td>50.10</td><td>10</td><td></td><td>50.10</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>
← 1 mark → ← 1 mark → ← 1 mark →
</td><td>3</td></tr>
<tr><td>5(b)</td><td>
One mark for each correct change (max two)

Box 2 Change the initialization value of the current ‘Max’ variable to a very high number

Box 4 Change the inequality from > to <

Boxes 2, 4, 5, 8 Change the Max variable to something more suitable e.g. Min
</td><td>2</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6(a)</td><td>One mark for correct answer

20</td><td>1</td></tr>
<tr><td>6(b)(i)</td><td>One mark for correct answer

CatNo</td><td>1</td></tr>
<tr><td>6(b)(ii)</td><td>One mark for correct answer

It is a unique identifier</td><td>1</td></tr>
</table>

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6(c)</td><td>One mark for every two correct data types
<table>
<tr><th>Field</th><th>Data Type</th></tr>
<tr><td>CatNo</td><td>Text</td></tr>
<tr><td>Title</td><td>Text</td></tr>
<tr><td>Genre 1</td><td>Text</td></tr>
<tr><td>Stream</td><td>Boolean / Text</td></tr>
</table></td><td>2</td></tr>
<tr><td>6(d)</td><td>One mark for each correct row
<table>
<tr><td>18m02</td><td>Golfwatch</td><td>Yes</td><td>No</td><td>Yes</td></tr>
<tr><td>18m03</td><td>Chair 27</td><td>Yes</td><td>Yes</td><td>No</td></tr>
</table>
Accept if drawn in a table, but don’t allow any punctuation</td><td>2</td></tr>
<tr><td>6(e)</td><td>
<table>
<tr><td>Field:</td><td>CatNo</td><td>Title</td><td>Genre 1</td><td>Genre 2</td><td>Stream</td></tr>
<tr><td>Table:</td><td>2018MOV</td><td>2018MOV</td><td>2018MOV</td><td>2018MOV</td><td>2018MOV</td></tr>
<tr><td>Sort:</td><td></td><td>Ascending</td><td></td><td></td><td></td></tr>
<tr><td>Show:</td><td>☑</td><td>☑</td><td>☐</td><td>☐</td><td>☐</td></tr>
<tr><td>Criteria:</td><td></td><td></td><td>=”Sci-Fi”</td><td></td><td>Yes</td></tr>
<tr><td>or:</td><td></td><td></td><td></td><td>=”Sci-Fi”</td><td>Yes</td></tr>
</table>
← 1 mark → ← 1 mark → ← 1 mark → ← 1 mark →

One mark per completely correct column / group of columns as shown.</td><td>4</td></tr>
</table>

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COMPUTER SCIENCE **0478/21**

Paper 2 Problem-solving and Programming **May/June 2018**

PRE-RELEASE MATERIAL

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READ THESE INSTRUCTIONS FIRST

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In preparation for the examination candidates should attempt the following practical tasks by **writing and testing a program or programs**.

A computer shop will build a computer from components to meet a customer's requirements. For each request for a computer to be built, an estimate of the cost is produced. The component stock level is checked; if all the components are in stock, a firm order to build the computer can be placed. A program is required to work out the cost of the computer, update the stock levels and provide a daily summary of orders for the shop owner.

Write and test a program or programs for the computer shop owner.

- Your program or programs must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Produce an estimate.

Write a program for TASK 1 to calculate the cost of building a computer using these components:

Component	**Choices**	**Prices in $**
Processor	p3 / p5 / p7	100 / 120 / 200
RAM	16 GB / 32 GB	75 / 150
Storage	1 TB / 2 TB	50 / 100
Screen	19" / 23"	65 / 120
Case	Mini Tower / Midi Tower	40 / 70
USB ports	2 ports / 4 ports	10 / 20

The customer makes a choice for each component and an estimate is produced. The estimate must show a unique estimate number, the components chosen and the price of each component. The estimate must also show the total cost of the computer, which is calculated as the sum of the cost of the components chosen plus 20%.

TASK 2 – Place an order.

Using your estimate from TASK 1, check if the components required are in stock. If all the components are in stock then update the stock levels. Add the unique estimate number to the list of order numbers. Add the customer's details and today's date to the estimate details to finalise the order. Print two copies of the order, one for the customer and one for the shop.

TASK 3 –Summarise the day's orders.

Extend TASK 2 to provide an end of day summary showing the number of orders made, the total number of each component sold and the value of the orders.

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COMPUTER SCIENCE **0478/22**

Paper 2 Problem-solving and Programming **May/June 2018**

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In preparation for the examination candidates should attempt the following practical tasks by **writing and testing a program or programs**.

A farmer records the milk production of a herd of cows. Every cow has a unique 3-digit identity code. Each cow can be milked twice a day, seven days a week. The volume of milk from each cow is recorded in litres correct to one decimal place (yield) every time the cow is milked. The size of the herd is fixed. At the end of the week the total and the average yield for each cow for that week is calculated.

The farmer identifies the cow that has produced the most milk that week. The farmer also identifies any cows that have produced less than 12 litres of milk on four or more days that week.

A program is required to record the yield for each cow every time it is milked, calculate the total weekly volume of milk for the herd and the average yield per cow in a week. The program must also identify the cow with the best yield that week and identify any cows with a yield of less than 12 litres of milk for four or more days that week.

Write and test a program or programs for the farmer.

- Your program or programs must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Record the yield.

Write a program for TASK 1 to record the milk yields for a week. The program records and stores the identity code number and the yield every time a cow is milked.

TASK 2 – Calculate the statistics.

Using your recorded data from TASK 1, calculate and display the total weekly volume of milk for the herd to the nearest whole litre. Calculate and display the average yield per cow in a week to the nearest whole litre.

TASK 3 – Identify the most productive cow and cows that are producing a low volume of milk.

Extend TASK 2 to identify and display the identity code number and weekly yield of the cow that has produced the most milk. Also identify and display the identity code numbers of any cows with a yield of less than 12 litres of milk for four days or more in the week.

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COMPUTER SCIENCE **0478/23**

Paper 2 Problem-solving and Programming **May/June 2018**

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In preparation for the examination candidates should attempt the following practical tasks by **writing and testing a program or programs**.

A car park has space for 100 cars and a barrier entrance and exit system. There is a display at the entrance to show how many spaces are empty. Cars are issued a ticket with a unique number on entry and the time of issue is stored. The car park charges $1.50 per hour and the fee is paid at a machine before leaving the car park. At the machine, the ticket number and departure time are entered; the fee is calculated by the machine and the amount due is paid by the ticket holder. Cars cannot stay overnight; the system is reset at midnight.

Write and test a program or programs for the car park manager.

- Your program or programs must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Operating the car park.

The system is reset at midnight every day.
Set up a system using arrays and with suitable prompts that will carry out the following as cars enter or leave the car park:

On Entry:
- display the number of empty car park spaces
- issue the next available ticket number
- store the current time and the ticket number
- display the updated number of empty car park spaces.

On Exit:
- input a ticket number and departure time
- output the amount of time the car stayed at the car park
- delete the ticket number from the array
- display the updated number of empty car park spaces.

TASK 2 – Working out the cost and daily takings.

Amend the program so that it will calculate the amount to be paid using a charge of $1.50 per hour, or part of an hour (i.e. any amount of time into the next hour is charged for a whole hour). The amount to be paid is displayed and is added to a running total for the day, before the ticket number is deleted from the array. At the end of the day, the following information is displayed:
- total daily takings
- number of cars that have used the car park
- average charge per car
- average length of stay per car.

TASK 3 – Introducing parking restrictions.

The car park manager decides to restrict the length of stay to a maximum of eight hours, and will charge an extra $100 if a car overstays. Modify your program to implement this change and ensure the driver is aware of this extra charge. Output the number of cars that have overstayed in a day.

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

2772106825

COMPUTER SCIENCE **0478/11**

Paper 1 Theory **May/June 2018**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

Any businesses described in this paper are entirely fictitious.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

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1 Jane answers an examination question about computers and data correctly.
Six different words or numbers have been removed from her answer.

Complete the sentences in Jane's answer, using the list given. Not all items in the list need to be used.

- 2
- 10
- 16
- analogue
- binary
- denary
- digital
- hexadecimal

As humans, we process …… data, but a computer cannot

process this type of data. For a computer to be able to process data it needs to be

converted to …… data.

As humans, we mostly use a …… number system;

this is a base …… number system.

Computers use a …… number system;

this is a base …… number system.

[6]

2 Dheeraj identifies **three** hexadecimal numbers.

Write the **denary** number for each of the three hexadecimal numbers:

2A .....

101 .....

21E .....

[3]

Working Space

.....

.....

.....

.....

.....

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3 The three binary numbers in the registers A, B and C have been transmitted from one computer to another.

	Parity bit							
Register A	1	0	0	1	1	0	0	0
Register B	0	1	1	0	0	1	1	1
Register C	1	0	0	1	1	0	0	1

One binary number has been transmitted incorrectly. This is identified through the use of a parity bit.

Identify which register contains the binary number that has been transmitted **incorrectly**. Explain the reason for your choice.

The binary number that has been transmitted incorrectly is in **Register** .....

Explanation .....

.....

.....

.....

.....

.....

[4]

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4 Michele wants to email a file to Elsa. The file is too large so it must be compressed.

(a) Name **two** types of compression that Michele could use.

Compression type 1 .....

Compression type 2 .....
[2]

(b) The file Michele is sending contains the source code for a large computer program.

Identify which type of compression would be most suitable for Michele to use.

Explain your choice.

Compression type.....

Explanation.....

.....

.....

.....

.....

.....
[4]

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5 **Six** components of the Von Neumann model for a computer system and **six** descriptions are given.

Draw a line to match each component to the most suitable description.

Component	Description
Immediate access store (IAS)	Holds data and instructions when they are loaded from main memory and are waiting to be processed.
Register	Holds data temporarily that is currently being used in a calculation.
Control unit (CU)	Holds data or instructions temporarily when they are being processed.
Accumulator (ACC)	Manages the flow of data and interaction between the components of the processor.
Arithmetic logic unit (ALU)	Carries out the calculations on data.
Bus	Pathway for transmitting data and instructions.

[5]

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6 Consider the logic statement:

X = 1 if ((A is NOT 1 OR B is 1) NOR C is 1) NAND ((A is 1 AND C is 1) NOR B is 1)

(a) Draw a logic circuit to represent the given logic statement.

[6]

(b) Complete the truth table for the given logic statement.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

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7 Translators, such as a compiler and an interpreter, are used when writing and running computer programs.

Describe how a compiler and an interpreter translates a computer program.

Compiler .....

.....

.....

.....

.....

.....

Interpreter .....

.....

.....

.....

.....

.....

[6]

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8 A supermarket uses a barcode scanner to read the barcodes on its products.

(a) Describe how the barcode scanner reads the barcode.

.....

.....

.....

.....

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[4]

(b) Explain how the barcode system could help the supermarket manage its stock.

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.....

[3]

(c) An infrared touch screen is used to view and navigate the supermarket stock system.

Explain how the infrared touch screen detects a user's touch.

.....

.....

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.....

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.....

.....

.....

[4]

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(d) The supermarket uses secondary storage and off-line storage to store data about its stock.

Explain what is meant by secondary storage and off-line storage.

Secondary storage .....

.....

.....

.....

Off-line storage .....

.....

.....

.....

[4]

9 A business wants to use a biometric security system to control entry to the office.

The system will use a biometric device and a microprocessor.

Explain how the biometric security system will make use of the biometric device and the microprocessor to control entry to the office.

.....

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.....

[6]

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10 RockICT is a music business that has a website to allow customers to view and buy the products it sells.

The website consists of web pages.

(a) Describe what is meant by HTML structure and presentation for a web page.

.....

.....

.....

.....

.....

.....

.....

.....[4]

(b) The URL for the music company's website is:

https://www.rockict.net/index.htm

Part 1 **Part 2**

(i) Identify what **Part 1** and **Part 2** represent in this URL.

Part 1 .....

Part 2 .....
[2]

(ii) Describe what is meant by **https**.

.....

.....

.....

.....[2]

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(c) When a customer enters the website, a message is displayed:

"RockICT makes use of cookies. By continuing to browse you are agreeing to our use of cookies."

Explain why the music company uses cookies.

.....

.....

.....

.....
[2]

(d) The music company is concerned about the security of its website.

The company uses a proxy server as part of its security system.

Describe the role of a proxy server in the security system.

.....

.....

.....

.....

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.....

.....

.....
[4]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/12**

Paper 1 Theory **May/June 2018**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
No marks will be awarded for using brand names of software packages or hardware.

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At the end of the examination, fasten all your work securely together.
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1 Different units of data can be used to represent the size of a file, as it changes in size.

Fill in the missing units of data, using the list given:

- byte
- gigabyte (GB)
- megabyte (MB)
- nibble

The units of data increase in size from smallest to largest.

Smallest	bit
↓	……..
	……..
	kilobyte (kB)
	……..
	……..
Largest	terabyte (TB)

[4]

2 **(a)** Nancy has captured images of her holiday with her camera. The captured images are stored as digital photo files on her camera.

Explain how the captured images are converted to digital photo files.

.....

.....

.....

.....

.....

.....

.....

..... [4]

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(b) Nancy wants to email the photos to Nadia.

Many of the photos are very large files, so Nancy needs to reduce their file size as much as possible.

Identify which type of compression would be most suitable for Nancy to use. Explain your choice.

Compression type .....

Explanation .....

.....

.....

.....

.....

.....

[4]

3 A stopwatch uses six digits to display hours, minutes and seconds.

The stopwatch is stopped at:

0 2 : 3 1 : 5 8
Hours **Minutes** **Seconds**

An 8-bit register is used to store each pair of digits.

(a) Write the 8-bit binary numbers that are currently stored for the **Hours**, **Minutes** and **Seconds**.

Hours								
Minutes								
Seconds								

[3]

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(b) The stopwatch is started again and then stopped.

When the watch is stopped, the 8-bit binary registers show:

Hours	0	0	0	0	0	1	0	1
Minutes	0	0	0	1	1	0	1	0
Seconds	0	0	1	1	0	1	1	1

Write the denary values that will now be shown on the stopwatch.

:	:	
Hours	**Minutes**	**Seconds**

[3]

4 Jafar is using the Internet when he gets the message:

"D03, page is not available"

Jafar remembers that hexadecimal is often used to represent binary values in error codes.

Convert the hexadecimal number in the error message into 12-bit binary.

[3]

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5 The three binary numbers in the registers X, Y and Z have been transmitted from one computer to another.

								Parity bit
Register X	1	0	0	1	0	0	1	0
Register Y	1	1	1	0	0	1	1	1
Register Z	1	1	1	0	1	0	0	1

Only **one** binary number has been transmitted correctly. This is identified through the use of a parity bit.

Identify which register contains the binary number that has been transmitted **correctly**. Explain the reason for your choice.

The binary number that has been transmitted correctly is in **Register** .....

Explanation .....

.....

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[4]

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6 Kelvin correctly answers an examination question about the Von Neumann model.

Eight different terms have been removed from his answer.

Complete the sentences in Kelvin's answer, using the list given.

Not all items in the list need to be used.

- accumulator (ACC)
- address bus
- arithmetic logic unit (ALU)
- control unit (CU)
- data bus
- executed
- fetches
- immediate access store (IAS)
- memory address register (MAR)
- memory data register (MDR)
- program counter (PC)
- saved
- transmits

The central processing unit (CPU) .....

the data and instructions needed and stores them in the

..... to wait to be processed.

The ..... holds the address of the next

instruction. This address is sent to the ..... .

The data from this address is sent to the ..... .

The instruction can then be decoded and ..... .

Any calculations that are carried out on the data are done by the

..... . During calculations, the data is temporarily

held in a register called the ..... .

[8]

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7 Consider the logic statement:

X = 1 if ((A is 1 AND B is NOT 1) NAND C is 1) XOR ((A is 1 AND C is 1) OR B is 1)

(a) Draw a logic circuit to represent the given logic statement.

[6]

(b) Complete the truth table for the given logic statement.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

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8 Dimitri is writing a computer program in a high-level language.

He needs to send just the machine code for the program to his friend, electronically.

It is important that the program is executed as quickly as possible.

Identify which translator will be most suitable for Dimitri to use. Explain your choice.

Type of translator .....

Explanation .....

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[4]

9 An advertisement in a magazine displays this barcode:

(a) Identify this type of barcode.

..... [1]

(b) Explain how the data stored in this barcode is read.

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.....[4]

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10 Alexandra has a new mobile device.

It has a touch screen that uses capacitive technology.

(a) Describe how a capacitive touch screen registers Alexandra's touch.

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..... [4]

(b) Alexandra is wearing gloves because it is cold.

She presses an icon on her touch screen but her action is not registered.

(i) Explain why the touch screen will not register her touch.

.....

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.....

..... [2]

(ii) Alexandra does not want to remove her gloves.

Explain how Alexandra could use her mobile device whilst still wearing gloves.

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..... [2]

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11 A factory uses a security system to control a security light. The system uses a sensor and a microprocessor.

Explain how the security system makes use of the sensor and the microprocessor to control the security light.

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..... [6]

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12 **(a)** Selma has some important personal information that she needs to email to her employer.

She wants to make sure that if the personal information is intercepted, it cannot be understood.

(i) State how Selma could email her personal data more securely.

..... [1]

(ii) Describe how your chosen solution works.

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..... [5]

(b) Selma wants to make sure that the information received is correct.

A parity check can be used to detect errors.

Describe another error detection method that can be used to check the information received is correct.

Error detection method .....

Description .....

.....

.....

.....
[3]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/13**

Paper 1 Theory **May/June 2018**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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Answer **all** questions.
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Any businesses described in this paper are entirely fictitious.

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[Turn over

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1 State **five** sensors that could be used in the following applications.

Give a **different** type of sensor for each application.

Application	**Sensor**
Weighing a baby in a hospital	
Turning off a kettle when the water boils	
Controlling an automatic door	
Monitoring the air quality in an aeroplane	
Counting cars crossing a bridge	

[5]

2 Draw a line to connect each term to the correct application.

Term	**Application**
Simplex	A telephone that can receive and transmit audio signals simultaneously.
Duplex	A two-way radio (walkie-talkie) that can receive and transmit messages, but not at the same time.
Half-duplex	A microphone that transmits data to a MIDI system.

[2]

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3 Three security issues that could affect users online are **phishing**, **pharming** and **spam**.

Explain what is meant by each security issue.

Phishing .....

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Pharming .....

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Spam .....

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[6]

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4 A company transmits data to external storage at the end of each day.

(a) Parity checks can be used to check for errors during data transmission.

The system uses **odd parity**.

(i) Tick (✓) to show for each of the received bytes whether they have been **transmitted correctly** or **transmitted incorrectly**.

Received byte	**Transmitted correctly (✓)**	**Transmitted incorrectly (✓)**
10001011		
10101110		
01011101		
00100101		

[4]

(ii) State **one** other method that could be used to check for transmission errors.

..... [1]

(b) Data can be transferred using parallel or serial data transmission.

(i) Describe what is meant by parallel data transmission.

.....

.....

.....

..... [2]

(ii) Give **one** application of parallel data transmission.

.....

..... [1]

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(iii) Explain why serial data transmission is normally used for transferring data over a long distance.

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..... [2]

(c) Data transferred over a network is encrypted to improve data security.

The system uses 64-bit symmetric encryption.

(i) Explain how encryption improves data security.

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..... [2]

(ii) Explain **one** method that could be used to increase the level of security provided by the encryption.

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..... [2]

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5 **(a)** Convert the denary number 107 to binary.

..... [1]

(b) Represent the denary number 300 as it would be stored in a 12-bit binary register.

..... [2]

(c) Convert the denary number 179 to hexadecimal.

..... [2]

6 One of the roles of an operating system is to deal with interrupts.

(a) Explain the term interrupt.

.....

.....

.....

..... [2]

(b) Identify **three** devices that make use of interrupts.

Device 1 .....

Device 2 .....

Device 3 .....
[3]

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7 A train station uses large touch screens to allow passengers to search for train information and buy tickets.

(a) State **three** benefits of using a touch screen in the train station.

Benefit 1 .....

.....

Benefit 2 .....

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Benefit 3 .....

.....
[3]

(b) The touch screens at the station use resistive touch technology.

Describe how resistive touch technology works.

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..... [4]

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8 A logic circuit is shown below.

(a) Complete the truth table for the given logic circuit.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

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(b) Draw a logic circuit corresponding to this logic statement:

X = 1 if (A is NOT 1) OR ((B is 1 OR C is 1) AND (B is NOT 1 OR A is NOT 1))

[6]

9 Three types of translators are **assemblers**, **compilers** and **interpreters**.

Tick (✓) the appropriate boxes to show which statements apply to each type of translator.

Statement	**Assembler (✓)**	**Compiler (✓)**	**Interpreter (✓)**
Translates high-level language into machine code			
Provides error diagnostics			
Translates whole program to object code in one operation			
Translates and executes one line of code at a time			

[3]

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10 Explain how an instruction is fetched in a computer based on the Von Neumann model.

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..... [6]

11 Identify **three** similarities between CDs and DVDs.

1 .....

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2 .....

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3 .....

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[3]

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12 An image is to be stored electronically.

The image is 256 pixels high by 200 pixels wide with a 16-bit colour depth.

Calculate the file size of the image. **You must show all of your working.**

File size ..... kB [3]

13 Describe the role of an Internet Service Provider (ISP).

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..... [6]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

1819492409

COMPUTER SCIENCE **0478/21**

Paper 2 Problem-solving and Programming **May/June 2018**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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Answer **all** questions.

DO NOT ATTEMPT TASKS 1, 2 AND 3 in the pre-release material; these are for information only.

You are advised to spend no more than **40 minutes** on **Section A** (Question 1).

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 50.

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Section A

You are advised to spend no longer than 40 minutes answering this section.

Here is a copy of the pre-release material.

DO NOT attempt Tasks 1, 2 and 3 now.

Use the pre-release material and your experience from attempting the tasks before the examination to answer Question 1.

Pre-release material

A computer shop will build a computer from components to meet a customer's requirements. For each request for a computer to be built, an estimate of the cost is produced. The component stock level is checked; if all the components are in stock, a firm order to build the computer can be placed. A program is required to work out the cost of the computer, update the stock levels and provide a daily summary of orders for the shop owner.

Write and test a program or programs for the computer shop owner.

- Your program or programs must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Produce an estimate.

Write a program for TASK 1 to calculate the cost of building a computer using these components.

Component	Choices	Prices in $
Processor	p3 / p5 / p7	100 / 120 / 200
RAM	16 GB / 32 GB	75 / 150
Storage	1 TB / 2 TB	50 / 100
Screen	19" / 23"	65 / 120
Case	Mini Tower / Midi Tower	40 / 70
USB ports	2 ports / 4 ports	10 / 20

The customer makes a choice for each component and an estimate is produced. The estimate must show a unique estimate number, the components chosen and the price of each component. The estimate must also show the total cost of the computer, which is calculated as the sum of the cost of the components chosen plus 20%.

TASK 2 – Place an order.

Using your estimate from TASK 1, check if the components required are in stock. If all the components are in stock then update the stock levels. Add the unique estimate number to the list of order numbers. Add the customer's details and today's date to the estimate details to finalise the order. Print two copies of the order, one for the customer and one for the shop.

TASK 3 – Summarise the day's orders.

Extend TASK 2 to provide an end of day summary showing the number of orders made, the total number of each component sold and the value of the orders.

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1 **(a)** All variables, constants and other identifiers should have meaningful names.

(i) You recorded information for the estimate of the cost of building a computer in **Task 1**. Give a data structure that you created for **Task 1**, its name, data type and use.

Data structure .....

Name .....

Data type .....

Use .....

.....
[4]

(ii) Describe the data structures that you have used in **Task 2** to record the customer details. Include sample data in the description.

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..... [4]

(b) Explain how your program for **Task 1** produces a unique estimate number.

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..... [2]

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(c) Write an algorithm for part of **Task 2** to check that the chosen **processor** and chosen **RAM** are in stock, using **either** pseudocode, programming statements **or** a flowchart. Assume that **Task 1** has been completed. Do **not** check the other components or produce the order.

..... [5]

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(d) Explain how your program completes **Task 3**. Any programming statements used in your answer must be fully explained.

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..... [5]

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Section B

2 **(a)** Write an algorithm to input 1000 numbers. Count how many numbers are positive and how many numbers are zero. Then output the results. Use **either** pseudocode **or** a flowchart.

.....

.....

.....

(b) Give one change you could make to your algorithm to ensure initial testing is more manageable.

.....

..... [1]

Question 3 starts on page 8.

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3 The global trade item number (GTIN-8) barcode has seven digits and a check digit.
This pseudocode algorithm inputs seven digits and calculates the eighth digit, then outputs the GTIN-8.
DIV(X,Y), finds the number of divides in division for example **DIV(23,10)** is 2.
MOD(X,Y), finds the remainder in division for example **MOD(23,10)** is 3.

```
FOR Count ← 1 TO 7
   INPUT Number
   Digit(Count) ← Number
NEXT
Sum ← (Digit(1)+Digit(3)+Digit(5)+Digit(7))*3+Digit(2)+Digit(4)+Digit(6)
IF MOD(Sum,10) <> 0
   THEN Digit(8) ← DIV(Sum,10)*10 + 10 - Sum
   ELSE Digit(8) ← 0
ENDIF
OUTPUT "GTIN-8"
FOR Count ← 1 TO 8
   OUTPUT Digit(Count)
NEXT
```

(a) Complete the trace table for the input data: 5, 7, 0, 1, 2, 3, 4

Digit(1)	Digit(2)	Digit(3)	Digit(4)	Digit(5)	Digit(6)	Digit(7)	Digit(8)	Sum	OUTPUT

Complete the trace table for the input data: 4, 3, 1, 0, 2, 3, 1

Digit(1)	Digit(2)	Digit(3)	Digit(4)	Digit(5)	Digit(6)	Digit(7)	Digit(8)	Sum	OUTPUT

[5]

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(b) Explain how you would change the algorithm to input eight digits (seven digits and the check digit) and output if the check digit entered is correct or not.

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..... [3]

Question 4 starts on page 10.

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4 A programmer has written a routine to check that prices are below $10.00. These values are used as test data.

10.00 9.99 ten

Explain why each value was chosen.

10.00 .....

.....

.....

9.99 .....

.....

.....

ten .....

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.....

[3]

5 Explain the difference between the programming concepts of **counting** and **totalling**. Include an example of a programming statement for each concept in your explanation.

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..... [4]

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6 A database table, PERFORMANCE, is used to keep a record of the performances at a local theatre.

Show Number	Type	Title	Date	Sold Out
SN091	Comedy	An Evening at Home	01 Sept	Yes
SN102	Drama	Old Places	02 Oct	No
SN113	Jazz	Acoustic Evening	03 Nov	No
SN124	Classical	Mozart Evening	04 Dec	Yes
SN021	Classical	Bach Favourites	01 Feb	Yes
SN032	Jazz	30 Years of Jazz	02 Mar	Yes
SN043	Comedy	Street Night	03 Apr	No
SN054	Comedy	Hoot	04 May	No

(a) State the number of fields and records in the table.

Fields .....

Records .....
[2]

(b) Give **two** validation checks that could be performed on the **Show Number** field.

Validation check 1 .....

.....

Validation check 2 .....

.....
[2]

(c) Using the query-by-example grid, write a query to identify jazz performances that are not sold out. Only display the date and the title.

Field:					
Table:					
Sort:					
Show:	☐	☐	☐	☐	☐
Criteria:					
or:					

[4]

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CANDIDATE NAME	

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COMPUTER SCIENCE **0478/22**

Paper 2 Problem-solving and Programming **May/June 2018**

1 hour 45 minutes

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Section A

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Use the pre-release material and your experience from attempting the tasks before the examination to answer Question 1.

Pre-release material

A farmer records the milk production of a herd of cows. Every cow has a unique 3-digit identity code. Each cow can be milked twice a day, seven days a week. The volume of milk from each cow is recorded in litres correct to one decimal place (yield) every time the cow is milked. The size of the herd is fixed. At the end of the week the total and the average yield for each cow for that week is calculated.

The farmer identifies the cow that has produced the most milk that week. The farmer also identifies any cows that have produced less than 12 litres of milk on four or more days that week.

A program is required to record the yield for each cow every time it is milked, calculate the total weekly volume of milk for the herd and the average yield per cow in a week. The program must also identify the cow with the best yield that week and identify any cows with a yield of less than 12 litres of milk for four or more days that week.

Write and test a program or programs for the farmer.

- Your program or programs must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Record the yield.

Write a program for TASK 1 to record the milk yields for a week. The program records and stores the identity code number and the yield every time a cow is milked.

TASK 2 – Calculate the statistics.

Using your recorded data from TASK 1, calculate and display the total weekly volume of milk for the herd to the nearest whole litre. Calculate and display the average yield per cow in a week to the nearest whole litre.

TASK 3 – Identify the most productive cow and cows that are producing a low volume of milk.

Extend TASK 2 to identify and display the identity code number and weekly yield of the cow that has produced the most milk. Also identify and display the identity code numbers of any cows with a yield of less than 12 litres of milk for four days or more in the week.

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1 **(a)** All variables, constants and other identifiers should have meaningful names.

(i) State the name, the data type and the use of **two** variables that you have used in **Task 2**.

Variable 1 name .....

Data type .....

Use .....

Variable 2 name .....

Data type .....

Use .....
[2]

(ii) Describe, with the aid of some sample data, the data structures that you have used to record the data for the cows in **Task 1**.

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.....[4]

(b) Explain how your program for **Task 1** ensures that each 3-digit identity code is unique.

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.....[2]

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(c) Write an algorithm for **Task 2**, using **either** pseudocode, programming statements **or** a flowchart**.** Assume that **Task 1** has been completed.

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.....[5]

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(d) **(i)** Explain how your program for **Task 3** finds the cows with a daily yield of less than 12 litres of milk for four days or more in the week. Any programming statements used in your answer must be fully explained.

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.....[5]

(ii) Explain how you would extend your program for **Task 3** to **store** the identity code number(s) of those cows with a yield of less than 12 litres of milk for four days or more in the week.

.....

.....

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.....

.....

.....[2]

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Section B

2 **(a)** Draw a flowchart for an algorithm to input numbers. Reject any numbers that are negative and count how many numbers are positive. When the number zero is input, the process ends and the count of positive numbers is output.

[6]

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(b) Explain the changes you will make to your algorithm to also count the negative numbers.

.....

.....

.....

.....[2]

Question 3 starts on Page 8.

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3 This pseudocode algorithm inputs two non-zero numbers and a sign, and then performs the calculation shown by the sign. An input of zero for the first number terminates the process.

```
INPUT Number1, Number2, Sign
WHILE Number1 <> 0
   IF Sign = '+' THEN Answer ← Number1 + Number2 ENDIF
   IF Sign = '-' THEN Answer ← Number1 - Number2 ENDIF
   IF Sign = '*' THEN Answer ← Number1 * Number2 ENDIF
   IF Sign = '/' THEN Answer ← Number1 / Number2 ENDIF
   IF Sign <> '/' AND Sign <> '*' AND Sign <> '-' AND Sign <> '+'
      THEN Answer ← 0
   ENDIF
   IF Answer <> 0 THEN OUTPUT Answer ENDIF
   INPUT Number1, Number2, Sign
ENDWHILE
```

(a) Complete the trace table for the input data:
5, 7, +, 6, 2, –, 4, 3, *, 7, 8, ?, 0, 0, /

Number1	Number2	Sign	Answer	OUTPUT

[3]

(b) Show how you could improve the algorithm written in pseudocode by writing an alternative type of conditional statement in pseudocode.

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.....[3]

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4 A programmer has written a routine to store the name, email address and password of a contributor to a website's discussion group.

(a) The programmer has chosen to verify the name, email address and password.

Explain why verification was chosen and describe how the programmer would verify this data.

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.....[4]

(b) The programmer has also decided to validate the email address and the password.

Describe validation checks that could be used.

Email address .....

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.....

Password .....

.....

.....
[2]

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5 A program checks that the weight of a basket of fruit is over 1.00 kilograms and under 1.10 kilograms. Weights are recorded to an accuracy of two decimal places and any weight not in this form has already been rejected.

Give **three** weights as test data and for each weight state a reason for choosing it. All your reasons must be different.

Weight 1 .....

Reason.....

.....

Weight 2 .....

Reason.....

.....

Weight 3 .....

Reason.....

.....

[3]

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6 A database table, TREES, is used to keep a record of the trees in a park. Each tree is given a unique number and is examined to see if it is at risk of dying. There are over 900 trees; part of the database table is shown.

Tree Number	Type	Map Position	Age in Years	At Risk
TN091	Acacia	A7	250	Y
TN172	Olive	C5	110	N
TN913	Cedar	B9	8	N
TN824	Banyan	A3	50	Y
TN021	Pine	D5	560	Y
TN532	Teak	C8	76	Y
TN043	Yew	B1	340	N
TN354	Spruce	D4	65	N
TN731	Elm	B10	22	Y
TN869	Oak	C9	13	N
TN954	Pine	E11	3	N

(a) State the number of fields in the table.

.....[1]

(b) The tree numbering system uses TN followed by three digits. The numbering system will not work if there are over 1000 trees.
Describe, with the aid of an example, how you could change the tree numbering system to allow for over 1000 trees. Existing tree numbers must not be changed.

.....

.....

.....

.....[2]

(c) Using the query-by-example grid, write a query to identify at risk trees over 100 years old. Display only the type and the position on the map.

Field:					
Table:					
Sort:					
Show:	☐	☐	☐	☐	☐
Criteria:					
or:					

[4]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/23**

Paper 2 Problem-solving and Programming **May/June 2018**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

DO NOT ATTEMPT TASKS 1, 2 AND 3 in the pre-release material; these are for information only.

You are advised to spend no more than **40 minutes** on **Section A** (Question 1).

No marks will be awarded for using brand names of software packages or hardware.

Any businesses described in this paper are entirely fictitious.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 50.

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This document consists of **11** printed pages and **1** blank page.

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[Turn over

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Section A

You are advised to spend no longer than 40 minutes answering this section.

Here is a copy of the pre-release material.

DO NOT attempt Tasks 1, 2 and 3 now.

Use the pre-release material and your experience from attempting the tasks before the examination to answer Question 1.

Pre-release material

A car park has space for 100 cars and a barrier entrance and exit system. There is a display at the entrance to show how many spaces are empty. Cars are issued a ticket with a unique number on entry and the time of issue is stored. The car park charges $1.50 per hour and the fee is paid at a machine before leaving the car park. At the machine, the ticket number and departure time are entered; the fee is calculated by the machine and the amount due is paid by the ticket holder. Cars cannot stay overnight; the system is reset at midnight.

Write and test a program or programs for the car park manager.

- Your program or programs must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Operating the car park.

The system is reset at midnight every day.
Set up a system using arrays and with suitable prompts that will carry out the following as cars enter or leave the car park:

On Entry:
- display the number of empty car park spaces
- issue the next available ticket number
- store the current time and the ticket number
- display the updated number of empty car park spaces.

On Exit:
- input a ticket number and departure time
- output the amount of time the car stayed at the car park
- delete the ticket number from the array
- display the updated number of empty car park spaces.

TASK 2 – Working out the cost and daily takings.

Amend the program so that it will calculate the amount to be paid using a charge of $1.50 per hour, or part of an hour (i.e. any amount of time into the next hour is charged for a whole hour). The amount to be paid is displayed and is added to a running total for the day, before the ticket number is deleted from the array. At the end of the day, the following information is displayed:
- total daily takings
- number of cars that have used the car park
- average charge per car
- average length of stay per car.

TASK 3 – Introducing parking restrictions.

The car park manager decides to restrict the length of stay to a maximum of eight hours, and will charge an extra $100 if a car overstays. Modify your program to implement this change and ensure the driver is aware of this extra charge. Output the number of cars that have overstayed in a day.

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1 **(a)** All variables, constants and other identifiers should have meaningful names.

(i) State the name, data type and use of **two** arrays you created for **Task 1**.

Array 1 name .....

Data type .....

Use .....

.....

Array 2 name .....

Data type .....

Use .....

.....
[4]

(ii) State the name, value and use of **two** constants you could have created for **Task 3**.

Constant 1 name.....

Value .....

Use .....

.....

Constant 2 name.....

Value .....

Use .....

.....
[4]

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(b) Write an algorithm to perform the set up and 'On Entry' part of **Task 1**, using **either** pseudocode, programming statements **or** a flowchart.

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.....[6]

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(c) Explain how your program calculates if a car has overstayed the permitted parking time and how the charge is calculated and output (part of **Task 3**). Any programming statements you use in your answer must be fully explained.

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.....[4]

(d) One of the inputs required 'On Exit' in **Task 1** is ticket number. State **two** items of suitable test data you could use to test your input validation and state why you chose them.

Test data 1 .....

Reason .....

.....

Test data 2 .....

Reason .....

.....

[2]

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Section B

2 Describe, using an example, the purpose of the following checks during data entry.

(a) Validation check

.....

.....

.....[2]

(b) Verification check

.....

.....

.....[2]

3 This section of program code reads the contents of the array, totals the numbers and prints out the sum and average of the numbers. Assume the array is full.

Complete the **four** missing items by writing them in the spaces provided in this code.

```
Numbers[1:30]
Total = 0
..................................... = 0
FOR Count = 1 TO ...................................................
Number = Numbers[Count]
Total = ................................................... + Number
Counter = Counter + 1
..................................................................... Count
PRINT 'The sum of the numbers you entered is ', Number
PRINT 'The average of the numbers you entered is ', Number / Counter
```

[4]

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4 An algorithm is written in pseudocode:

```
INPUT Number
IF Number > 100
   THEN OUTPUT "The number is too large"
   ELSE OUTPUT "The number is acceptable"
ENDIF
```

(a) Describe the purpose of the algorithm.

.....

.....

.....

.....

.....[2]

(b) **(i)** The algorithm only allows one attempt at inputting an acceptable value.

State how you would change the algorithm so that it continues until a suitable input is supplied.

.....

.....[1]

(ii) Re-write the algorithm in full, using pseudocode, to implement your answer to **part (b)(i).**

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.....[3]

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5 The flowchart allows a set of 10 numbers to be entered; it finds and outputs the largest of these numbers.

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(a) Complete the trace table for the input data:

6.30, 18.62, 50.01, 3.13, 2.05, 50.10, 40.35, 30.69, 0.85, 17.30

Max	Counter	Num	OUTPUT

[3]

(b) Describe **two** different changes you should make to the flowchart to find the smallest number instead of the largest number.

Change 1 .....

.....

Change 2 .....

.....

[2]

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6 A shop that sells copies of movies to the public has set up a new database table called 2018MOV to store some new releases. Part of this table is given, showing the catalogue number, title, genres and available formats (Blu-ray, DVD or streaming) of each movie.

CatNo	Title	Genre 1	Genre 2	Blu-ray	DVD	Stream
18m01	Battery Rangers	Adventure	Fantasy	Yes	No	Yes
18m02	Golfwatch	Comedy	Drama	Yes	No	Yes
18m03	Chair 27	Comedy	Drama	Yes	Yes	No
18m04	Wander Woman	Action	Fantasy	Yes	No	Yes
18m05	Justine League	Action	Fantasy	Yes	Yes	Yes
18m06	That	Horror	Thriller	Yes	Yes	No
18m07	Insect Dude	Action	Fantasy	No	Yes	No
18m08	Dover Beach	Action	History	No	Yes	No
18m12	Slow 25	Action	Thriller	No	Yes	No
18m15	Kongkers	Adventure	Fantasy	No	Yes	No
18m16	Transducers: The Last Night	Action	Sci-Fi	Yes	Yes	Yes
18m17	The Pale Tower	Fantasy	Sci-Fi	Yes	Yes	No
18m19	Bea and the Bute	Fantasy	Romance	Yes	Yes	Yes
18m21	The Daddy	Action	Fantasy	No	No	Yes
18m22	Planet Wars: Episode X	Sci-Fi	Action	Yes	No	Yes
18m23	Guardians of the Milky Way	Action	Sci-Fi	Yes	Yes	Yes
18m26	Odin	Horror	Sci-Fi	No	Yes	Yes
18m27	That	Fantasy	Sci-Fi	No	No	Yes
18m30	Underneath	Action	Horror	Yes	No	No
18m31	Debatable Me	Animation	Action	Yes	Yes	No

(a) State the number of records in this part of the table.

.....[1]

(b) **(i)** Give the name of the field that should be used for the primary key.

.....[1]

(ii) State the reason for choosing this field for the primary key.

.....

.....[1]

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(c) Complete the table to show the most appropriate data type for each field based on the data shown in the table at the start of question 6.

Field	Data type
CatNo	
Title	
Genre 1	
Stream	

[2]

(d) List the output that would be given by this query-by-example.

Field:	CatNo	Title	Genre 1	Blu-ray	DVD	Stream	
Table:	2018MOV	2018MOV	2018MOV	2018MOV	2018MOV	2018MOV	
Sort:							
Show:	✓	✓	☐	✓	✓	✓	☐
Criteria:			="Comedy"				
or:							

.....

.....

.....

.....[2]

(e) Using the query-by-example grid, write a query to identify all the movies that are categorised as Sci-Fi and available to stream. Only display the catalogue number and title of the film, with the titles listed in alphabetical order.

Field:							
Table:							
Sort:							
Show:	☐	☐	☐	☐	☐	☐	☐
Criteria:							
or:							

[4]

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COMPUTER SCIENCE

Paper 0478/12
Paper 1

Key messages

This standard of candidate's work continues to improve for this syllabus. There is a continued move to provide questions where candidates have to apply their knowledge, rather than just show their ability to simply remember facts. There is strong evidence that this is producing candidates who are now exhibiting an improved understanding of many of the topics.

General comments

Candidates and centres are reminded that written papers are now scanned in and marked on computer screens by examiners. Consequently, if a candidate writes the answer to a question on an additional page, they must indicate very clearly to the examiner where their revised answer is to be found. Also, if answers have been crossed out, the new answer must be written very clearly, so that examiners can easily read the text and award candidates the appropriate mark.

Comments on specific questions

Question 1

(a) Most candidates correctly identified the larger file size.

(b) Most candidates correctly identified the larger file size.

Question 2

(a) (i) Many candidates were able to describe the purpose of an input device. It would be beneficial for candidates to understand that an input device should not be described as an analogue to digital converter.

It would also be beneficial for candidates to be detailed in their response. Some candidates stated that an input device was used to input something. An increased level of detail is required.

(ii) Most candidates were able to correctly name an input device.

(b) (i) Many candidates were able to describe the purpose of an output device. It would be beneficial for candidates to understand that an output device should not be described as a digital to analogue converter.

It would also be beneficial for candidates to be detailed in their response. Some candidates stated that an output device was used to output something. An increased level of detail is required.

(ii) Most candidates were able to correctly name an output device.

It would be beneficial for candidates to be detailed in their response. Some candidates provided responses such as screen. An increased level of details is required.

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Question 3

(a) (i) Many candidates were able to provide the correct binary value. It would be beneficial if candidates noted the number of bits required for the binary value. Some candidates provided an 8-bit binary answer, rather than a 12-bit binary answer.

(ii) Many candidates were able to provide the correct binary value. It would be beneficial if candidates noted the number of bits required for the binary value. Some candidates did not provide the necessary leading zeros to make it a 12-bit binary answer.

(iii) Most candidates were able to provide the correct working and final value.

(b) (i) Many candidates were able to provide two suitable sensors. The most common incorrect answer was acoustic/sound sensor. This would not be a suitable sensor for the scenario.

(ii) Some candidates were able to fully describe the process of the system. It would be beneficial for candidates to increase the level of detail in their response. Some candidates provided vague responses such as 'value is compared'.

Question 4

(a) Many candidates were able to explain why a high-level language was chosen for the scenario. It would be beneficial if candidates understood that high-level language is converted to binary to be stored by the computer. Some candidates stated that high-level language takes up less storage space.

(b) Some candidates correctly identified which statements applied to each translator. It would be beneficial for candidates to understand that a program will still run, using an interpreter, until the error is encountered. It would also be beneficial for candidates to understand that an error report is produced at the end of translation with a compiler, but errors are reported, during runtime, as they are encountered with an interpreter.

(c) Many candidates were able to provide a correct explanation. It would be beneficial for candidates to provide an improved level of detail. Some candidates provided vague statements, such as lossy would be bad for code. A more detailed level of response is required.

(d) (i) Some candidates were able to describe the full process of checksum. It would be beneficial for candidates to make sure that they are providing a response for the question given. Some candidates spent time describing the disadvantages of the method, these were not required. It would also be beneficial for candidates to understand that the calculations are done by the computer and not the user. Some candidates described the user carrying out the calculations.

Some candidates also chose to only describe the process of calculating the first checksum. It would be beneficial for candidates to describe the whole process of checksum and not just a detailed explanation of how a checksum is calculated.

(ii) Most candidates were able to identify three other error checking methods.

Question 5

(a) Most candidates were able to provide a correct logic circuit.

(b) Most candidate were able to provide a correct truth table.

Question 6

(a) Many candidates were able to provide a detailed explanation. It would be beneficial for candidates to understand the difference between a USB connection and a USB storage device. Some candidates incorrectly described a USB storage device.

(b) (i) Most candidates correct identified a laser printer.

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(ii) Some candidates were able to provide suitable benefits. It would be beneficial for candidates to provide an increased level of detail in their responses. Some candidates provided vague statements, such as it is faster, and it is cheaper.

(iii) Some candidates were able to provide a suitable drawback. It would be beneficial for candidates to provide an increased level of detail in their responses. Some candidates provided vague statements, such as it is expensive.

(c) (i) Many candidates were able to provide the correct storage types for each device. The most common incorrect response was candidates categorising an Solid state drive (SSD) as primary storage.

(ii) Few candidates were able to provide a detailed description of the process of storing data on magnetic storage. It would be beneficial for candidates to understand the difference between storing data on magnetic storage and storing data on optical storage. Many candidates described the process of optical rather than magnetic.

(iii) Some candidates were able to provide suitable benefits of magnetic. It would be beneficial for candidates to provide an improved level of detail in their response. Some candidates provided vague statements such as it is cheaper.

Question 7

Some candidates were able to identify and describe three risks. It would be beneficial for candidates to read and consider the scenario given. In the case, it required risks that would affect and damage the data on the computer. Therefore, risks such as phishing, were not relevant to the given scenario.

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COMPUTER SCIENCE

Paper 0478/22
Paper 2

Key messages

Candidates who had completed the tasks for the pre-release (pizza ordering service) were able to provide answers for ***Section A*** that showed good understanding of the tasks undertaken. Candidates, who read each question carefully and answered the question, as set on the paper, performed better than those who had memorised their solution and used all of that information without considering what information needed to be included in their answer.

Candidates should take care when declaring variables, constants and arrays to ensure that the identifier declared could be used in a program. Identifier names must not contain spaces. Once declared the same identifier name should be used throughout the answer.

Questions asking for an explanation about a section of a program, require the candidate to explain what this part of the program does as well as quoting any programming code used.

When candidates complete trace tables, values in the cells should be easily readable. Any incorrect values should be clearly crossed out.

General comments

Most candidates attempted all the question parts in ***Section A***. **Question 1** parts **(c)(ii)** and **(d)** were the ones most frequently omitted. Nearly all candidates attempted all the questions in ***Section B***.

Comments on specific questions

Section A

Question 1

(a) Most candidates correctly stated a suitable constant and variable to use for **Task 1**. A common error was to incorrectly state the name of an array rather than a variable.

(b) Some candidates correctly explained the changes that would be required to the **Task 1** program if there were three types of pizza base to choose from. Suitable changes included extra storage, displaying another base type and the changes required to the program code. A few candidates incorrectly provided program code rather than an explanation.

(c) (i) Algorithms were usually written in pseudocode or program code, a few flowcharts were seen. Most candidates correctly showed some the steps required for choosing the additional toppings in **Task 1**. Some candidates incorrectly included some of the steps required for other parts of **Task 1**, for example choosing the base or size, these steps could not be credited.

(ii) Most responses seen, explained how the candidate's algorithm only allowed valid additional pizza toppings. Some candidates incorrectly included validation for other data entry, this could not be credited.

(d) Many candidates gave very detailed answers that included explanation of how their program completed both **Task 2** and **Task 3**, only the explanation of how the steps for **Task 3** were programmed could be credited.

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Section B

Question 2

(a) The full range of marks were awarded, most candidates correctly identified two or three errors. A few candidates showed good understanding of the pseudocode by correctly identifying the problem with the `REPEAT … UNTIL` condition.

(b) Generally well answered.

Question 3

Most candidates showed the skill of using a trace table. Some candidates provided a 'rough answer' in pencil and a final answer in ink; this is not recommended as extra values can be seen in the trace table. Candidates found the output the most challenging column to complete correctly and common errors seen were to incorrectly include commas in the output or Child instead of Children. A few candidates incorrectly included all the input data from the examination paper, not recognising that Z ended the process.

Question 4

Generally well answered, most candidates correctly recognised three or four of the examples given. The most common error seen was not recognising the `WHILE` loop as repetition.

Question 5

(a) Most candidates gained full marks for this part of the question.

(b) Generally, well answered. Candidates needed to consider the range of data carefully when including examples of test data.

Question 6

All candidates attempted this question and most candidates identified the appropriate fields and could also provide suitable criteria. A few candidates' answers were lacking in accuracy; common errors included misspelt field names, missing table names, incorrect sort instructions and incorrectly including mm in the criteria for the Width field.

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Grade thresholds – March 2019

Cambridge IGCSE™ Computer Science (0478)

Grade thresholds taken for Syllabus 0478 (Computer Science) in the March 2019 examination.

		minimum raw mark required for grade:						
	maximum raw mark available	A	B	C	D	E	F	G
Component 12	75	51	44	37	31	24	17	10
Component 22	50	33	27	21	16	12	8	4

Grade A* does not exist at the level of an individual component.

The maximum total mark for this syllabus, after weighting has been applied, is **125**.

The overall thresholds for the different grades were set as follows.

Option	Combination of Components	A*	A	B	C	D	E	F	G
AY	12, 22	97	84	71	58	47	36	25	14

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COMPUTER SCIENCE **0478/12**

Paper 1 **March 2019**

MARK SCHEME

Maximum Mark: 50

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)</td><td><table><tr><th>File size</th><th>Tick (✓)</th></tr><tr><td>20 MB</td><td></td></tr><tr><td>10 GB</td><td>✓</td></tr></table></td><td>1</td></tr>
<tr><td>1(b)</td><td><table><tr><th>File size</th><th>Tick (✓)</th></tr><tr><td>3500 kB</td><td>✓</td></tr><tr><td>3 MB</td><td></td></tr></table></td><td>1</td></tr>
</table>

Question	Answer	Marks
2(a)(i)	– (A device that allows) **data** to be entered (into a computer system)	1
2(a)(ii)	**One** from e.g.: – Keyboard – Mouse – Microphone – Sensor – Touch screen	1
2(b)(i)	– (A device that allows the user to) view/hear the **data** (that has been entered into a computer system)	1
2(b)(ii)	**One** from e.g. : – Monitor – Speaker – Headphones – Printer	1

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Question	Answer	Marks
3(a)(i)	– 000000100111 1 mark 1 mark	**2**
3(a)(ii)	– 000101011110 1 mark 1 mark	**2**
3(a)(iii)	1 mark for working, 1 mark for correct answer – 1024 + 512 + 128 + 64 + 4 + 2 + 1 – 1735	**2**
3(b)(i)	**Two** from: – Pressure sensor – Light sensor – Motion sensor – Magnetic field (can be used if competitors are wearing a compatible chip)	**2**
3(b)(ii)	– Sensor sends signal to microprocessor – Signal is analogue and is converted to digital (using ADC) – Data is compared to stored value // Check for signal – If data does not match / is out of range/ in range // signal detected … – … counter is incremented by 1 – Continuous process	**6**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(a)</td><td>Two from:
– Closer to English statements / human language
– Easier / quicker to write / read / understand / remember
– Easier / quicker to debug
– Less likely to make errors
– One line of code can carry out multiple commands
– Portable language</td><td>2</td></tr>
<tr><td>4(b)</td><td>1 mark for correct tick(s) for each statement
<table>
<tr><th>Statement</th><th>Compiler</th><th>Interpreter</th></tr>
<tr><td>A report of errors is produced at the end of translation</td><td>✓</td><td></td></tr>
<tr><td>The program is translated one line at a time</td><td></td><td>✓</td></tr>
<tr><td>The program is translated from high-level language into machine code</td><td>✓</td><td>✓</td></tr>
<tr><td>An executable file is produced</td><td>✓</td><td></td></tr>
<tr><td>The program will not run at all if an error is detected</td><td>✓</td><td></td></tr>
</table></td><td>5</td></tr>
<tr><td>4(c)</td><td>– Lossy would remove data
– Lossless does not remove data // No data can be lost …
– Can be restored to original state …
– … otherwise will not run / work correctly</td><td>4</td></tr>
<tr><td>4(d)(i)</td><td>– Sending device creates value from calculation on data // By example
– Value is transmitted with the data
– Receiving device performs same calculation
– Values are compared after transmission // If values do not match …
– … an error is detected</td><td>5</td></tr>
</table>

Question	Answer	Marks
4d(ii)	– Parity check – Check digit – Automatic repeat request	**3**

Question	Answer	Marks
5(a)	1 mark for each correct logic gate with correct input(s) 	**6**

Question	Answer	Marks
5(b)	4 marks for 8 correct outputs 3 marks for 6/7 correct outputs 2 marks for 4/5 correct outputs 1 mark for 2/3 correct outputs	**4**

A	B	C	Working space	X
0	0	0		**0**
0	0	1		**0**
0	1	0		**1**
0	1	1		**0**
1	0	0		**0**
1	0	1		**1**
1	1	0		**1**
1	1	1		**1**

Question	Answer	Marks
6(a)	**Three** from: – Universal Serial Bus – Data transmission method – Uses serial transmission // bits of data are sent one at a time – Universal standard // common interface	**3**
6(b)(i)	– Laser printer	**1**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6(b)(ii)</td><td>Two from:
– Cheaper printing cost per page
– It prints at a faster speed
– It prints text at a high quality
– Colour fast</td><td>2</td></tr>
<tr><td>6(b)(iii)</td><td>One from:
– Expensive to purchase printer
– Toner is expensive
– Print images at a lower quality
– Can be quite large in size</td><td>1</td></tr>
<tr><td>6(c)(i)</td><td>1 mark per each correct tick
<table>
<tr><th>Storage example</th><th>Primary</th><th>Secondary</th><th>Off-line</th></tr>
<tr><td>Solid state drive (SSD)</td><td></td><td>✓</td><td></td></tr>
<tr><td>Blu-ray disc</td><td></td><td></td><td>✓</td></tr>
<tr><td>USB flash memory</td><td></td><td></td><td>✓</td></tr>
<tr><td>Random access memory (RAM)</td><td>✓</td><td></td><td></td></tr>
<tr><td>Read only memory (ROM)</td><td>✓</td><td></td><td></td></tr>
</table></td><td>5</td></tr>
</table>

Question	Answer	Marks
6(c)(ii)	**Six** from: – Storage device has platters – Platters/disk divided into tracks – Storage platter / disk is spun – Has a read/write arm that moves across storage media – Read/writes data using electromagnets – Uses magnetic fields to control magnetic dots of data – Magnetic field determines binary value NOTE: Marks can be awarded for an alternative description e.g. magnetic tape	**6**
6(c)(iii)	– Magnetic is cheaper **per unit of data** – Magnetic has more longevity // Magnetic can perform more read/write cycles	**2**

Question	Answer	Marks
7	For each of **three** risks Naming the risk – 1 mark, describing the risk – 1 mark: – Hacking … – … when a person tries to gain unauthorised access to a computer system – … data can be deleted/corrupted by hacker – Malware … – … a software program designed to damage data / disrupt the computer system – … replicates itself and fills the hard disk – Virus … – … a program that replicates itself to damage / delete files NOTE: Multiple kinds of malware can be awarded if listed and given a matching description e.g. trojan horse, worm.	**6**

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COMPUTER SCIENCE **0478/22**

Paper 2 **March 2019**

MARK SCHEME

Maximum Mark: 50

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the March 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
	Section A	
1(a)	Many correct answers, they must be meaningful. The names are examples only. Constant name `Max_Extra_Top` Value 3 Use Storing the number of extra toppings a pizza can have Variable name `NextOrderNo` Data type integer Use storing the next order number available	**6**
1(b)	Any **two** from Store an extra type of base Display another option Change the if statement/validation check to include the third option//extra crispy	**2**

Question	Answer	Marks

1(c)(i)	Any **five** from:
	Enter Number of toppings
	Check number of toppings chosen
	Display toppings available
	Provide method of selection
	Only accept correct selections
	Error message if topping not found
	Finish selection
	There are many possible correct answers, this is an example only.
	Sample answer
	`PRINT "Pepperoni  1"`
	`PRINT "Chicken  2"`
	`PRINT "Extra cheese  3"`
	`PRINT "Mushrooms  4"`
	`PRINT "Spinach  5"`
	`PRINT "Olives  6"`
	`REPEAT`
	`  PRINT "How many extra toppings do you want"`
	`  INPUT NoTopping`
	`UNTIL NoTopping >= 0 and NoTopping <=3`
	`WHILE NoTopping >0 DO`
	`  PRINT "Enter Topping ",  NoTopping`
	`  INPUT ToppingType`
	`  CASE OF ToppingType`
	`  1: Pepperoni ← Pepperoni + 1`
	`  2: Chicken ← Chicken + 1`
	`  3: ExtraCheese ← ExtraCheese + 1`
	`  4: Mushrooms ← Mushrooms + 1`
	`  5: Spinach ← Spinach + 1`
	`  6: Olives ← Olives + 1`
	`  OTHERWISE: PRINT "Error"`
	`  ENDCASE`
		5

Question	Answer	Marks

1(c)(i)	`  IF ToppingType >=1 AND ToppingType <=6`
	`    THEN`
	`    PizzaTop[NoTopping] ← ToppingType`
	`    NoTopping ← NoTopping - 1`
	`  ENDIF`
	`ENDWHILE`	

1(c)(ii)	Answers must relate to the algorithm provided for (c)(i) Any **three** from: Display the valid toppings e.g. choose from a menu Check input for each topping is valid … method e.g. using a CASE statement / range check Provide a suitable error message for invalid toppings Provide a method to re-input a topping e.g. use of REPEAT…UNTIL	**3**
1(d)	Explanation Any **four** from: How the total of each additional pizza toppings was checked How the largest value was selected How the smallest value was selected How the topping descriptions were recorded for largest/smallest Method used to calculate percentages … … calculation relates to the total number of additional toppings ordered Display results including suitable messages	**4**

Question	Answer	Marks
	Section B	

2(a)	`Total ← Count` should be `Total ← 0`
	
	`Number <> 0` should be `Number > 0`
	
	`Total ← Total + Count` should be `Total ← Total + Number`
	
	`UNTIL Count < 50` should be
	`UNTIL Count > 50, UNTIL Count >= 51, UNTIL Count = 51`
	
	1 mark for each error identified + suggested correction
		4

2(b)	The test should be `IF Number > 0 AND Number <20` One mark for both ends of the range and one mark for the **AND.**	**2**

Question	Answer	Marks
3		**5**

Senior	Adult	Child	Type	OUTPUT
0	0	0		
			S	
1			S	
2			S	
3			A	
	1		C	
		1	C	
		2	C	
		3	A	
	2		A	
	3		A	
	4		A	
	5		W	
			S	
4			S	
5			D	
			C	
		4	Z	Seniors 5
				Adults 5
				Children 4

One mark for each correct column.

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4</td><td>
<table>
<tr><th>Statements</th><th>Selection</th><th>Repetition</th></tr>
<tr><td>FOR X ← 1 TO 10
  SUM ← SUM + 1
NEXT X</td><td></td><td>✓</td></tr>
<tr><td>WHILE X > 10 DO
  SUM ← SUM + 1
  X ← X - 1
ENDWHILE</td><td></td><td>✓</td></tr>
<tr><td>IF X > 10
THEN
  SUM ← SUM + 1
  X ← X - 1
ENDIF</td><td>✓</td><td></td></tr>
<tr><td>REPEAT
  SUM ← SUM + 1
  X ← X - 1
UNTIL X > 10</td><td></td><td>✓</td></tr>
</table>
</td><td>4</td></tr>
</table>

Question	Answer	Marks
5(a)	Validation Range check	2

Question	Answer	Marks
5(b)	For each of **three** different data types Data type - 1 mark, Example - 1 mark, Reason - 1 mark There are many possible correct answers, this is an example only. Normal data (1 mark) 65 (1 mark) to show that the program accepts this value (1 mark) Erroneous data (1 mark) seventy (1 mark) to show that the program rejects this value (1 mark) Extreme data (1 mark) 89 (1 mark) to show that the program accepts this value (1 mark)	**9**

Question	Answer	Marks
6		**4**

Field:	Tyre Code	Stock Level	Width	Terrain
Table:	BIKETYRES	BIKETYRES	BIKETYRES	BIKETYRES
Sort:		Ascending		
Show:	☑	☑	☐	☐
Criteria:			= 24	= 'Asphalt'
or:				

One mark for each correct column

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COMPUTER SCIENCE **0478/22**

Paper 2 Problem-solving and Programming **February/March 2019**

PRE-RELEASE MATERIAL

No Additional Materials are required.

This material should be given to the relevant teachers and candidates as soon as it has been received at the centre.

READ THESE INSTRUCTIONS FIRST

Candidates should use this material in preparation for the examination. Candidates should attempt the practical programming tasks using their chosen high-level, procedural programming language.

Any businesses described in this paper are entirely fictitious.

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[Turn over

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Your preparation for the examination should include attempting the following practical tasks by **writing and testing a program or programs**.

A pizza ordering service allows customers to design their own pizza. There are three sizes: small, medium and large. A pizza can have a thick or thin base. All pizzas come with tomato and cheese toppings as standard and there are six additional types of topping available:

- Pepperoni
- Chicken
- Extra cheese
- Mushrooms
- Spinach
- Olives

Pizzas always come with tomato and cheese toppings as standard, and can have up to three additional toppings. Customers need to be able to design their own pizza and then confirm or change it. Records are kept showing the number of pizzas sold for each base and size. The number of sales for each additional topping is also recorded.

Write and test a program or programs for the pizza ordering service.

- Your program or programs must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Design your pizza.

The customer is given choices of size, base and additional toppings (number and type) as stated above. Only valid choices can be accepted. The customer is asked to confirm their order or alter their choices or not proceed. If the customer confirms their order they are given a unique order number.

TASK 2 – Record the choices.

Extend TASK 1 to record totals for the choices made for ordered pizzas only and calculate the total number of pizzas ordered.

TASK 3 – Find the most and least popular additional pizza toppings.

Using your results from TASK 2, display the most popular and least popular additional toppings as a percentage of the total number of additional toppings ordered.

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/12**

Paper 1 Theory **February/March 2019**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
No marks will be awarded for using brand names of software packages or hardware.

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The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

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1 **(a)** Elle has a file stored on her computer that is 20 MB in size. Jordan has a file that is 10 GB in size.

Tick (✓) to show which is the **larger** file.

File size	Tick (✓)
20 MB	
10 GB	

[1]

(b) Bob has a file stored on his computer that is 3500 kB in size. Gerty has a file that is 3 MB in size.

Tick (✓) to show which is the **larger** file.

File size	Tick (✓)
3500 kB	
3 MB	

[1]

2 Many computer systems have an input device and an output device.

(a) **(i)** State what is meant by an input device.

.....

..... [1]

(ii) Give an example of an input device.

..... [1]

(b) **(i)** State what is meant by an output device.

.....

..... [1]

(ii) Give an example of an output device.

..... [1]

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3 **(a)** A long distance running race uses an electronic counter that counts each competitor who finishes the race.

The count is stored as binary in a **12-bit** register.

A denary value of the count is displayed on a screen above the finish line.

(i) The screen currently displays:

0	0	3	9

State the binary value that is currently stored to display the count shown.

.....

..... [2]

(ii) More competitors cross the finish line and the screen now displays:

0	3	5	0

State the binary value that is currently stored to display the count shown.

.....

..... [2]

(iii) At the end of the race the binary value stored is:

011011000111

Give the denary value that would be displayed on the screen at the end of the race.

Show your working.

.....

.....

.....

.....

Screen display: [ ]

[2]

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(b) Sensors are used at the finish line to identify the number of competitors who finish the race.

(i) Identify **two** different sensors that could be used to identify the number of competitors.

Sensor 1 .....

Sensor 2 .....
[2]

(ii) The sensors are used with a microprocessor to count how many competitors finish the race.

Explain how the sensor and the microprocessor are used.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

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4 Darius is writing a computer program that allows binary values to be calculated.

Darius chooses to write the program in a high-level language rather than a low-level language.

(a) Explain why Darius chooses to write the program in a high-level language.

.....

.....

.....

..... [2]

(b) Darius will use a translator to translate the program. He could use a compiler or an interpreter.

Five statements are given about compilers and interpreters.

Tick (✓) to show if the statement applies to a **Compiler** or an **Interpreter**. Statements may apply to both.

Statement	Compiler (✓)	Interpreter (✓)
A report of errors is produced at the end of translation.		
The program is translated one line at a time.		
The program is translated from high-level language into machine code.		
An executable file is produced.		
The program will not run at all if an error is detected.		

[5]

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Darius is sending several programs that he has created to his friend Selma.

(c) He wants to compress the files to send them as he needs to attach them to an email.

Darius tells Selma he is going to use lossy compression. Selma tells him that he should use lossless instead.

Explain why Selma tells Darius to use lossless compression instead of lossy.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(d) Errors can occur when data is transmitted, stored or entered into a system.

Darius could use an error detection method to find whether errors have occurred.

One error detection method he could use is a checksum.

(i) Describe how a checksum detects errors.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

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(ii) State **three** other error detection methods that Darius could use.

Method 1 .....

Method 2 .....

Method 3 .....
[3]

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5 Consider the following logic statement:

X = 1 if ((A is 1 NAND C is 1) NOR A is NOT 1) OR (B is 1 AND C is NOT 1)

(a) Draw a logic circuit that represents the given logic statement. Your logic gates must have a maximum of two inputs. Do **not** simplify the logic statement.

[6]

(b) Complete the truth table for the given logic statement.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

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6 Nadia purchases a printer to print out her homework.

She connects the printer to her computer using USB.

(a) Explain what is meant by USB.

.....

.....

.....

.....

.....

..... [3]

(b) Nadia's printer uses powdered toner rather than liquid ink.

(i) State the type of printer Nadia has purchased.

..... [1]

(ii) Give **two** benefits of using this type of printer.

Benefit 1 .....

.....

Benefit 2 .....

.....
[2]

(iii) Give **one** drawback of using this type of printer.

Drawback 1 .....

..... [1]

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(c) Nadia uses several types of computer storage for her homework and other projects.

(i) **Five** examples of computer storage are given.

Tick (✓) to show if the computer storage is **Primary**, **Secondary** or **Off-line**.

Storage example	Primary (✓)	Secondary (✓)	Off-line (✓)
Solid state drive (SSD)			
Blu-ray disc			
USB flash memory			
Random access memory (RAM)			
Read only memory (ROM)			

[5]

(ii) Nadia is considering purchasing a magnetic storage device.

Describe how a magnetic storage device stores data.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

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(iii) Give **two** advantages of using a magnetic storage device rather than a solid state storage device.

Advantage 1 .....

.....

Advantage 2 .....

.....
[2]

7 Arya regularly uses the Internet as a research tool for her school projects.

Identify **and** describe **three** risks to Arya's computer when she is using the Internet for research.

Risk 1 .....

Description .....

.....

.....

Risk 2 .....

Description .....

.....

.....

Risk 3 .....

Description .....

.....

.....
[6]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/22**

Paper 2 Problem-solving and Programming **February/March 2019**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

DO NOT ATTEMPT TASKS 1, 2 AND 3 in the pre-release material; these are for information only.

You are advised to spend no more than **40 minutes** on **Section A** (Question 1).

No marks will be awarded for using brand names of software packages or hardware.

Any businesses described in this paper are entirely fictitious.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 50.

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[Turn over

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Section A

You are advised to spend no longer than 40 minutes answering this section.

Here is a copy of the pre-release material.

DO NOT attempt Tasks 1, 2 and 3 now.

Use the pre-release material and your experience from attempting the tasks before the examination to answer Question 1.

Pre-release material

A pizza ordering service allows customers to design their own pizza. There are three sizes: small, medium and large. A pizza can have a thick or thin base. All pizzas come with tomato and cheese toppings as standard and there are six additional types of topping available:

- Pepperoni
- Chicken
- Extra cheese
- Mushrooms
- Spinach
- Olives

Pizzas always come with tomato and cheese toppings as standard, and can have up to three additional toppings. Customers need to be able to design their own pizza and then confirm or change it. Records are kept showing the number of pizzas sold for each base and size. The number of sales for each additional topping is also recorded.

Write and test a program or programs for the pizza ordering service.

- Your program or programs must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Design your pizza.

The customer is given choices of size, base and additional toppings (number and type) as stated above. Only valid choices can be accepted. The customer is asked to confirm their order or alter their choices or not proceed. If the customer confirms their order they are given a unique order number.

TASK 2 – Record the choices.

Extend TASK 1 to record totals for the choices made for ordered pizzas only and calculate the total number of pizzas ordered.

TASK 3 – Find the most and least popular additional pizza toppings.

Using your results from TASK 2, display the most popular and least popular additional toppings as a percentage of the total number of additional toppings ordered.

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1 **(a)** All variables, constants and other identifiers should have meaningful names.

State **one** constant and **one** variable that you could have used for **Task 1**. Give the value that would be assigned to the constant. Give the data type for the variable. Explain what each one could be used for.

Constant name .....

Value .....

Use .....

.....

Variable name .....

Data type .....

Use .....

.....
[6]

(b) Explain how you would need to change your program for **Task 1** if there were three bases to choose from (thick, thin and extra crispy).

.....

.....

.....

..... [2]

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(c) **(i)** Write an algorithm for choosing the additional toppings in **Task 1**, using **either** pseudocode, programming statements **or** a flowchart. Your algorithm must only include this part of **Task 1**.

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[5]

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(ii) Explain how your algorithm in **part (c)(i)** only allowed valid choices for the additional pizza toppings.

.....

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..... [3]

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(d) Explain how your program completed **Task 3**. Any programming statements used in your answer must be fully explained.

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..... [4]

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Section B

2 **(a)** An algorithm has been written in pseudocode to input 50 numbers and total only the positive numbers.

```
Count ← 1
Total ← Count
REPEAT
  INPUT Number
  IF Number <> 0
  THEN
    Total ← Total + Count
  ENDIF
  Count ← Count + 1
UNTIL Count < 50
PRINT Total
```

Find the **four** errors in the pseudocode and suggest a correction for each error.

Error 1 .....

Correction .....

.....

Error 2 .....

Correction .....

.....

Error 3 .....

Correction .....

.....

Error 4 .....

Correction .....

.....

[4]

(b) Show how you would change the corrected algorithm to only total numbers greater than 0 and less than 20.

.....

.....

..... [2]

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Question 3 starts on page 10.

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3 This flowchart inputs the type of passenger for a survey: S for Senior, A for Adult, C for Child. All other values are ignored, apart from Z which ends the process.

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Complete the trace table for the passenger input data:
S, S, S, A, C, C, C, A, A, A, A, W, S, S, D, C, Z, D, S

Senior	Adult	Child	Type	OUTPUT

[5]

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4 For each of the **four** groups of statements in the table, place a tick in the correct column to show whether it is an example of **Selection** or **Repetition**.

Statements	Selection	Repetition

`FOR X ← 1 TO 10`
`  SUM ← SUM + 1`
`NEXT X`		

`WHILE X > 10 DO`
`  SUM ← SUM + 1`
`  X ← X - 1`
`ENDWHILE`		

`IF X > 10`
`THEN`
`  SUM ← SUM + 1`
`  X ← X - 1`
`ENDIF`		

`REPEAT`
`  SUM ← SUM + 1`
`  X ← X - 1`
`UNTIL X > 10`		

[4]

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5 A programmer restricts input values to less than 90 and greater than 60.

(a) State whether this is called validation or verification.

.....

Name the check that needs to be used.

.....
[2]

(b) State **three** different types of test data the programmer would need to use. Give an example of each type and the reason that the programmer chose that test data.

Type 1 .....

Example .....

Reason .....

.....

Type 2 .....

Example .....

Reason .....

.....

Type 3 .....

Example .....

Reason .....

.....
[9]

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6 A database table, BIKETYRES, is used to keep a record of tyres for sale in a cycle shop. Tyres are categorised by width and diameter in millimetres, whether they have an inner tube and the type of terrain for which they are designed.

Tyre Code	Width	Diameter	Tube	Terrain	Stock Level
SLTT	23	700	YES	Asphalt	18
MLNT	24	700	NO	Asphalt	23
LLNT	28	700	NO	Asphalt	19
SLTM	23	700	YES	Mixed	22
MLTM	24	700	YES	Mixed	14
LLTM	28	700	YES	Mixed	12
SLTH	23	700	YES	Hard	10
MLTH	24	700	YES	Hard	5
LLNH	28	700	NO	Hard	7
SLNM	23	700	NO	Mixed	12
MLNM	24	700	NO	Mixed	22
LLNM	28	700	NO	Mixed	18
SSNT	23	650	NO	Asphalt	10
MSNT	24	650	NO	Asphalt	8
SSTM	23	650	YES	Mixed	5
MSNM	24	650	NO	Mixed	4

The query-by-example grid below displays the tyre code and the stock level of all 28 mm width tyres suitable for mixed terrain.

Field:	Tyre Code	Stock Level	Width	Terrain
Table:	BIKETYRES	BIKETYRES	BIKETYRES	BIKETYRES
Sort:				
Show:	☑	☑	☐	☐
Criteria:			= 28	= 'Mixed'
or:				

Alter the query to show the tyre code and stock level in ascending order of stock level for all 24 mm asphalt terrain tyres. Write the new query in the following query-by-example grid.

Field:				
Table:				
Sort:				
Show:	☐	☐	☐	☐
Criteria:				
or:				

[4]

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Grade thresholds – June 2019

Cambridge IGCSE™ Computer Science (0478)

Grade thresholds taken for Syllabus 0478 (Computer Science) in the June 2019 examination.

		minimum raw mark required for grade:						
	maximum raw mark available	A	B	C	D	E	F	G
Component 11	75	51	43	34	29	24	19	14
Component 12	75	53	44	35	30	24	19	14
Component 13	75	51	43	34	29	24	19	14
Component 21	50	33	25	18	14	11	8	5
Component 22	50	35	27	19	15	12	9	6
Component 23	50	33	25	18	14	11	8	5

Grade A* does not exist at the level of an individual component.

The maximum total mark for this syllabus, after weighting has been applied, is **125**.

The overall thresholds for the different grades were set as follows.

Option	Combination of Components	A*	A	B	C	D	E	F	G
AX	11, 21	100	84	68	52	43	35	27	19
AY	12, 22	105	88	71	54	45	36	28	20
AZ	13, 23	100	84	68	52	43	35	27	19

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Cambridge International General Certificate of Secondary Education

COMPUTER SCIENCE **0478/11**

Paper 1 **May/June 2019**

MARK SCHEME

Maximum Mark: 75

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

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Generic Marking Principles

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GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

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- marks are awarded when candidates clearly demonstrate what they know and can do
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- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
1(a)	97 1 0 0 1 0 1 1 1 1 mark 1 mark 5C 0 1 0 1 1 1 0 0 1 mark 1 mark E1 1 1 1 0 0 0 0 1 1 mark 1 mark	**6**
1(b)	**Four** from: • Media Access Control (address) • Used to identify a device • It is a **unique** (address) • It is a static address // It does not change • It is set by the manufacturer • The first part is the manufacturer ID/number/identifies the manufacturer • The second part is the serial number/ID	**4**

Question	Answer	Marks
1(c)	**Two** from e.g.: • Colour **codes** // Colour in **HTML / CSS** • Error messages • Locations in memory • Memory dump // debugging • IP address • ASCII // Unicode • Assembly language • URL	**2**

Question	Answer	Marks
2(a)	1 mark for correct name, 1 mark for correct gate symbol – AND 	**2**
2(b)	1 mark for correct name, 1 mark for correct gate symbol – NOR 	**2**

Question	Answer	Marks
2(c)	1 mark for correct name, 1 mark for correct gate symbol – NAND 	**2**

Question	Answer	Marks
3	1 mark for each correct device	**5**

Description of input or output device	Name of device
This is an input device that works by shining a light onto the surface of a document. The light source is automatically moved across the document and the reflected light is captured by mirrors and lenses.	**2D Scanner**
This is an input device where a laser or a light source is moved across an object. The width, height and depth of the object are measured to allow a model to be created.	**3D scanner**
This is a large input device that is usually fixed to a wall. A user can calibrate the device to make sure the sensors align with a projected image. The user can use either their finger or a special pen to make selections.	**Interactive whiteboard**
This is an output device that uses many small mirrors to reflect light towards a lens. This will display an image.	**Projector**
This is an output device that creates an object by building layer upon layer of material.	**3D printer**

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Question	Answer	Marks
4(a)(i)	1 mark for security method, 2 marks for description **Anti-virus (software) // Anti-malware (software)** • Scans the computer system (for viruses) • Has a record of known viruses • Removes/quarantines any viruses that are found • Checks data before it is downloaded • … and stops download if virus found/warns user may contain virus **Firewall // Proxy server** • Monitors traffic coming **into and out of** the computer system • **Checks** that the traffic meets any criteria/rules set • Blocks any traffic that does not meet the criteria/rules set // set blacklist/whitelist	**3**

Question	Answer	Marks
4(a)(ii)	1 mark for security method, 2 marks for description **Firewall // proxy server** • Monitors traffic coming into and out of the computer system • Check that the traffic meets any criteria/rules set • Blocks any traffic that does not meet the criteria/rules set // set blacklist/whitelist **NOTE: Cannot be awarded if already given in 4(a)(i)** **Passwords** • Making a password stronger // by example • Changing it regularly • Lock out after set number of attempts // stops brute force attacks // makes it more difficult to guess **Biometrics** • Data needed to enter is unique to individual • … therefore very difficult to replicate • Lock out after set number of attempts **Two-step verification // Two-factor authentication** • Extra data is sent to device, pre-set by user • … making it more difficult for hacker to obtain it • Data has to be entered into the same system • … so if attempted from a remote location, it will not be accepted	**3**

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Question	Answer	Marks
4(a)(iii)	1 mark for security method, 2 marks for description **Anti-spyware software // Anti-malware (software)** • Scans the computer for spyware • Removes/quarantines any spyware that is found • Can prevent spyware being downloaded **NOTE: Anti-malware (software) cannot be awarded if already given in 4(a)(i)** **Drop-down boxes // onscreen/virtual keyboard** • Means key logger cannot collect data // key presses cannot be recorded • … and relay it to third party **Two-step verification // Two-factor authentication** • Extra data is sent to device, pre-set by user • … making it more difficult for hacker to obtain it • Data has to be entered into the same system • … so if attempted from a remote location, it will not be accepted **NOTE: Cannot be awarded if already given in 4(a)(ii)** **Firewall // proxy server** • Monitors traffic coming into and out of the computer system • Check that the traffic meets any criteria/rules set • Blocks any traffic that does not meet the criteria/rules set // set blacklist/whitelist **NOTE: Cannot be awarded if already given in 4(a)(i) or 4(a)(ii)**	**3**
4(b)(i)	**Three** from: • Human error e.g. accidentally deleting a file • Hardware failure • Physical damage e.g. fire/flood • Power failure // power surge • Misplacing a storage device	**3**

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Question	Answer	Marks
4(b)(ii)	**Two** from: • Back data up • Use surge protection • Keep data in a fireproof / waterproof / protective case • Use verification methods (for deleting files) • Following correct procedure e.g. ejecting offline devices / regularly saving	**2**

Question	Answer	Marks

5	**Five** from:
	• A (compression) algorithm is used
	• No data is removed in the process // original file can be restored
	• **Repeated** words (are identified) // **Patterns** in the data (are identified)
	• … and are indexed/put into a table // by example
	• … and are replaced with their index // by example
	• … and their positions are stored (in the table) // by example
	• … and the number of times the word/pattern appears is stored (in the table) // by example
	
	NOTE: Other valid methods of lossless compression can be awarded marks
		5

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Question	Answer	Marks
6(a)	**Four** from (max 2 marks per improvement): • Make the password require more characters • Makes the password harder to crack/guess • More possible combinations for the password • Make the password require different types of characters • Makes the password harder to crack/guess • More possible combinations for the password • Use a biometric device • Hard to fake a person's biological data // data is **unique** • Two-step verification // Two factor-authentication • Adds an additional level to hack • Have to have the set device for the code to receive it • Drop-down boxes // onscreen keyboard • To prevent passwords being obtained using keylogger • Request random characters • Won't reveal entire password • Set number of password attempts • Will lock account if attempting to guess • Will stop brute-force attacks	**4**

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Question	Answer	Marks
6(b)	**Four** from (max 3 marks for benefits only, without an explanation): • More read/write cycles (over its lifetime) // greater longevity … • … likely to be a lot of read/write functions each day • Read/write speed is sufficient … • … even though it is slower than solid-state • Cheaper **per unit of data** stored … • … better value for the company to purchase • … so the law company can afford to buy a server with greater storage capacity • No requirement for portability … • … as a server, it does not need to be moved • Trusted technology … • … it has been traditionally used for many years	**4**
6(c)	• DVD • CD • Blu-ray	**3**

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Question	Answer	Marks
7	1 mark for each correct term, in the correct place: • Syntax • High-level language • Translator • Machine code • Assembly • Low-level language	**6**

Question	Answer	Marks
8(a)	**Six** from: • SSL is a (security) protocol • It encrypts any data that is sent • It uses/sends digital certificates … • … which is sent to the (buyer's/user's) browser // requested by (buyer's/user's) browser • … that contains the gallery's public key • … that can be used to authenticate the gallery • Once the certificate is authenticated, the transaction will begin	**6**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>8(b)</td><td>1 mark for each correct tick.
<table>
<tr><th>Statement</th><th>True (✓)</th><th>False (✓)</th></tr>
<tr><td>Firewalls are only available as hardware devices</td><td></td><td>✓</td></tr>
<tr><td>Firewalls allow a user to set rules for network traffic</td><td>✓</td><td></td></tr>
<tr><td>Firewalls will automatically stop all malicious traffic</td><td></td><td>✓</td></tr>
<tr><td>Firewalls only examine traffic entering a network</td><td></td><td>✓</td></tr>
<tr><td>Firewalls encrypt all data that is transmitted around a network</td><td></td><td>✓</td></tr>
<tr><td>Firewalls can be used to block access to certain websites</td><td>✓</td><td></td></tr>
</table></td><td>6</td></tr>
<tr><td>8(c)</td><td>**Four** from:
• A set of guidelines
• Rules/laws that govern the use of computers / by example
• Tell people how to behave when using computers // helps keep users safe when using computers // by example
• **Art gallery** could be subject to plagiarism / intellectual property theft
• **Art gallery** could **copyright** their work (to make it illegal to steal it)</td><td>4</td></tr>
</table>

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COMPUTER SCIENCE **0478/12**

Paper 1 **May/June 2019**

MARK SCHEME

Maximum Mark: 75

Published

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Question	Answer	Marks
1(a)	**Three** from e.g.: – Keyboard – Mouse – Microphone – 2D scanner – 3D scanner – Touchscreen – Webcam // digital camera – Joystick – Trackpad – Sensor – Interactive whiteboard	**3**
1(b)	**Three** from e.g.: – Monitor // touchscreen – Inkjet printer – Laser printer – 3D printer – Speaker – Headphones – LED Projector – DLP – 2D cutter – 3D cutter – Actuator	**3**

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Question	Answer	Marks
2(a)	**Two** from: – It is non-volatile – Can be easily disconnected from the computer – It is not directly accessed by the CPU – Suitable example e.g. CD, DVD, USB flash memory	**2**
2(b)(i)	**One** from: – ROM – RAM	**1**
2(b)(ii)	**Two** from: – HDD – SSD – Flash memory	**2**

Question	Answer	Marks
3	1 mark for each correct term, in the correct place: – Data/instructions – Instructions/data (must be the alternative to MP1) – Fetched – RAM – Decoded – Executed	**6**

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Question	Answer	Marks
4(a)	**Two** from e.g.: – DVD uses red **laser**/light whereas blu-ray uses **blue**/violet laser/light – DVD has a **smaller** (storage) capacity // Blu-ray has a **larger** (storage) capacity – DVD has **two layers** (of polycarbonate) whereas Blu-ray disks have a **single layer** (of polycarbonate) – DVD has a **slower transfer** rate (of approximately 10 mbps) // Blu-ray has a **faster transfer** rate (of approximately 36 mbps)	**2**
4(b)(i)	2 marks for any two correct stages of working, 1 mark for correct answer. – 500 * 300 * 10 // 150 000 *10 – * 8 then ÷ 8 (anywhere in the process) – 1 500 000 ÷ 1024 ÷ 1024 // 1 500 000 ÷ 1 048 576 – = 1.43 MB	**3**
4(b)(ii)	**Four** from: – **Rollers** are used to move the paper through the printer – **Nozzles** spray/drop/jet ink onto the paper – Ink jets/print head/nozzles are moved across the paper (to distribute the ink) – Different colour inks are mixed to create required colours – Technology could be piezoelectric – Technology could be thermal bubble – **Ink** is heated – … and expands/evaporates into a bubble – Bubble is pushed through the nozzle on to the paper – … then the bubble collapses – Electrical current is applied to a crystal – … which makes it vibrate – … which forces a droplet of ink through the nozzle	**4**

Question	Answer	Marks
5	– Password protection – **Password** is released on the **release date** – Encryption – Encryption **key** is released on the **release date**	**4**

Question	Answer	Marks
6(a)	**Structure** – This is the **layout** of the web page – e.g. placing an image alongside some text // example of tag, such as **Presentation** – This is the **formatting/style** of the web page – e.g. the colour that is applied to some text // example of tag, such as <font-color>	**4**
6(b)	1 mark per each correct row.	**5**

Statement	True (✓)	False (✓)
Cookies can be used to store a customer's credit card details	✓	
Cookies can be used to track the items a customer has viewed on a website	✓	
Cookies will corrupt the data on a customer's computer		✓
Cookies are downloaded onto a customer's computer	✓	
Cookies can be deleted from a customer's computer	✓	

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Question	Answer	Marks
6(c)	– Several/multiple **bits** are transmitted **at a time/simultaneously** – Several/multiple wires are used – Data is transmitted in both directions … – … at the **same time/simultaneously**	**4**
6(d)	**One** from: – Uniform resource locator – The website's address – User friendly version of the IP address	**1**
6(e)(i)	**Four** from: – Designed to deny people access to a website – A large number/numerous requests are sent (to a server) … – … all at the same time – The server is unable to respond/struggles to respond to all the requests – The server fails/times out as a result	**4**
6(e)(ii)	**One** from: – Proxy server – Firewall	**1**

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Question	Answer	Marks
7(a)	**Six** from: – Motion sensor is used – Sensor sends data/signal to microprocessor – Data/Signal is converted from analogue data to digital data (using ADC) – Value to compared to stored value(s) // – If value is outside range/matches … – … **microprocessor** sends signal to switch lights on – … actuator used to switch light on/off – … timer is set for 2 minutes – Every time movement is detected the timer is reset – When timer reaches **0/120/times out microprocessor** sends signal to switch lights **off** – **Process** is continuous	**6**
7(b)	**Three** from: – Read only memory – Non-volatile memory // Contents of memory are retained when power is turned off//permanent storage – Primary storage // directly accessed by the CPU – Holds firmware/boot-up instructions/start-up instructions/BIOS – Cannot be written to	**3**

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Question	Answer	Marks
8(a)	1 mark per each correct logic gate, with correct input(s)	**6**

Question	Answer	Marks
8(b)	4 marks for 8 correct outputs 3 marks for 6/7 correct outputs 2 marks for 4/5 correct outputs 1 mark for 2/3 correct outputs	**4**

A	B	C	Working space	X
0	0	0		**0**
0	0	1		**0**
0	1	0		**1**
0	1	1		**0**
1	0	0		**0**
1	0	1		**0**
1	1	0		**1**
1	1	1		**1**

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Question	Answer	Marks
9	1 mark per each correct parity bit:	**3**

	Parity bit							
Register A	**1**	0	1	0	0	1	0	1
Register B	**1**	1	0	0	0	0	0	1
Register C	**1**	1	0	0	0	0	1	1

Question	Answer	Marks
10	**Four** from: – **Electrical** field/charge is spread across the screen – Sensors are located around the screen // sensors are used to read the electric field – When finger touches screen, the charge/ is transferred to the user – … as it is affected by the conductivity of another object – Coordinates of touch determined/calculated/measured	**4**

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COMPUTER SCIENCE **0478/13**

Paper 1 Theory **May/June 2019**

MARK SCHEME

Maximum Mark: 75

Published

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Question	Answer	Marks
1(a)		**6**

1	1	0	1	0	0	1	0	1	1	1	0
1 mark				1 mark				1 mark			

0	0	1	1	1	1	1	1	0	1	0	1
1 mark				1 mark				1 mark			

Question	Answer	Marks
1(b)	**One** from: – Hypertext Mark-up Language – A mark-up language used to create webpages	**1**
1(c)	1 mark for each correct row:	**5**

Example	Structure (✓)	Presentation (✓)
The colour applied to a text heading on a web page		✓
The font style applied to a paragraph of text on a web page		✓
The placement of a paragraph of text on a web page	✓	
The size that an image is set to be displayed at on a web page		✓
The placement of an image next to a paragraph of text of a web page	✓	

Question	Answer	Marks
1(d)	1 mark for each correct term, in the correct place: – URL – https – Domain name – Web server – Browser – HTML	**6**
1(e)(i)	– Small packets of data – … that are stored by the web browser	**2**
1(e)(ii)	**Four** from: – To store a customer's password … – To store a customer's credit card details … – … so they do not need to be re-entered in future – To track what the customer has viewed on the website … – … so she can send them adverts that match their preferences	**4**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>1 mark for each correct row:
<table>
<tr><th>Statement</th><th>True (✓)</th><th>False (✓)</th></tr>
<tr><td>A MAC address is unique to a computer on a network</td><td>✓</td><td></td></tr>
<tr><td>Once an IP address has been set it cannot be changed</td><td></td><td>✓</td></tr>
<tr><td>A MAC address is made up of the computer’s serial number and the IP address</td><td></td><td>✓</td></tr>
<tr><td>If a computer does not have an IP address it cannot communicate with another device using the Internet</td><td>✓</td><td></td></tr>
</table></td><td>4</td></tr>
<tr><td>2(b)(i)</td><td>**Two** from:
– Programs / instructions are stored in **memory**
– Data is stored in **memory**
– Instructions are fetched and executed **one after another**</td><td>2</td></tr>
<tr><td>2(b)(ii)</td><td>– Carries out calculations
– Carries out logical operations
– Holds temporary / interim values during calculations
– … in a register called the accumulator (ACC)</td><td>4</td></tr>
</table>

Question	Answer	Marks
2(c)(i)	– Interrupt	**1**
2(c)(ii)	**Two** from: – Provides an interface – Loads / opens / installs / closes software – Manages the hardware // manages peripherals // spooling – Manages the transfer of programs into and out of memory – Divides processing time // processor management – Manages file handling – Manages error handling // interrupt handling – Manages security software – Manages utility software – Manages user accounts – Multitasking – Multiprogramming // time slicing – Batch processing	**2**

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Question	Answer	Marks
3(a)	**Four** from: – The company could use the firewall to set criteria – Gaming websites can be listed as blocked websites // ports can be blocked – The firewall would examine any traffic leaving the network – If it detected traffic requesting a listed website, it will block access to it – Keeps a log of all attempts to access blocked websites	**4**
3(b)	**Four** from: – An encryption algorithm is used – … to scramble data – The original data is called the plain text – A key is used to encrypt the data – The key is applied to the plain text – Plain text is encrypted into cypher text	**4**
3(c)	**Six** from: – The user could have been sent an email with an attachment / link containing the spyware – The user could have clicked a link on an untrusted website – When the attachment / link was clicked the spyware was downloaded onto the user's computer – The spyware recorded all the key logs from the user's keyboard – The recorded key logs were sent back to the creator of the spyware – The key logs were analysed – A common pattern / word in the key logs could have allowed a password to be identified	**6**

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Question	Answer	Marks
4(a)	1 mark for each correct logic gate, with correct inputs:	**4**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(b)</td><td>4 marks for 8 correct outputs
3 marks for 6/7 correct outputs
2 marks for 4/5 correct outputs
1 mark for 2/3 correct outputs

<table>
<tr><th>A</th><th>B</th><th>C</th><th>Working space</th><th>X</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td></td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td></td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td></td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td></td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td></td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td></td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td></td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td></td><td>0</td></tr>
</table></td><td>4</td></tr>
<tr><td>4(c)</td><td>Two from:

– To carry out a logical operation
– To control the flow of electricity through a logic circuit
– An input is given and the logic of the gate is applied to give an output // to alter the output from given inputs</td><td>2</td></tr>
</table>

Question	Answer	Marks
5	– B **Three** from: – Added up the number of 1's / 0's in each register – With the parity bit, two registers have an odd number of 1's / 0's – One register has an even number of 1's / 0's – Odd parity must be the parity used	**4**

Question	Answer	Marks
6(a)	**Four** from: – Screen has two / multiple layers – Visitor presses on top layer – Top layer connects to bottom layer – … creating a circuit – Calculation is carried out on where layers are connected	**4**
6(b)	**Two** from: – Speaker – Headphones – Printer	**2**

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Question	Answer	Marks
6(c)	**Four** from (max. 2 marks per type): **Primary** – Memory that is directly accessed by the CPU – An example is RAM / ROM – RAM stores programs and data that are currently in use and ROM stores boot-up instructions – RAM is volatile and ROM is non volatile **Secondary** – Storage that is not directly accessed by the CPU – An example is HDD / SSD – Stores data / files that can be accessed at a later stage – Non volatile	**4**

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COMPUTER SCIENCE **0478/21**

Paper 1 **May/June 2019**

MARK SCHEME

Maximum Mark: 50

Published

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Question	Answer	Marks
1(a)(i)	Many correct answers, the name must be meaningful. Must relate to **Task 1** 1 mark per bullet point e.g.1 • Array `BusA` • Data type integer • Purpose storing the minutes late e.g.2 • Array `Day` • Data type string • Purpose storing the code for the day of the week	**3**
1(a)(ii)	Many correct answers, the name must be meaningful. Names shown are examples only. 1 mark per bullet point • Task 2 variable name `BusAMinsLate` • Data type real • Purpose used in calculation of average minutes late • Task 3 variable name `SearchDay` • Data type string • Purpose to input the day to be searched for	**6**
1(b)	1 mark for each point: MP1 Conditional statement to identify when a bus is late (punctuality < 0) MP2 Count the number of late days for at least one bus route MP3 Total the late minutes for at least one bus route MP4 Calculation of average minutes late 1 mark for each point (max **three** points): MP5 Initialisation of counting/totalling variables MP6 Iteration through days MP7 Checking all buses… MP8 Count late days and total minutes for all bus routes MP9 Output of number of late arrivals or average minutes late for at least one bus route… MP10 Output complete with all bus routes with late arrivals and average minutes late, with appropriate messages **Example algorithm on next page**	**6**

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Question	Answer	Marks
1(b)	Example algorithm CountA ← 0; CountB ← 0; CountC ← 0; CountD ← 0; CountE ← 0; CountF ← 0 TotalA ← 0; TotalB ← 0; TotalC ← 0; TotalD ← 0; TotalE ← 0; TotalF ← 0 FOR Days ← 0 to 19 IF BusA[Days] < 0 THEN CountA ← CountA + 1 TotalA ← TotalA + BusA[Days] ENDIF IF BusB[Days] < 0 THEN CountB ← CountB + 1 TotalB ← TotalB + BusBA[Days] ENDIF IF BusC[Days] < 0 THEN CountC ← CountC + 1 TotalC ← TotalC + BusC[Days] ENDIF IF BusD[Days] < 0 THEN CountD ← CountD + 1 TotalD ← TotalD + BusD[Days] ENDIF IF BusE[Days] < 0 THEN CountE ← CountE + 1 TotalE ← TotalE + BusE[Days] ENDIF IF BusF[Days] < 0 THEN CountF ← CountF + 1 TotalF ← TotalF + BusF[Days] ENDIF NEXT PRINT "The number of late days for each bus route are: Bus A "CountA", Bus B "CountB", Bus C "CountC", Bus D ", CountD", Bus E ", CountE", Bus F "CountF PRINT "The average number of minutes late for each route are: Bus A "TotalA/20", Bus B "TotalB/20", Bus C "TotalC/20", Bus D ", TotalD/20", Bus E ", TotalE/20", Bus F "TotalF/20	

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Question	Answer	Marks
1(c)	Explanation of how the candidate's program performed the following: **Three** from: MP1 The input stored as a variable MP2 The method used to find the position of the day in the Day array that matches the input MP3 The array index is stored as a variable MP4 The index variable used as the array index for each bus array MP5 …and the contents of each array stored/output.	**3**
1(d)	**Two** from: MP1 Add a user input and prompt to enter the number of **weeks** required to record data on arrival times MP2 Store the user input for number of weeks as a variable MP3 Calculation to change number of weeks to number of days MP4 Replace the upper limit of the loop with a variable MP5 Increase the maximum size of the arrays to accommodate a higher number of weeks	**2**

Question	Answer	Marks
2	Many possible answers, those given are examples only. 1 mark for each correct description and 1 mark for each correct example **Char** Description: A single character (from the keyboard) Example: A / # / 2 **String** Description: An (ordered) sequence of characters Example: Hello world / #123?Y / 234 78963 **Boolean** Description: A data type with two possible values Example: TRUE / FALSE	**6**

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Question	Answer	Marks

3(a)	Many possible answers, those given are examples only.
	1 mark per bullet:
	• IF
	• Condition and outcome
	
	Example answer:
	`IF X < 0`
	`  THEN`
	`  PRINT "Negative"`
	`  ELSE`
	`  PRINT "Not negative"`
	`ENDIF`
	
	OR
	
	1 mark per bullet:
	• CASE
	• Condition and outcome
	
	Example answer:
	`CASE X OF`
	`  1: PRINT ("ONE")`
	`  2: PRINT ("TWO")`
	`  OTHERWISE PRINT ("Less than ONE or more than TWO")`
	`ENDCASE`
		2

3(b)	• To allow different routes through a program • dependent on meeting certain criteria	**2**

Question	Answer	Marks
4(a)	Range check	**1**
4(b)	**Two** from: • The entered number (`Value`) is being checked to see that it is not < 0 or not > 100 • If it is, it is rejected and the user has to enter another number / an error message is displayed • Otherwise the number is accepted, the word 'Accepted' is output along with the `Value`	**2**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(c)</td><td>
<table>
<tr><th>Value</th><th>OUTPUT</th></tr>
<tr><td></td><td>Input a value between 0 and 100 inclusive</td></tr>
<tr><td>200</td><td>Invalid value, try again</td></tr>
<tr><td>300</td><td>Invalid value, try again</td></tr>
<tr><td>–1</td><td>Invalid value, try again</td></tr>
<tr><td>50</td><td>Accepted: 50</td></tr>
<tr><td></td><td></td></tr>
</table>
1 mark – Value column
1 mark – OUTPUT column first line
1 mark – OUTPUT column lines two to five
</td><td>3</td></tr>
</table>

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Question	Answer	Marks
4(d)	 1 mark – Input prompt and input value 1 mark – Correct decision box labelled sufficiently (Yes/No) – allow 2 decision boxes 1 mark – Remaining outputs correct 1 mark – All connecting lines and arrows to be complete and correct 1 mark – Standard flowchart symbols used	**5**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(a)</td><td>Each data value is unique</td><td>1</td></tr>
<tr><td>5(b)</td><td>10 records</td><td>1</td></tr>
<tr><td>5(c)</td><td>Bev07 Lemonade
Bev01 Cola

1 mark for each correct content
1 mark for each correct format
1 mark for correct order</td><td>3</td></tr>
<tr><td>5(d)</td><td>
<table>
<tr><td>Field:</td><td>BevNo</td><td>BevName</td><td>Calories</td><td></td><td></td><td></td></tr>
<tr><td>Table:</td><td>BEVERAGES</td><td>BEVERAGES</td><td>BEVERAGES</td><td></td><td></td><td></td></tr>
<tr><td>Sort:</td><td></td><td>Ascending</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Show:</td><td>☑</td><td>☑</td><td>☐</td><td>☐</td><td>☐</td><td>☐</td></tr>
<tr><td>Criteria:</td><td></td><td></td><td>>45</td><td></td><td></td><td></td></tr>
<tr><td>or:</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

1 mark for correct Field row
1 mark for Table and Sort rows
1 mark for correct Show row
1 mark for correct Criteria rows</td><td>4</td></tr>
</table>

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COMPUTER SCIENCE **0478/22**

Paper 2 **May/June 2019**

MARK SCHEME

Maximum Mark: 50

Published

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Question	Answer	Marks
	Section A	
1(a)	4 marks for: Data Structure(s) **max 2** • Arrays • Variable(s) for // data entry such as reserve price // index / constant for minimum number of items Further description **max 3** • Data type(s) one or more • Use(s) one or more • Name(s) one or more e.g. `Item_Number`, `NumberBids`, `Description`, `Reserve Price` • Sample data for appropriate arrays e.g. 1234, 0, vase, 20.00 // Sample data for variable or constant e.g. 10 1 mark for: • At least four appropriate named arrays with sample data	**5**
1(b)	• Keep a counter/number • Add one every time a new item is added or • Keep a list of numbers used • Using a loop check number is not already in the list before a new item number is added	**2**

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Question	Answer	Marks

1(c)	**Five** from:
	MP1 Enter Buyer Number
	MP2 Check if buyer number valid
	MP3 Enter new bid
	MP4 Check if new bid less than or equal to current highest bid …
	MP5 … if so reject
	MP6 … Otherwise store the bid entered as new highest bid
	MP7 Increase number of bids by one
	MP8 Store Buyer Number
	
	Sample answer
	
	`REPEAT`
	`  PRINT "Enter Buyer Number"`
	`  INPUT BuyerNumber`
	`UNTIL BuyerNumber >= BuyerLow and BuyerNumber <=`
	`BuyerHigh`
	`REPEAT`
	`  PRINT "Enter Bid -99 to exit"`
	`  INPUT Bid`
	`  IF Bid > HighestBid(item)`
	`  THEN`
	`  HighestBid(item) ← Bid`
	`  NumberBids(item) ← NumberBids(item) + 1`
	`  ENDIF`
	`UNTIL Bid > HighestBid(item) OR Bid = -99`
	`IF Bid <> -99`
	`  THEN`
	`  BuyerItem(item) ← BuyerNumber`
	`ENDIF`
	
	There are many possible correct answers, this is an example only.
		5

1(d)	**Three** from: MP1 Using index number of item, to find if any bids for item exist MP2 Using IF/UNTIL/WHILE (statement) to compare new bid with highest/latest bid recorded MP3 Use an assignment (statement) to replace current highest bid, if new bid greater than current highest bid MP4 … else reject bid // using a (REPEAT/WHILE) loop ask for bid to be re-entered MP5 If number of bids / highest bid = zero add bid (provided greater than zero)	**3**

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Question	Answer	Marks
1(e)	Explanation of how the candidate's program performed the following. **Five** from: MP1 Method to search item arrays MP2 Conditional statement used to check for the successful bids MP3 … equal to / greater than reserve price MP4 Method used to calculate 10% percent of successful bid (for each item) MP5 …and add to auction company total fee MP6 Method used to display total fee with a suitable message All programming statements used must be explained.	**5**

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Question	Answer	Marks
	Section B	
2(a)	1 mark for each error identified + suggested correction • `Low ← Count` should be `Low ← Number` • `Number > Low` should be `Number < Low` • `UNTIL Count = 99` should be `UNTIL Count > 99` or `UNTIL Count = 100` or `UNTIL Count >= 100` // `Count ← 1` should be `Count ← 0` • `PRINT "Largest Number is ", Number` should be `PRINT "Largest Number is ", High`	**4**

2(b)	MP1 Add `Total ← 0` // `Total ← Number`
	MP2 Add `Total ← Total + Number`
	MP3 Add `PRINT "Total is ", Total`
	MP4 All positioning explained / seen
	
	`Count ← 1`
	`INPUT Number`
	`High ← Number`
	`Low ← Number`
	`Total ← Number`
	`REPEAT`
	`  INPUT Number`
	`  Total ← Total + Number`
	`  IF Number > High`
	`  THEN`
	`  High ← Number`
	`  ENDIF`
	`  IF Number < Low`
	`  THEN`
	`  Low ← Number`
	`  ENDIF`
	`  Count ← Count + 1`
	`UNTIL Count > 99`
	`PRINT "Largest Number is ", High`
	`PRINT "Smallest Number is ", Low`
	`PRINT "Total is ", Total`
		4

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Question	Answer	Marks
3		4

Total	Count	Distinction	Mark	OUTPUT
0	0	0	50	
50	1	0	70	
120	2	0	65	
185	3	0	30	
215	4	0	95	
310	5	1	50	
360	6	1	55	
415	7	1	85	
500	8	2	65	
565	9	2	35	
600	10		–1	Number of Distinctions 2
				Average Mark 60

1 mark for Total and Count columns both correct.
1 mark for each correct column apart from Total and Count.
If no marks awarded allow 1 mark for initialisation of Total, Count and Distinction, set to zero.

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4</td><td>
<table>
<tr><th>Statements</th><th>Selection</th><th>Repetition</th></tr>
<tr><td><pre>FOR A ← 1 TO 100
   B ← B + 1
NEXT A</pre></td><td></td><td>✓</td></tr>
<tr><td><pre>CASE A OF
   100: B ← A
   200: C ← A
ENDCASE</pre></td><td>✓</td><td></td></tr>
<tr><td><pre>IF A > 100
   THEN
      B ← A
ENDIF</pre></td><td>✓</td><td></td></tr>
<tr><td><pre>REPEAT
   A ← B * 10
UNTIL A > 100</pre></td><td></td><td>✓</td></tr>
</table>
1 mark for each correct row
</td><td>4</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5</td><td>
Validation
Two from:
• automated checking
• checking that data is reasonable / of a certain type
• checking that data meets certain criteria

Example 1 mark
• range check // length check // type check // check digit etc.

Verification
Two from:
• checking that data has not changed…
• … during input to a computer
• … during transfer between computers / devices

Example 1 mark
• double entry // checking against original // visual check // use of checksum etc.
</td><td>6</td></tr>
</table>

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6(a)</td><td>Passengers</td><td>1</td></tr>
<tr><td>6(b)</td><td>Explanation
Three from:
• Flight number not displayed
• Passengers displayed when should not be
• Departure time = not >
• "Freight and passengers" flight not excluded

Revised QBE – answers shown are examples only
1 mark per bullet
• correct field and table names (either 3 or 4 columns) must include Notes, Flight number and Departure time
• correct show
• correct time criteria for the candidate’s QBE grid
• use of criteria to select planes with passengers only

<table>
<tr><td>Field:</td><td>Flight number</td><td>Passengers</td><td>Departure time</td><td>Notes</td></tr>
<tr><td>Table:</td><td>FLIGHT</td><td>FLIGHT</td><td>FLIGHT</td><td>FLIGHT</td></tr>
<tr><td>Sort:</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Show:</td><td>☑</td><td>☐</td><td>☐</td><td>☐</td></tr>
<tr><td>Criteria:</td><td></td><td>=Y</td><td>>10:00</td><td><> "Freight and passengers"</td></tr>
<tr><td>or:</td><td></td><td></td><td></td><td></td></tr>
</table>
OR
<table>
<tr><td>Field:</td><td>Flight number</td><td>Departure time</td><td>Notes</td></tr>
<tr><td>Table:</td><td>FLIGHT</td><td>FLIGHT</td><td>FLIGHT</td></tr>
<tr><td>Sort:</td><td></td><td></td><td></td></tr>
<tr><td>Show:</td><td>☑</td><td>☐</td><td>☐</td></tr>
<tr><td>Criteria:</td><td></td><td>>10:00</td><td>= "Passengers only"</td></tr>
<tr><td>or:</td><td></td><td>>10:00</td><td>="Private passenger flight"</td></tr>
</table>
</td><td>7</td></tr>
</table>

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COMPUTER SCIENCE **0478/23**

Paper 2 **May/June 2019**

MARK SCHEME

Maximum Mark: 50

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the May/June 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
	Section A	
1(a)	4 marks for: Data Structure(s) **max 2** ▯ Arrays ▯ Variable(s) for // data entry such as Item Code // index / constant for minimum number of items Further description **max 3** ▯ Data type(s) one or more ▯ Use(s) one or more ▯ Name(s) one or more e.g. `Item_Code, Description, Price, Stock` ▯ Sample data for appropriate arrays e.g. 1234, Notepad, 0.050, 1000 // Sample data for variable or constant e.g. 10 1 mark for: ▯ All four names and suitable data samples	5
1(b)	▯ Keep a counter/number ▯ Add one every time a new item code is added or ▯ Keep a list of item codes used ▯ Using a loop check item codes is not already in the list before a new item code is added	2
1(c)	▯ Check items in stock array ▯ … with a value of 10 or less ▯ Display these values in a different way e.g. in red	3

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Question	Answer	Marks

1(d)	**Five** from:
	MP1 Enter the item code
	MP2 …and check if valid
	MP3 Enter number to purchase and check if less than or equal to number in stock for that item number
	MP4 Display error message(s) if needed
	MP5 Calculate price to pay
	MP6 Using the number to purchase calculate discount …
	MP7 Check for new customer AND $50 spend/returning customer eligibility …
	MP8 … application of discount(s) if available
	MP9 Check order confirmed …
	MP10 … update appropriate stock level
	
	Sample answer
	`REPEAT`
	`  PRINT "Enter Item Code"`
	`  INPUT ItemCode`
	`  Found ← False`
	`  Count ← 1`
	`  REPEAT`
	`  IF ItemCode = ItemList(Count} THEN Found ← True`
	`ENDIF`
	`  Count ← Count + 1`
	`  UNTIL Found OR Count = NoItems`
	`UNTIL Found`
	`REPEAT`
	`  PRINT "Enter Number to purchase"`
	`  INPUT Number`
	`UNTIL Number > 0 and Number <= Stock(ItemCode)`
	`PriceToPay ← Number * Price (ItemCode)`
	`IF Number >= 10 AND Number < 20 THEN PriceToPay ←`
	`PriceToPay * 0.95 ENDIF`
	`IF Number >= 20 AND Number < 50 THEN PriceToPay ←`
	`PriceToPay * 0.9 ENDIF`
	`IF Number >= 50 AND Number < 100 THEN PriceToPay ←`
	`PriceToPay * 0.75 ENDIF`
	`IF Number >= 100 AND Number < 500 THEN PriceToPay ←`
	`PriceToPay * 0.65 ENDIF`
	`IF Number >= 500 THEN PriceToPay ← PriceToPay * 0.5`
	`ENDIF`
	`PRINT "Enter Value of discount voucher, 0 if no voucher"`
	`INPUT Voucher`
	`PriceToPay ← PriceToPay – Voucher`
	`PRINT "Price to pay is ", PriceToPay`
	`PRINT "Order confirmed? Y/N"`
	`INPUT Confirm`
	`IF Confirm = "Y" THEN Stock(ItemCode) ← Stock(ItemCode)`
	`– Number ENDIF`
		5

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Question	Answer	Marks
1(e)	Explanation **Five** from: MP1 Search item arrays MP2 For stock level = 0 … MP3 … list these as sold out MP4 Check stock level at end of day with original stock level//search items sold arrays MP5 … if the same, display/store item code as not sold//if 0, display/store item code as not sold MP6 … update largest value if greater than existing greatest value … //use max function on items sold array … //other method to find highest number sold … MP7 … display this item number with a suitable message All programming statements used must be explained.	**5**

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Question	Answer	Marks
	Section B	

2(a)	1 mark for each error identified + suggested correction
	
	`Count ← 1` should be `Count ← 0` or `Count >= 500` should be `Count > 500`
	`AND` should be `OR`
	`Reject ← Reject - 1` should be `Reject ← Reject + 1`
	`Reject ← Reject/100` should be `Reject ← Reject/5` or `Reject * 100 / 500`
		4

2(b)	MP1 Add `Accept ← 0` at start
	MP2 Add `ELSE Accept ← Accept + 1` after `THEN` <u>AND</u> `Over` and `Under` defined/position described
	OR
	Add `Accept ← Accept + 1` after `THEN` <u>AND</u> Replace `IF` statement with …`<= Over AND` …`>= UNDER`… /position described
	MP3 Add `Accept ← Accept/5` after `UNTIL` AND correct loop/position described
	MP4 ADD `IF Accept < 50 THEN PRINT "Less than 50% accepted"` at end
	`Accept ← 0`
	`Count ← 1 // 0`
	`Reject ← 0`
	`Over ← 62`
	`Under ← 58`
	`REPEAT`
	`  INPUT ItemWeight`
	`  IF ItemWeight > Over OR ItemWeight < Under // IF ItemWeight <= Over AND`
	`  ItemWeight >= Under`
	`  THEN`
	`  Reject ← Reject + 1`
	`  ELSE`
	`  Accept ← Accept + 1//ELSE` not required
	`  ENDIF`
	`  Count ← Count + 1`
	`UNTIL Count > 500  // >= 500`
	`Accept ← Accept / 5`
	
	`IF Accept < 50`
	`  THEN`
	`  PRINT "Less than 50% accepted"`
	`ENDIF`
		4

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Question	Answer	Marks
3		4

TreadReject	Count	Depth	OUTPUT
0	1		
	2	1.7	
	3	1.9	
1	4	1.4	
	5	1.8	
	6	2.0	
			Car is potentially roadworthy

TreadReject	Count	Depth	OUTPUT
0	1		
1	2	1.2	
	3	1.9	
2	4	1.4	
	5	1.8	
	6	2.4	
			Car is not roadworthy

1 mark for each correct pairs of columns.

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Question	Answer	Marks
4		**4**

Statements	Validation	Verification
Range check	✓	
Double entry		✓
Check digit	✓	
Presence check	✓	

1 mark for each correct row

Question	Answer	Marks
5	• `FOR … TO … NEXT` • fixed number of repetitions • `REPEAT … UNTIL` • always executed // condition tested at end • `WHILE … DO … ENDWHILE` • may not be executed // condition tested at beginning	**6**

Question	Answer	Marks
6(a)	Number is repeated/not unique	**1**
6(b)	**Three** from: Train number not displayed Departure time before 8:30 Criteria of =Y for Platform not required/incorrect All late trains will be shown/the condition should be on the line above 4 marks, one mark for each correct column	**7**

Field:	Train Number	Platform	Departure Time	Status
Table:	TRAIN	TRAIN	TRAIN	TRAIN
Sort:				
Show:	☑	☑	☐	☐
Criteria:			> 08:30	= "Late"
or:				

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COMPUTER SCIENCE **0478/21**

Paper 2 Problem-solving and Programming **May/June 2019**

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In preparation for the examination candidates should attempt the following practical tasks by **writing and testing a program or programs**.

The local high school uses buses to transport students to school. There are six bus routes labelled A to F. You have conducted a survey to analyse the punctuality statistics of these buses over a four-week period. The data from the survey are shown in the table:

	Punctuality table					
Day	**Bus A**	**Bus B**	**Bus C**	**Bus D**	**Bus E**	**Bus F**
Mon1	0	0	2	1	–1	0
Tue1	0	1	0	0	–1	–5
Wed1	0	0	–1	0	–1	–5
Thu1	2	0	–1	0	–2	–5
Fri1	2	1	–2	0	–4	–4
Mon2	4	2	–2	0	–10	–3
Tue2	0	0	–3	0	–2	–5
Wed2	3	0	–1	0	0	0
Thu2	4	0	0	0	0	0
Fri2	–2	0	0	0	0	0
Mon3	–5	1	–2	2	0	0
Tue3	0	0	0	0	1	–2
Wed3	0	0	1	0	2	–3
Thu3	3	0	1	0	–3	1
Fri3	4	2	1	0	1	1
Mon4	–1	0	1	0	1	1
Tue4	8	0	–1	0	3	0
Wed4	1	1	–1	0	–1	0
Thu4	1	0	2	0	0	–2
Fri4	–2	0	–2	0	0	–5

Positive numbers represent minutes early, negative numbers represent minutes late and 0 represents the bus having been on time.

Write and test a program or programs for the local high school.

- Your program or programs must include appropriate prompts for the entry of data; data must be validated on entry.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

Task 1 – Setting up the data storage.
Using arrays set up a system to enable data for each bus route to be entered covering each day of a four-week period. It must be possible to enter the data supplied or your own set of data, using suitable prompts as necessary.

Task 2 – Working out the statistics.
Extend your program so that the following statistics for the four-week period may be calculated and output:
- the number of late arrivals for each bus route
- the average number of minutes late for each bus route
- the bus route with the highest number of days on which it was late
- the average number of minutes late for each bus route, using only data from days on which it was late

All the results should be displayed with appropriate annotation.

Task 3 – Checking specific days.
Extend the program as follows:
- Allow the user to input a specific day, for example Fri3, to be used for analysis of data.
- Find and display how many buses were late on this particular day.
- For each late bus, display the route label and how late the bus was on this particular day.

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COMPUTER SCIENCE **0478/22**

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In preparation for the examination candidates should attempt the following practical tasks by **writing and testing a program or programs**.

An auction company has an interactive auction board at their sale rooms, which allows buyers to place bids at any time during the auction. Before the auction starts, the sellers place their items in the sale room with a unique number attached to each item (item number). The following details about each item need to be set up on the interactive auction board system: item number, number of bids, description and reserve price. The number of bids is initially set to zero.

During the auction, buyers can look at the items in the sale room and then place a bid on the interactive auction board at the sale room. Each buyer is given a unique number for identification (buyer number). All the buyer needs to do is enter their buyer number, the item number and their bid. Their bid must be greater than any existing bids.

At the end of the auction, the company checks all the items and marks those that have bids greater than the reserve as sold. Any items sold will incur a fee of 10% of the final bid to be paid to the auction company.

Write and test a program or programs for the auction company.

- Your program or programs must include appropriate prompts for the entry of data, data must be validated on entry.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

Task 1 – Auction set up.

For every item in the auction the item number, description and the reserve price should be recorded. The number of bids is set to zero. There must be at least 10 items in the auction.

Task 2 – Buyer bids.

A buyer should be able to find an item and view the item number, description and the current highest bid. A buyer can then enter their buyer number and bid, which must be higher than any previously recorded bids. Every time a new bid is recorded the number of bids for that item is increased by one. Buyers can bid for an item many times and they can bid for many items.

Task 3 – At the end of the auction.

Using the results from TASK 2, identify items that have reached their reserve price, mark them as sold, calculate 10% of the final bid as the auction company fee and add this to the total fee for all sold items. Display this total fee. Display the item number and final bid for all the items with bids that have not reached their reserve price. Display the item number of any items that have received no bids. Display the number of items sold, the number of items that did not meet the reserve price and the number of items with no bids.

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COMPUTER SCIENCE **0478/23**

Paper 2 Problem-solving and Programming **May/June 2019**

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In preparation for the examination candidates should attempt the following practical tasks by **writing and testing a program or programs**.

A discount stationery store sells items in bulk at a discount to its customers. Customers can order from a small range of items available on that day. The greater the quantity of an item they buy in one order, the greater the discount for that item.

Quantity of an item	Discount
10	5%
20	10%
50	25%
100	35%
500	50%

In addition to this, new customers can use a $10 voucher, provided their order comes to more than $50. Also, returning customers are given a discount voucher with a monetary value.

Write and test a program or programs for the discount stationery store.

- Your program or programs must include appropriate prompts for the entry of data; data must be validated on entry.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

Task 1 – Stationery available on the day.

Using arrays, set up a list of at least 10 different items available that day. For every item include: item code, description, price and the amount in stock. All item codes must be different. Display the item code, description, price and the amount in stock on the screen.

Task 2 – Customer places an order.

The customer chooses an item code from the list of currently available items. Any items that are out of stock are not displayed and any items that have low stock of 10 or fewer are highlighted. The customer enters the number they wish to purchase. If there are not enough items in stock the number is rejected. The price to pay and any discount is shown on the screen. When the order is complete, any customer discount voucher is applied and the total price is shown. If the customer confirms the order, the stock numbers are then updated.

Task 3 – At the end of the day.

List the item codes of any items that have sold out. Display the item code of any items of which none have been sold. Display the item code and description of the item of which the greatest quantity have been sold today.

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

8226468OTL

COMPUTER SCIENCE **0478/11**

Paper 1 Theory **May/June 2019**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

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At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 75.

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1 Hexadecimal is used for MAC addresses.

Part of a MAC address is given:

97 – 5C – E1

Each pair of digits is stored as binary in an 8-bit register.

(a) Show what the binary register stores for each pair of the given digits.

97								
5C								
E1								

[6]

(b) Explain what is meant by a MAC address.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) Give **two** other examples where hexadecimal can be used.

Example 1 .....

.....

Example 2 .....

.....

[2]

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2 Rajesh creates a logic circuit.

He uses three different logic gates in his circuit. Each logic gate has a maximum of **two** inputs.

He describes the logic of each gate.

(a) "The only time the output will be 1 is when both inputs are 1."

State the single logic gate .....

Draw the single logic gate:

[2]

(b) "The only time the output will be 1 is when both inputs are 0."

State the single logic gate .....

Draw the single logic gate:

[2]

(c) "The only time the output will be 0 is when both inputs are 1."

State the single logic gate .....

Draw the single logic gate:

[2]

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3 **Five** descriptions of different input or output devices are given in the table.

Complete the table by stating the **name** of each input or output device.

Description	Name of device
This is an input device that works by shining a light onto the surface of a document. The light source is automatically moved across the document and the reflected light is captured by mirrors and lenses.	.....
This is an input device where a laser or a light source is moved across an object. The width, height and depth of the object are measured to allow a model to be created.	.....
This is a large input device that is usually fixed to a wall. A user can calibrate the device to make sure the sensors align with a projected image. The user can use either their finger or a special pen to make selections.	.....
This is an output device that uses many small mirrors to reflect light towards a lens. This will display an image.	.....
This is an output device that creates an object by building layer upon layer of material.	.....

[5]

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4 **(a)** Lola is concerned about the risks to her computer when using the Internet.

She wants to use some security methods to help protect her computer from the risks.

Identify a security method she could use for each of the following risks. Each security method must be different.

Describe how each security method will help protect Lola's computer.

(i) Computer virus

Security method .....

Description .....

.....

.....

.....
[3]

(ii) Hacking

Security method .....

Description .....

.....

.....

.....
[3]

(iii) Spyware

Security method .....

Description .....

.....

.....

.....
[3]

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(b) Lola is also concerned that the data she stores could be subject to accidental damage or accidental loss.

(i) State **three** ways that the data Lola stores could be accidentally damaged or accidentally lost.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

(ii) Give **two** methods that Lola could use to help keep her data safe from accidental damage or accidental loss.

1 .....

.....

2 .....

.....

[2]

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5 The following text is stored as a text file:

She sells sea shells on the seashore. The shells that she sells are sea shells I am sure.

Explain how lossless compression would compress this file.

.....

.....

.....

.....

.....

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.....

.....

.....

..... [5]

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6 A law company holds a lot of sensitive data about its clients.

(a) It currently requires employees to enter a username and a password to log-in to an account. Each password must be 8 letters.

The company wants to increase the security of the log-in system.
Identify **two** improvements the company could use to make the log-in system more secure.

Explain how each improvement increases security.

Improvement 1 .....

.....

Explanation .....

.....

.....

Improvement 2 .....

.....

Explanation .....

.....

.....
[4]

(b) The law company wants to purchase a new file server.

The company can purchase a server with either solid state storage or magnetic storage. After discussion, it decides to purchase a file server with magnetic storage.

Explain why the company chose magnetic storage rather than solid state storage.

.....

.....

.....

.....

.....

.....

.....

..... [4]

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(c) The law company also uses optical storage.

Give **three** different examples of optical storage.

1 .....

2 .....

3 .....
[3]

7 Annie writes a paragraph of text as an answer to an examination question about programming languages.

Using the list given, complete Annie's answer by inserting the correct **six** missing terms. Not all terms will be used.

- Assembly
- Converter
- Denary
- Hexadecimal
- High-level language
- Low-level language
- Machine Code
- Source Code
- Syntax
- Translator

The structure of language statements in a computer program is called the

..... . A programming language that uses natural

language statements is called a ..... . When programs

are written in this type of language they need a ..... to

convert them into ..... .

A programming language that is written using mnemonic codes is called a

..... . An example of this type of language is

..... language.
[6]

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8 An art gallery has a website that is used to display and sell art.

(a) The gallery uses Secure Socket Layer (SSL) to provide a secure connection when selling art.

Describe the process of SSL and how it provides a secure connection.

.....

.....

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..... [6]

(b) The art gallery also uses a firewall.

Six statements are given about firewalls.

Tick (✓) to show if the statement is **True** or **False**.

Statement	True (✓)	False (✓)
Firewalls are only available as hardware devices		
Firewalls allow a user to set rules for network traffic		
Firewalls will automatically stop all malicious traffic		
Firewalls only examine traffic entering a network		
Firewalls encrypt all data that is transmitted around a network		
Firewalls can be used to block access to certain websites		

[6]

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(c) The art gallery is concerned about computer ethics relating to its website.

Explain what is meant by computer ethics **and** why the art gallery is concerned about computer ethics.

.....

.....

.....

.....

.....

.....

.....

..... [4]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

5135683263

COMPUTER SCIENCE **0478/12**

Paper 1 Theory **May/June 2019**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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[Turn over

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1 Input and output devices are often connected to a personal computer.

(a) Identify **three** input devices that can be connected to a personal computer.

1 .....

2 .....

3 .....
[3]

(b) Identify **three** output devices that can be connected to a personal computer.

1 .....

2 .....

3 .....
[3]

2 A finance company uses off-line storage to archive their accounts.

(a) Explain what is meant by off-line storage.

.....

.....

.....

..... [2]

(b) The computers in the finance company use both primary and secondary storage.

(i) Give **one** example of primary storage.

..... [1]

(ii) Give **two** examples of secondary storage.

1 .....

2 .....
[2]

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3 Vanessa writes a paragraph as an answer to an examination question about the central processing unit (CPU).

Use the list given to complete Vanessa's answer by inserting the correct **six** missing terms. Not all terms will be used.

- Components
- Data
- Decoded
- Executed
- Fetched
- Instructions
- RAM
- ROM
- Secondary storage

The CPU processes ..... and ..... .

An instruction is ..... from .....

into the CPU where it is then ..... . Once this has taken place the

instruction is then ..... .

[6]

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4 **(a)** Marley wants to store a video he has created for his school project.

He considers using a DVD or a Blu-ray to store the video.

Explain **two** differences between a DVD and a Blu-ray.

1 .....

.....

.....

.....

2 .....

.....

.....

.....

[2]

(b) **(i)** Marley also needs to store ten 8-bit colour images in a file for his project.

Each image is 500 pixels wide and 300 pixels high.

Calculate the total file size in megabytes (MB) for all Marley's images.

Show all your working.

.....

.....

.....

.....

.....

.....

.....

File size ..... **MB**

[3]

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(ii) Marley prints the images for his project using an inkjet printer.

Describe how the inkjet printer prints an image.

.....

.....

.....

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..... [4]

5 A music company wants to send a new music file to many radio stations. It will send the music file the day before the release date so that the radio stations can store the file ready for release.

The music company does not want the radio stations to be able to open the music file until 09:00 on the release date.

Identify **two** security measures **and** describe how each measure can be used to make sure the music file cannot be opened until the release date.

Security measure 1 .....

Description .....

.....

.....

Security measure 2 .....

Description .....

.....

.....
[4]

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6 Priya creates a website to sell her old comic books and superhero figures.

(a) She uses HTML to create her website. The HTML she produces has both structure and presentation.

Explain what is meant by HTML **structure** and **presentation**. Include an **example** of each.

Structure .....

.....

.....

.....

Presentation .....

.....

.....

.....

[4]

(b) Priya uses cookies in her website.

Five statements are given about cookies.

Tick (✓) to show if the statement is **True** or **False**.

Statement	True (✓)	False (✓)
Cookies can be used to store a customer's credit card details		
Cookies can be used to track the items a customer has viewed on a website		
Cookies will corrupt the data on a customer's computer		
Cookies are downloaded onto a customer's computer		
Cookies can be deleted from a customer's computer		

[5]

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(c) Priya stores her website on a webserver.

To transmit the website data to the webserver she uses parallel duplex data transmission.

Describe how data is transmitted using parallel duplex data transmission.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(d) Priya has a URL for her website.

State what is meant by a URL.

.....

..... [1]

(e) Priya is concerned about a denial of service attack (DoS) occurring on her webserver.

(i) Explain what is meant by a denial of service attack.

.....

.....

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.....

.....

..... [4]

(ii) Give **one** security device that can be used to help prevent a denial of service attack.

..... [1]

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7 **(a)** An office has an automated lighting system. When movement is detected in the office the lights are switched on. If movement is not detected for a period of 2 minutes the lights are switched off. The system uses a sensor and a microprocessor.

Describe how the automated lighting system uses a sensor and a microprocessor.

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..... [6]

(b) A microprocessor uses ROM.

Explain what is meant by ROM.

.....

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..... [3]

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8 Consider the logic statement:

X = 1 if ((A is 1 NOR C is 1) AND (B is NOT 1 NOR C is 1)) OR (A is 1 AND B is 1)

(a) Draw a logic circuit to match the given logic statement. Each logic gate used must have a maximum of **two** inputs. Do **not** attempt to simplify the logic statement.

[6]

(b) Complete the truth table for the given logic statement.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

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9 The contents of three binary registers have been transmitted from one computer to another. **Even parity** has been used as an error detection method.

The outcome after transmission is:

Register A and **Register C** have been transmitted **correctly**.

Register B has been transmitted **incorrectly**.

Complete the **Parity bit** for each register to show the given outcome.

	Parity bit							
Register A		0	1	0	0	1	0	1
Register B		1	0	0	0	0	0	1
Register C		1	0	0	0	0	1	1

[3]

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10 Remy has a mobile device that has a capacitive touch screen.

Describe how the capacitive touch screen registers Remy's touch.

.....

.....

.....

.....

.....

.....

.....

..... [4]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/13**

Paper 1 Theory **May/June 2019**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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1 Victoria is building a website for her cake design business.

(a) She uses the hexadecimal colour code #D2E3F5 as the background colour for her website.

The colour code is stored in two 12-bit binary registers.

Show how the code would be stored in the registers.

D2E												
3F5												

[6]

(b) Victoria uses HTML to create her website.

State what is meant by HTML.

.....

..... [1]

(c) The HTML Victoria writes has both structure and presentation.

Five examples are given of structure and presentation.

Tick (✓) to show which example is **Structure** and which is **Presentation**.

Example	Structure (✓)	Presentation (✓)
The colour applied to a text heading on a web page		
The font style applied to a paragraph of text on a web page		
The placement of a paragraph of text on a web page		
The size that an image is set to be displayed at on a web page		
The placement of an image next to a paragraph of text on a web page		

[5]

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(d) Customers will use a web browser to access Victoria's website.

Victoria writes a paragraph of text to explain how the website will be displayed on a customer's computer.

Use the list given to complete Victoria's paragraph by inserting the correct **six** missing terms. Not all terms will be used.

- browser
- domain name
- firewall
- hexadecimal
- HTML
- https
- MAC address
- search engine
- Uniform Resource Locator (URL)
- web server

The user enters the website ..... into the address bar.

The protocol that is used is ..... . The URL contains

the ..... for the website. This is used to look up the

IP address of the company. A DNS server stores an index of IP addresses.

The browser sends a request to the ..... as this is

where the files for the website are stored. The files are sent back to the

..... as ..... files.

This is interpreted by the browser and the web page is displayed.

[6]

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(e) When customers access Victoria's website they will be given the message:

This website uses cookies. An explanation of their purpose can be found in our cookies policy.

(i) Explain what is meant by cookies.

.....

.....

.....

..... [2]

(ii) Explain why Victoria would use cookies as part of her website.

.....

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..... [4]

2 **(a)** A computer can have both a MAC address and an IP address.

Four statements are given about MAC addresses and IP addresses.

Tick (✓) to show whether each statement is **True** or **False**.

Statement	True (✓)	False (✓)
A MAC address is unique to a computer on a network		
Once an IP address has been set it cannot be changed		
A MAC address is made up of the computer's serial number and the IP address		
If a computer does not have an IP address it cannot communicate with another device using the Internet		

[4]

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(b) A computer uses the Von Neumann model and the stored program concept.

(i) Explain what is meant by the stored program concept.

.....

.....

.....

..... [2]

(ii) The Von Neumann model has several components that are used in the fetch-execute cycle.

One component is the Arithmetic Logic Unit (ALU).

Describe the role of the ALU.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) The computer has an operating system.

(i) A signal causes the operating system to stop and assess what to do next.

Identify the name of this signal.

..... [1]

(ii) State **two** functions of an operating system.

1 .....

2 .....
[2]

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3 A finance company is concerned that its employees are being distracted by using gaming websites at work.

(a) Explain how a firewall could help prevent this distraction.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) The finance company is also worried about the security of the data stored on its servers.

The company has decided to encrypt the data to improve the security.

Describe how the data are encrypted.

.....

.....

.....

.....

.....

.....

.....

..... [4]

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(c) The finance company realises that its computer systems have been hacked.

The company thinks that spyware was used to obtain a user's password.

Explain how spyware could have been used to obtain the user's password.

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..... [6]

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4 Consider the given logic circuit:

(a) Redraw the logic circuit using only 4 logic gates. Each logic gate used must have a maximum of **two** inputs.

[4]

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(b) Complete the truth table for the **given** logic circuit.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

(c) Describe the purpose of a logic gate in a logic circuit.

.....

.....

.....

..... [2]

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5 The three binary numbers in the registers given have been transmitted from one computer to another.

One binary number has been transmitted incorrectly. This can be identified by the use of a **Parity bit**.

Identify the binary number that has been transmitted **incorrectly**. Explain how you identified the incorrect binary number.

	Parity bit							
Register A	1	0	1	1	1	0	0	1
Register B	1	1	1	0	0	1	1	1
Register C	1	0	0	1	1	0	1	1

The binary number that has been transmitted incorrectly is in **Register** .....

Explanation .....

.....

.....

.....

.....

..... [4]

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6 A museum has an information point.

Visitors to the museum can use the information point to plan their visit to the museum.

The information point allows visitors to access the information using a resistive touch screen.

Visitors can either listen to the information or read it on the screen. They can also select to output a paper copy of the information they require.

(a) Describe how the resistive touch screen registers the visitor's touch.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) The information point has a screen to allow visitors to read information.

Identify **two** other output devices that are present in the information point.

Output device 1 .....

Output device 2 .....
[2]

(c) The information point uses both primary and secondary storage.

Explain what is meant by primary and secondary storage.

Primary .....

.....

.....

.....

Secondary .....

.....

.....

.....
[4]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

2509236395

COMPUTER SCIENCE **0478/21**

Paper 2 Problem-solving and Programming **May/June 2019**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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Answer **all** questions.

DO NOT ATTEMPT TASKS 1, 2 AND 3 in the pre-release material; these are for information only.

You are advised to spend no more than **40 minutes** on **Section A** (Question 1).

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Section A

You are advised to spend no longer than 40 minutes answering this section.

Here is a copy of the pre-release material.

DO NOT attempt Tasks 1, 2 and 3 now.

Use the pre-release material and your experience from attempting the tasks before the examination to answer Question 1.

Pre-release material

The local high school uses buses to transport students to school. There are six bus routes labelled A to F. You have conducted a survey to analyse the punctuality statistics of these buses over a four-week period. The data from the survey are shown in the table:

	Punctuality table					
Day	**Bus A**	**Bus B**	**Bus C**	**Bus D**	**Bus E**	**Bus F**
Mon1	0	0	2	1	–1	0
Tue1	0	1	0	0	–1	–5
Wed1	0	0	–1	0	–1	–5
Thu1	2	0	–1	0	–2	–5
Fri1	2	1	–2	0	–4	–4
Mon2	4	2	–2	0	–10	–3
Tue2	0	0	–3	0	–2	–5
Wed2	3	0	–1	0	0	0
Thu2	4	0	0	0	0	0
Fri2	–2	0	0	0	0	0
Mon3	–5	1	–2	2	0	0
Tue3	0	0	0	0	1	–2
Wed3	0	0	1	0	2	–3
Thu3	3	0	1	0	–3	1
Fri3	4	2	1	0	1	1
Mon4	–1	0	1	0	1	1
Tue4	8	0	–1	0	3	0
Wed4	1	1	–1	0	–1	0
Thu4	1	0	2	0	0	–2
Fri4	–2	0	–2	0	0	–5

Positive numbers represent minutes early, negative numbers represent minutes late and 0 represents the bus having been on time.

Write and test a program or programs for the local high school.

- Your program or programs must include appropriate prompts for the entry of data; data must be validated on entry.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

Task 1 – Setting up the data storage.
Using arrays set up a system to enable data for each bus route to be entered covering each day of a four-week period. It must be possible to enter the data supplied or your own set of data, using suitable prompts as necessary.

Task 2 – Working out the statistics.
Extend your program so that the following statistics for the four-week period may be calculated and output:
- the number of late arrivals for each bus route
- the average number of minutes late for each bus route
- the bus route with the highest number of days on which it was late
- the average number of minutes late for each bus route, using only data from days on which it was late

All the results should be displayed with appropriate annotation.

Task 3 – Checking specific days.
Extend the program as follows:
- Allow the user to input a specific day, for example Fri3, to be used for analysis of data.
- Find and display how many buses were late on this particular day.
- For each late bus, display the route label and how late the bus was on this particular day.

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1 **(a)** All variables, constants and other identifiers must have meaningful names.

(i) State **one** array you used for **Task 1**. State the data type and purpose of this array.

Array .....

Data type .....

Purpose .....

.....

.....
[3]

(ii) State **one** variable you used for **Task 2** and **one** variable you used for **Task 3**. In each case, state the data type and purpose of the variable.

Task 2 variable name .....

Data type .....

Purpose .....

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.....

Task 3 variable name .....

Data type .....

Purpose .....

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[6]

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(b) Write an algorithm to show how you calculated and output the number of late arrivals and the average number of minutes late for each bus route (part of **Task 2**), using **either** pseudocode, programming statements **or** a flowchart.

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(c) Explain how your program uses the input in **Task 3** to only find the data for that specific day (part of Task 3). Any programming statements used in your answer must be fully explained.

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(d) Explain how you would alter your program in **Task 1** to allow you to choose the number of weeks to enter data on bus arrival times.

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..... [2]

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Section B

2 Describe each of the following data types used in programming. In each case, give an example of a piece of data to illustrate your answer. Each example must be different.

Char

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String

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Boolean

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[6]

3 **(a)** Give an example of a conditional statement using pseudocode.

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..... [2]

(b) Describe the purpose of a conditional statement.

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..... [2]

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Question 4 starts on page 10.

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4 This section of program code may be used as a validation check.

```
PRINT "Input a value between 0 and 100 inclusive"
INPUT Value
WHILE Value < 0 OR Value > 100
  PRINT "Invalid value, try again"
  INPUT Value
ENDWHILE
PRINT "Accepted: ", Value
```

(a) Give a name for this type of validation check.

..... [1]

(b) Describe what is happening in this validation check.

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..... [2]

(c) Complete the trace table for this program code using the test data: 200, 300, –1, 50, 60

Value	OUTPUT

[3]

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(d) Draw a flowchart to represent this section of program code.

[5]

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5 The table, BEVERAGES, shows the number of calories in 100 ml of a range of popular beverages. It also shows the availability of these drinks in a can, a small bottle and a large bottle.

BevNo	BevName	Calories	Can	Small Bottle	Large Bottle
Bev01	Cola	40	Yes	Yes	Yes
Bev02	Lime	45	Yes	No	Yes
Bev03	Energy Drink 1	52	Yes	Yes	No
Bev04	Energy Drink 2	43	Yes	No	No
Bev05	Mango	47	Yes	No	Yes
Bev06	Lemon Iced Tea	38	Yes	No	Yes
Bev07	Lemonade	58	Yes	Yes	Yes
Bev08	Orange Juice	46	Yes	Yes	No
Bev12	Apple Juice	50	Yes	Yes	No
Bev15	Chocolate Milk	83	Yes	Yes	No

(a) Give a reason for choosing BevNo as the primary key for this table.

.....

..... [1]

(b) State the number of records shown in the table BEVERAGES.

..... [1]

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(c) List the output that would be given by this query-by-example.

Field:	BevNo	BevName	Can	Small Bottle	Large Bottle	
Table:	BEVERAGES	BEVERAGES	BEVERAGES	BEVERAGES	BEVERAGES	
Sort:		Descending				
Show:	☑	☑	☐	☐	☐	☐
Criteria:			= "Yes"	= "Yes"	= "Yes"	
or:						

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..... [3]

(d) Complete the query-by-example grid to output a list showing just the names and primary keys of all the beverages with a calorie count greater than 45. The list should be in alphabetical order of names.

Field:						
Table:						
Sort:						
Show:	☐	☐	☐	☐	☐	☐
Criteria:						
or:						

[4]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/22**

Paper 2 Problem-solving and Programming **May/June 2019**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

DO NOT ATTEMPT TASKS 1, 2 AND 3 in the pre-release material; these are for information only.

You are advised to spend no more than **40 minutes** on **Section A** (Question 1).

No marks will be awarded for using brand names of software packages or hardware.

Any businesses described in this paper are entirely fictitious.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 50.

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Section A

You are advised to spend no longer than 40 minutes answering this section.

Here is a copy of the pre-release material.

DO NOT attempt Tasks 1, 2 and 3 now.

Use the pre-release material and your experience from attempting the tasks before the examination to answer Question 1.

Pre-release material

An auction company has an interactive auction board at their sale rooms, which allows buyers to place bids at any time during the auction. Before the auction starts, the sellers place their items in the sale room with a unique number attached to each item (item number). The following details about each item need to be set up on the interactive auction board system: item number, number of bids, description and reserve price. The number of bids is initially set to zero.

During the auction, buyers can look at the items in the sale room and then place a bid on the interactive auction board at the sale room. Each buyer is given a unique number for identification (buyer number). All the buyer needs to do is enter their buyer number, the item number and their bid. Their bid must be greater than any existing bids.

At the end of the auction, the company checks all the items and marks those that have bids greater than the reserve as sold. Any items sold will incur a fee of 10% of the final bid to be paid to the auction company.

Write and test a program or programs for the auction company.

- Your program or programs must include appropriate prompts for the entry of data, data must be validated on entry.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

Task 1 – Auction set up.

For every item in the auction the item number, description and the reserve price should be recorded. The number of bids is set to zero. There must be at least 10 items in the auction.

Task 2 – Buyer bids.

A buyer should be able to find an item and view the item number, description and the current highest bid. A buyer can then enter their buyer number and bid, which must be higher than any previously recorded bids. Every time a new bid is recorded the number of bids for that item is increased by one. Buyers can bid for an item many times and they can bid for many items.

Task 3 – At the end of the auction.

Using the results from TASK 2, identify items that have reached their reserve price, mark them as sold, calculate 10% of the final bid as the auction company fee and add this to the total fee for all sold items. Display this total fee. Display the item number and final bid for all the items with bids that have not reached their reserve price. Display the item number of any items that have received no bids. Display the number of items sold, the number of items that did not meet the reserve price and the number of items with no bids.

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1 **(a)** All variables, constants and other identifiers must have meaningful names.

Describe the data structures you have used in **Task 1** to record the items for sale. Include some sample data for each data structure you have described.

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(b) Explain how your program for **Task 1** ensures the item number is unique.

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..... [2]

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(c) Write an algorithm for the part of **Task 2** that allows the buyer to add a new bid, using **either** pseudocode, programming statements **or** a flowchart. Assume that **Task 1** has been completed and that the item details have already been found.

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(d) Explain how your program for **Task 2** checks that a new bid is higher than previous bids for an item.

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..... [3]

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(e) Explain how your program identifies the items that have reached their reserve price, then calculates and displays the total auction company fee for all sold items as part of **Task 3**. Any programming statements used in your answer must be fully explained.

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Section B

2 **(a)** An algorithm has been written in pseudocode to input 100 numbers, select and print the largest number and smallest number.

```
Count ← 1
INPUT Number
High ← Number
Low ← Count
REPEAT
  INPUT Number
  IF Number > High
    THEN
      High ← Number
  ENDIF
  IF Number > Low
    THEN
      Low ← Number
  ENDIF
  Count ← Count + 1
UNTIL Count > 99
PRINT "Largest Number is ", Number
PRINT "Smallest Number is ", Low
```

Find the **four** errors in the pseudocode and suggest a correction for each error.

Error 1 .....

Correction .....

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Error 2 .....

Correction .....

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Error 3 .....

Correction .....

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Error 4 .....

Correction .....

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[4]

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(b) Show how you would change the corrected algorithm to total the numbers and print the total. Use a variable `Total`.

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..... [4]

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3 This flowchart inputs the marks gained in an examination. An input of –1 ends the routine.

Complete the trace table for the mark input data: 50, 70, 65, 30, 95, 50, 55, 85, 65, 35, –1, 45

Total	Count	Distinction	Mark	**OUTPUT**

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[4]

4 For each of the **four** groups of statements in the table, place a tick in the correct column to show whether it is an example of **Selection** or **Repetition**.

Statements	Selection	Repetition

`FOR A ← 1 TO 100`
`  B ← B + 1`
`NEXT A`		

`CASE A OF`
`  100: B ← A`
`  200: C ← A`
`ENDCASE`		

`IF A > 100`
`THEN`
`  B ← A`
`ENDIF`		

`REPEAT`
`  A ← B * 10`
`UNTIL A > 100`		

[4]

5 Explain what is meant by **validation** and **verification**.
Give an example for each one.

Validation .....

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Example .....

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Verification .....

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Example .....

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[6]

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6 A database table, FLIGHT, is used to keep a record of flights from a small airfield. Planes can carry passengers, freight or both. Some flights are marked as private and only carry passengers.

Flight number	Plane	Notes	Departure time	Passengers
FN101	Caravan 1	Private passenger flight	08:00	Y
CN101	Caravan 2	Freight only	08:30	N
CN102	Piper 1	Freight only	09:00	N
FN104	Piper 2	Passengers only	09:20	Y
FN105	Piper 1	Freight and passengers	10:00	Y
FN106	Caravan 1	Passengers only	10:30	Y
CN108	Caravan 2	Freight only	08:00	N
CN110	Lear	Private passenger flight	08:00	Y

(a) State the field that could have a Boolean data type.

Field ..... [1]

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(b) A query-by-example has been written to display just the flight numbers of all planes leaving after 10:00 that only carry passengers.

Field:	Flight number	Passengers	Departure time	
Table:	FLIGHT	FLIGHT	FLIGHT	
Sort:				
Show:	☐	☑	☐	☐
Criteria:		= Y	= 10:00	
or:				

Explain why the query-by-example is incorrect, and write a correct query-by-example.

Explanation .....

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Field:				
Table:				
Sort:				
Show:	☐	☐	☐	☐
Criteria:				
or:				

[7]

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CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/23**

Paper 2 Problem-solving and Programming **May/June 2019**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

DO NOT ATTEMPT TASKS 1, 2 AND 3 in the pre-release material; these are for information only.

You are advised to spend no more than **40 minutes** on **Section A** (Question 1).

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Section A

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Here is a copy of the pre-release material.

DO NOT attempt Tasks 1, 2 and 3 now.

Use the pre-release material and your experience from attempting the tasks before the examination to answer Question 1.

Pre-release Material

A discount stationery store sells items in bulk at a discount to its customers. Customers can order from a small range of items available on that day. The greater the quantity of an item they buy in one order, the greater the discount for that item.

Quantity of an item	Discount
10	5%
20	10%
50	25%
100	35%
500	50%

In addition to this, new customers can use a $10 voucher, provided their order comes to more than $50. Also, returning customers are given a discount voucher with a monetary value.

Write and test a program or programs for the discount stationery store.

- Your program or programs must include appropriate prompts for the entry of data; data must be validated on entry.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

Task 1 – Stationery available on the day.

Using arrays, set up a list of at least 10 different items available that day. For every item include: item code, description, price and the amount in stock. All item codes must be different. Display the item code, description, price and the amount in stock on the screen.

Task 2 – Customer places an order.

The customer chooses an item code from the list of currently available items. Any items that are out of stock are not displayed and any items that have low stock of 10 or fewer are highlighted. The customer enters the number they wish to purchase. If there are not enough items in stock the number is rejected. The price to pay and any discount is shown on the screen. When the order is complete, any customer discount voucher is applied and the total price is shown. If the customer confirms the order, the stock numbers are then updated.

Task 3 – At the end of the day.

List the item codes of any items that have sold out. Display the item code of any items of which none have been sold. Display the item code and description of the item of which the greatest quantity have been sold today.

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1 **(a)** All variables, constants and other identifiers must have meaningful names.

Describe the data structures you have used in **Task 1** to record the items available that day. Include some sample data for each data structure you have described.

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(b) Explain how your program for **Task 1** ensures all the item codes are different.

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..... [2]

(c) Explain how your program for **Task 2** highlights items where the stock level is low.

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..... [3]

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(d) Write an algorithm for **Task 2** using **either** pseudocode, programming statements **or** a flowchart. Assume that **Task 1** has been completed and the list of items currently available has already been displayed.

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[5]

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(e) Explain how your program completes **Task 3**. Any programming statements used in your answer must be fully explained.

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Question 2 begins on page 8.

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Section B

2 **(a)** An algorithm has been written in pseudocode to input the weight of 500 items and reject any that are over-weight or under-weight, then print the percentage rejected.

```
Count ← 1
Reject ← 0
Over ← 62
Under ← 58
REPEAT
  INPUT ItemWeight
  IF ItemWeight > Over AND ItemWeight < Under
    THEN
      Reject ← Reject - 1
  ENDIF
  Count ← Count + 1
UNTIL Count > = 500
Reject ← Reject / 100
PRINT "Percentage rejected is ", Reject
```

Find the **four** errors in the pseudocode and suggest a correction for each error.

Error 1 .....

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Correction .....

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Error 2 .....

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Correction .....

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Error 3 .....

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Correction .....

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Error 4 .....

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Correction .....

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[4]

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(b) Describe how you would change the corrected algorithm to calculate the number accepted instead of rejected, using a variable `Accept`, and print a warning if fewer than 50% are accepted.

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..... [4]

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3 This flowchart inputs the tread depth of five tyres, four on the car and a spare tyre. Any tread depth of 1.6 mm or less is rejected. To be potentially roadworthy, a car must have four tyres with a tread depth greater than 1.6 mm.

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Complete Trace table 1 for the tread depth input data:
1.7, 1.9, 1.4, 1.8, 2.0

TreadReject	Count	Depth	OUTPUT

Trace table 1

Complete Trace table 2 for the tread depth input data:
1.2, 1.9, 1.4, 1.8, 2.4

TreadReject	Count	Depth	OUTPUT

Trace table 2

[4]

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4 For each of the **four** checks in the table, place a tick in the correct column to show whether it is an example of a **validation** or **verification** check.

Statements	**Validation**	**Verification**
Range check		
Double entry		
Check digit		
Presence check		

[4]

5 Identify and describe **three** loop structures that are available in pseudocode.

Loop structure 1 .....

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Description .....

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Loop structure 2 .....

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Description .....

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Loop structure 3 .....

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Description .....

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[6]

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Question 6 begins on page 14.

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6 A database table, TRAIN, is used to keep a record of train departures from a station.

Train Number	Platform	Destination	Departure Time	Status
1A37	1	Newtown	08:00	On time
2X19	2	Anytown	08:10	Late
1A29	1	Bigcity	08:15	On time
1A28	2	Anytown	08:30	Cancelled
1A67	3	Gardenvillage	08:45	On time
1A37	1	Newtown	08:50	On time
1A24	2	Charter Train	09:00	Late
1A67	3	Gardenvillage	09:15	On time

(a) Explain why the field **Train Number** could not be used as a primary key.

.....

..... [1]

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(b) A query-by-example has been written to display only the train numbers and platforms of all trains leaving after 08:30 that are late.

Field:	Train Number	Platform	Departure Time	Status
Table:	TRAIN	TRAIN	TRAIN	TRAIN
Sort:				
Show:	☐	☑	☐	☐
Criteria:		= Y	< 08:30	
or:				= "Late"

Explain why the query-by-example is incorrect, and write a correct query-by-example.

Explanation .....

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Field:				
Table:				
Sort:				
Show:	☐	☐	☐	☐
Criteria:				
or:				

[7]

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Grade thresholds – November 2019

Cambridge IGCSE™ Computer Science (0478)

Grade thresholds taken for Syllabus 0478 (Computer Science) in the November 2019 examination.

		minimum raw mark required for grade:						
	maximum raw mark available	A	B	C	D	E	F	G
Component 11	75	54	46	37	29	22	15	8
Component 12	75	42	34	26	22	18	14	10
Component 13	75	57	49	40	32	25	18	11
Component 21	50	36	28	21	17	13	9	5
Component 22	50	35	27	20	16	12	8	4
Component 23	50	35	27	20	16	12	8	4

Grade A* does not exist at the level of an individual component.

The maximum total mark for this syllabus, after weighting has been applied, is **125**.

The overall thresholds for the different grades were set as follows.

Option	Combination of Components	A*	A	B	C	D	E	F	G
AX	11, 21	106	90	74	58	46	35	24	13
AY	12, 22	93	77	61	46	38	30	22	14
AZ	13, 23	108	92	76	60	48	37	26	15

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COMPUTER SCIENCE **0478/11**

Paper 1 **October/November 2019**

MARK SCHEME

Maximum Mark: 75

Published

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

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Question	Answer	Marks
1(a)	**Printer** **Statement** **One** mark for correct lines from inkjet **One** mark for correct lines from laser	**2**
1(b)	• Laser	**1**
1(c)	**Two** from: • Design is created on the computer / software / CAD • Material is loaded to cutter • Different types of material can be used • Uses lasers to cut material … • … that use infra-red • … that produces extreme heat • … that is focussed using a special lens • Can work on both the *x*,*y* and *z* axis	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>One mark for each correct denary value

<table><tr><th>Binary</th><th>Denary</th></tr><tr><td>0001001110</td><td>78</td></tr><tr><td>0110110111</td><td>439</td></tr><tr><td>1000000001</td><td>513</td></tr></table></td><td>3</td></tr>
<tr><td>2(b)</td><td>Two from:
• Uses fewer characters // shorter
• Easier to read / write / understand
• Less likely to make mistakes // less error prone
• Easier to debug</td><td>2</td></tr>
<tr><td>2(c)</td><td>One mark for each correct hexadecimal value in correct order
2 B 5</td><td>3</td></tr>
</table>

Question	Answer	Marks
3(a)	**Three** from: • Malicious software // type of malware • Tracks / records keypresses // keylogger • Sends data to third party • Collected data is analysed to obtain data	**3**
3(b)	**One** mark for identified method, **one** mark for how it prevents spyware: **Drop-down boxes // onscreen / virtual keyboard** • Means key logger cannot collect data **Only requires part of the password** • Hacker doesn't get the full password **Two-step verification // Two-factor authentication** • Extra data is sent to device making it more difficult for hacker to obtain it • Data has to be entered into the same system // if attempted from a remote location, it will not be accepted **Use a biometric device** • The person's biological data (e.g. their fingerprint) is also required	**2**
3(c)	**Four** from: • Monitors traffic coming into and out of the computer system • Checks that the traffic meets any criteria / rules set • Blocks any traffic that does not meet the criteria / rules set • Allows a set blacklist / whitelist // can block certain IP addresses • Can close certain ports	**4**
3(d)	**Two** from: • Passwords // biometrics • Levels of access • Proxy servers • Physical security methods – e.g. PC's in locked rooms, etc.	**2**

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Question	Answer	Marks
4(a)	**One** from: • Touch screen • Keyboard • Microphone • Mouse	**1**
4(b)	**One** from: • Headphones • Speakers • Printer • Light / LED	**1**
4(c)	**One** from: • HDD • SSD • USB drive	**1**
4(d)	**Four** from: • QR code is scanned using a camera on a mobile device … • … and read / decoded using an application / software • Illuminator shone on code • Squares reflect light differently • Corners of code are used for orientation • Opens document with information // Directs to website with information • QR code can be saved for future reference	**4**

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Question	Answer	Marks
5(a)	• Data is sent down a single wire … • … one bit at a time • Data is sent in both directions … • … but only one direction at a time	**4**
5(b)	**One** mark for correct byte (Byte) 2 // 01010100 **Three** from: • Added up / counted the 1s / 0s • Even parity used // 3 bytes are even • Byte 2 uses odd parity // 1 byte is odd	**4**

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Question	Answer	Marks
6(a)(i)	**One** from: • Code will run without the need of an interpreter • (Object) Code is platform independent • Source code not available / cannot be modified	**1**
6(a)(ii)	**One** from: • Source code not available / cannot be modified • Comments, etc. not visible • Future changes will require code to be recompiled	**1**
6(b)(i)	**One** from: • Protocol is HTTPS • Padlock icon is locked • Can view website certificate	**1**
6(b)(ii)	**Five** from: • Browser / client sends request to webserver to request identification • Web server sends its digital / security certificate • Browser authenticates certificate … • … if authentic connection, is established • Any data sent is encrypted … • … using public and private keys	**5**
6(c)	**Four** from: • A type of software licence • Free of charge • Normally distributed without the source code • Can legally share / copy • Cannot legally modify code • Cannot resell	**4**

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Question	Answer	Marks
6(d)(i)	**Two** from: • File size is reduced … • … so it uses less storage space • … so faster transmission • … so quicker to download	**2**
6(d)(ii)	• Lossless	**1**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>7(a)</td><td>
<table>
<tr><th>Input A</th><th>Input B</th><th>Output</th></tr>
<tr><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>1</td></tr>
</table>
</td><td>1</td></tr>
<tr><td>7(b)</td><td>• Exclusive OR / XOR / EOR</td><td>1</td></tr>
<tr><td>7(c)</td><td>One mark for each correct logic gate with correct inputs
</td><td>5</td></tr>
<tr><td>7(d)</td><td>Two from:
• Can work continuously
• Avoids human error
• It could be a dangerous environment and will avoid human risk
• Detect errors instantly
• Maintain consistent and correct conditions</td><td>2</td></tr>
</table>

Question	Answer	Marks
8	**Six** from: • PC holds address of the instruction • The address held in PC is sent to MAR … • … using address bus • MAR goes to location in memory where instruction is stored • Instruction sent to MDR … • … using data bus • Instruction sent to CIR • Control unit sends signals to manage the process … • … using the control bus	**6**
9(a)	**Two** from: • Layout of the webpage • e.g. where a paragraph is placed • Defined using tags	**2**
9(b)	**One** mark for each correct term in the correct order: • browser • IP address • web server • HTML	**4**

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Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

COMPUTER SCIENCE **0478/12**

Paper 1 **October/November 2019**

MARK SCHEME

Maximum Mark: 75

Published

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This document consists of **15** printed pages.

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1</td><td>One mark for each correct tick
<table>
<tr><th>Statement</th><th>True (✓)</th><th>False (✓)</th></tr>
<tr><td>25 kB is larger than 100 MB</td><td></td><td>✓</td></tr>
<tr><td>999 MB is larger than 50 GB</td><td></td><td>✓</td></tr>
<tr><td>3500 kB is smaller than 2 GB</td><td>✓</td><td></td></tr>
<tr><td>2350 bytes is smaller than 2 kB</td><td></td><td>✓</td></tr>
</table></td><td>4</td></tr>
</table>

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Question	Answer	Marks
2	**Four** from: • Arithmetic and logic unit (ALU) • Memory address register (MAR) • Memory data register (MDR) // Memory buffer register (MBR) • Accumulator (ACC) • Immediate Access Store (IAS) • Main memory // RAM • Program counter (PC) • Current instruction register (CIR) • Address bus • Data bus • Control bus • Input device • Output device • Secondary storage device	**4**

Question	Answer	Marks
3(a)	**One** from: • Continuous data // by description • Non-discrete data // by description • By example, e.g. data such as a sound wave	**1**
3(b)	**One** from: • Discrete data that has only two values • By example, e.g. binary data / 1's and 0's	**1**

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Question	Answer	Marks
4(a)	• 52	**1**
4(b)	1 1 0 1 0 0 0 0	**1**
4(c)	• It is multiplied by 4	**1**

Question	Answer	Marks
5(a)	**Four** from: • A compression algorithm is used • Discards any unnecessary sounds … • … using perceptual musical shaping • … such as removing background noise / sounds humans can't hear // or other suitable example • Reduces sample size / resolution // by example • Reduces sample rate // by example • Sound is clipped • The data is permanently removed	**4**
5(b)(i)	**One** from: • The file size will be smaller than lossless • Requires less storage space • Requires less time to transmit	**1**
5(b)(ii)	**One** from: • The quality of the sound will be reduced • The original file cannot be restored	**1**

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Question	Answer	Marks
5(c)(i)	**Four** from: • Musical Instrument Digital Interface file • Stores a set of commands / instructions for how the sound should be played • Does not store the actual sounds • Data in the file has been recorded using digital instruments • Specifies pitch of the note // specifies the note to be played • Specifies when each note plays and stops playing // Specifies key on/off • Specifies duration of the note • Specifies volume of the note • Specifies the tempo • Specifies the type of instrument	**4**
5(c)(ii)	**Four** from: • It uses a single wire … • … therefore, it is cheaper to manufacture / buy / install • … therefore, less likely to have interference // no crosstalk • … therefore, can be used over longer distances • Data is sent a bit at a time … • … therefore, less chance of data being skewed // data is received in order • Transmission can be synchronised … • … can reduce rate of errors	**4**

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Question	Answer	Marks
6	**One** mark for each correct tick	**6**

Statement	Resistive (✓)	Capacitive (✓)
This touch screen has multi-touch capabilities		✓
This touch screen cannot be used whilst wearing gloves		✓
This touch screen is made up of two layers with a small space in between	✓	
This touch screen uses the electrical properties of the human body		✓
This touch screen is normally cheaper to manufacture	✓	
This touch screen has a quicker response time		✓

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Question	Answer	Marks
7(a)	**Four** from: • Membrane / matrix / circuit board present at base of keys • A key is pressed that presses a switch • When a key is pressed it completes a circuit // changes the current in a circuit • The location of the keypress is calculated • An index of characters is searched to find the corresponding keypress • Each character has an ASCII / Unicode value • The ASCII / Unicode value has a binary value • Keypress generates an interrupt • Each character / keypress is added to a buffer to wait to be processed • The binary can then be processed by the CPU to action the key press	**4**
7(b)	**Three** from: • Display a web page • Sends a request to the web server • Receives data from web server • Translates HTML files • Processes client-side script, e.g. JavaScript • Store favourites • Store history • Navigation forward and backward • Check security • Store / access cookies • Find specific text within a web page • Downloading file from the web • Allows a homepage • Allows multiple tabs / web pages to be opened • Stores data in its cache	**3**

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Question	Answer	Marks
7(c)	**Three** from: • Hypertext Transfer Protocol Secure // It is a protocol … • … that is a set of rules/standards • Secure version of HTTP • Secure website // secures data • Uses TLS / SSL • Uses encryption	**3**

Question	Answer	Marks
8(a)	• X = 1 if (A is 1 XOR C is 1) OR (B is 1 NAND C is NOT 1) • X = (A XOR C) OR (B NAND NOTC) **One** mark for each bullet: • (A XOR C) • OR • (B NAND NOTC)	**3**

Question	Answer	Marks
8(b)	**Four** marks for 8 correct outputs **Three** marks for 6 or 7 correct outputs **Two** marks for 4 or 5 correct outputs **One** mark for 2 or 3 correct outputs	**4**

A	B	C	Working space	X
0	0	0		**1**
0	0	1		**1**
0	1	0		**0**
0	1	1		**1**
1	0	0		**1**
1	0	1		**1**
1	1	0		**1**
1	1	1		**1**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>9(a)</td><td>One mark per each correct tick
<table>
<tr><th>Statement</th><th>True (✓)</th><th>False (✓)</th></tr>
<tr><td>Duplex data transmission can be either serial or parallel</td><td>✓</td><td></td></tr>
<tr><td>Duplex data transmission is when data is transmitted both ways, but only one way at a time</td><td></td><td>✓</td></tr>
<tr><td>Duplex data transmission is always used to connect a device to a computer</td><td></td><td>✓</td></tr>
<tr><td>Duplex data transmission is when data is transmitted both ways at the same time</td><td>✓</td><td></td></tr>
<tr><td>Duplex data transmission automatically detects any errors in data</td><td></td><td>✓</td></tr>
</table></td><td>5</td></tr>
<tr><td>9(b)</td><td>• Parallel data transmission</td><td>1</td></tr>
</table>

Question	Answer	Marks
9(c)	**Four** from (maximum two marks per benefit): • It is a universal standard … • … so it is likely to be compatible with the computer • It can only be inserted one way … • … so there is less chance of connecting a device incorrectly • It is a high-speed connection … • … so data will be transmitted quicker • It uses serial transmission … • … so it is cheaper to manufacture/buy • … less chance of skewing / errors • It doesn't require a (wireless) network … • … therefore, can be used if a network is down • It is backwards compatible … • … so no additional technology is needed • It can power the device … • … therefore no separate source of power is needed • Drivers are automatically downloaded // device is automatically identified … • … so no need to find them online / install them manually	**4**

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Question	Answer	Marks
10(a)	**Four** from: • Validation method • Used to check data entry • Digit is calculated from data // by example • Digit is appended / added to data • Digit is recalculated when data has been input • Digits are compared • If digits are different, error is detected // If digits match, no error is detected	**4**
10(b)	**Six** from (maximum three marks per security method): • Firewall … • … Monitors the traffic • … **Blocks** any traffic that doesn't meet the **criteria** / **rules** • (Strong) password // biometric … • … Data cannot be accessed without the use of the password / bio data • … Prevent brute force attacks • Encryption … • … Data will be scrambled • … **Key** is required to decrypt the data • … If data is stolen it will be meaningless • Physical security methods … • … The physical security will need to be overcome • … This can help deter theft of the data • Antispyware … • … will remove any spyware from system • … will prevent data being relayed to a third party	**6**

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Question	Answer	Marks
11(a)	**RAM** • To store the data / instructions / parts of OS that are currently in use **ROM** • To store the firmware / bootup instructions / BIOS **SSD** • To store files / software // by example	**3**
11(b)	**Two** from: • It is more durable // it has no moving parts • It has a faster read / write / access speed • It is more compact / light weight / smaller / portable • It uses less energy // battery will last longer • It is quieter • Not affected by magnetic forces • It runs at a cooler temperature • Less latency // takes less time to warm up	**2**

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Cambridge International General Certificate of Secondary Education

COMPUTER SCIENCE **0478/13**

Paper 1 **October/November 2019**

MARK SCHEME

Maximum Mark: 75

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Question	Answer	Marks
1(a)(i)	**Two** from: • 2D scanner • Touchscreen • Keypad/keyboard • Card reader • Mouse • Digital camera	**2**
1(a)(ii)	**Two** from: • HDD • SSD • USB flash memory drive • SD card • Any optical	**2**
1(a)(iii)	**Two** from: • Monitor/Touch screen • Speaker • Printer • LED // Light	**2**
1(b)(i)	• Increase the length of the key // make key 12-bit, etc.	**1**
1(b)(ii)	• Cypher text	**1**

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Question	Answer	Marks
1(b)(iii)	**Six** from: • The system could use odd or even parity • A parity bit is added • The data is checked to see if it has incorrect/correct parity // by example • If parity is correct no error is found • An acknowledgement is sent that data is received correctly • The next packet of data is transmitted • If incorrect parity is found an error has occurred • A signal is sent back to request the data is resent • The data is resent until data is received correctly/timeout occurs	**6**
1(c)(i)	1 1 1 1 | 1 0 0 1 | 0 0 1 0 1 mark 1 mark 1 mark 1 0 1 0 | 0 0 0 1 | 0 0 0 0 1 mark 1 mark 1 mark	**6**

Question	Answer	Marks
1(c)(ii)	**One** mark for identification: • Compression **Three** from e.g.: • Best compression would be lossy • Use compression algorithm • This would remove all the unnecessary data from the file // removes detail/sound that the human eye/ear may not see/hear • Reduce colour palette … • … so each pixel requires fewer bits • Reduce resolution • Only store what changes between frames // temporal redundancy	**4**
1(d)	**Five** from: • The display is made up of pixels … • … that are arranged together as a matrix • Each pixel has three filters, red, blue and green • Shades of colour are achieved by mixing red, blue and green • The screen is backlit • Light is shone through the liquid crystals • The liquid crystals can be made to turn solid or transparent/on or off … • … by changing the shape of the crystal	**5**

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Question	Answer	Marks
2(a)	**One** mark for each correct row	**4**

Statement	True (✓)	False (✓)
High-level languages need to be translated into machine code to run on a computer	✓	
High-level languages are written using mnemonic codes		✓
High-level languages are specific to the computer's hardware		✓
High-level languages are portable languages	✓	

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(b)</td><td>

One mark for the correct tick

<table>
<tr><th>Example program</th><th>Tick (✓)</th></tr>
<tr><td>1011100000110000
0000011011100010</td><td></td></tr>
<tr><td>INP
STA ONE
INP
STA TWO
ADD ONE</td><td></td></tr>
<tr><td>a = input()
b = input()
if a == b:
    print("Correct")
else:
    print("Incorrect")</td><td>✓</td></tr>
</table>

</td><td>1</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3</td><td>

One mark for each correct term in the correct order
- Serial
- Parallel
- Serial
- Simplex
- Parallel

</td><td>5</td></tr>
</table>

Question	Answer	Marks
4(a)	**One** mark for each correct logic gate with correct input(s)	**4**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(b)</td><td>

Four mark for 8 correct outputs
Three marks for 6 or 7 correct outputs
Two mark for 4 or 5 correct outputs
One mark for 2 or 3 correct outputs

<table>
<tr><th>A</th><th>T</th><th>P</th><th>Working space</th><th>X</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td></td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td></td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td></td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td></td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td></td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td></td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td></td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td></td><td>1</td></tr>
</table>

</td><td>4</td></tr>
<tr><td>4(c)</td><td>

Six from:
- Sensor sends a signal/reading/data to the microprocessor
- Signal/reading/data is analogue and is converted to digital using ADC
- Reading/data is stored in the system
- Microprocessor compares data/reading to the pre-set value of 7
- If value is greater than 7 …
- … a signal/data is sent by the microprocessor to display a warning message on a monitor
- The process is continuous

</td><td>6</td></tr>
</table>

Question	Answer	Marks
5	**One** mark for each correct parity bit	**3**

	Parity bit							
Register A	**0**	0	1	0	0	0	1	1
Register B	**0**	0	0	0	0	1	1	1
Register C	**0**	0	0	0	0	0	1	1

Question	Answer	Marks
6(a)	• Free software	**1**
6(b)	• Freeware	**1**
6(c)	• Shareware	**1**
6(d)	• Plagiarism // Intellectual property theft	**1**
6(e)	• Copyright	**1**

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Question	Answer	Marks
7(a)(i)	**Three** from: • RAM • Primary memory • Volatile memory • Holds currently in use data/instructions • Directly accessed by the CPU	**3**
7(a)(ii)	**Two** from: • Arithmetic and logic unit (ALU) • Memory address register (MAR) • Memory data register (MDR) // Memory buffer register (MBR) • Accumulator (ACC) • Immediate Access Store (IAS) • Control Unit (CU) • Program counter (PC) • Current instruction register (CIR) • Address bus • Data bus • Control bus • Input device • Output device • Secondary storage device	**2**

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Question	Answer	Marks
7(b)	**One** mark for each correct row	**5**

Statement	True (✓)	False (✓)
Interrupts can be hardware based or software based	✓	
Interrupts are handled by the operating system	✓	
Interrupts allow a computer to multitask	✓	
Interrupts work out which program to give priority to		✓
Interrupts are vital to a computer and it cannot function without them	✓	

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Question	Answer	Marks
8	**Four** from: • A hacker could have hacked the network … • … and downloaded the malware onto the network • Clicking a link/attachment/downloaded a file from an email/on a webpage … • … the malware could have been embedded into the link/attachment/file • Opening an infected software package … • … this would trigger the malware to download onto the network • Inserting an infected portable storage device … • … when the drive is accessed the malware is downloaded to the network • Firewall has been turned off … • … so malware would not be detected/checked for when entering network • Anti-malware has been turned off … • … so malware is not detected/checked for when files are downloaded	**4**

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COMPUTER SCIENCE **0478/21**

Paper 2 **October/November 2019**

MARK SCHEME

Maximum Mark: 50

Published

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Question	Answer	Marks
1(a)	Two examples of: Any meaningful name for a variable related to **Task 1** – **one** mark Correct data type related to **Task 1** – **one** mark Correct purpose related to **Task 1** – **one** mark e.g. • Length // Width • … real • … to store the length // width of the patio • StoneType • … string • … to store the type of stone slab chosen by the user • PatioArea • … integer • … to store the area of stone needed for the patio Note: variable names should not contain spaces or punctuation marks	**6**
1(b)	**Two** from: • Use of two one-dimensional arrays … • … with matching indexes • … each with a specific data types, e.g. string for stone and real for price • Size of array / number of elements / length of each array is 6 • Meaningful array names, e.g. Stone and Price	**2**

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Question	Answer	Marks

1(c)	**Five** from:
	MP1 Prompt and input for number of rectangles making up the patio …
	MP2 … and the type of stone to be used
	MP3 Loop to input dimensions for rectangles
	MP4 Prompt and input for dimensions for each rectangle inside loop
	MP5 Calculation of area of a rectangle
	MP6 Running total of area of patio
	MP7 Looking up the cost of the stone
	MP8 Calculation of cost of stone …
	MP9 …rounded up to the nearest square metre
	MP10 Output of cost of patio with annotation
	Example
	`TotalCost ← 0`
	`OUTPUT "Please enter type of stone needed"`
	`INPUT StoneType`
	`OUTPUT "Please enter the number of rectangles needed"`
	`INPUT NumberRectangle`
	`FOR Counter ← 1 TO NumberRectangle`
	`  OUTPUT "Please enter the length"`
	`  INPUT Length`
	`  OUTPUT "Please enter the Width"`
	`  INPUT Width`
	`  TotalCost ← TotalCost + CostFromTask1(Length, Width, StoneType)`
	`  // use Task 1 to calculate cost`
	`NEXT Counter`
	`OUTPUT ("Total Cost of Patio " TotalCost`
		5

1(d)	**Three** from: • Explanation of user input to name the percentage value to be used • Explanation of the calculation to add this percentage to the already calculated quantity of stone required • Explanation of rounding this value up • Explanation of the calculation of the new cost • Explanation of the output that will include annotation, quantity of stone to the nearest square metre and cost of stone If only program statements given with no explanation, **zero** marks.	**3**

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Question	Answer	Marks
1(e)	Two examples of: **One** mark for each correct validation check related to patio dimensions in **Task 1 or Task 2** and **one** mark for an appropriate related purpose e.g. • Range check // Limit check • … to make sure the dimension is entered is greater than zero and less than the maximum size • Type check • … to make sure any dimension entered is a number • Presence check • … to make sure a length/width has been entered for the area of the patio	**4**

Question	Answer	Marks
2	**One** mark for each correct row	**4**

Description	Structure diagram	Flowchart	Library routines
A modelling tool used to show the hierarchy of a system	✓		
A collection of standard programs available for immediate use			✓
A graphical representation used to represent an algorithm		✓	
A graphical representation to show how a system is broken into sub-systems	✓		

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Question	Answer	Marks
3(a)	• Inputs a series of values • Finds the total • Prints out the average	**3**
3(b)	**Three** from: • Use of loop structure • Allow input to define the limit of the loop / use sentinel value • Keeping a count of the number of values • It could use a totalling process to keep a running total	**3**

3(c)	Marks awarded as follows (maximum five marks):
	• Initialise Total
	• Enter limit
	• Suitable loop structure
	• Correct input
	• Correct totalling
	• Correct output
	e.g.
	
	`Total ← 0`
	`INPUT CounterLimit`
	`FOR LoopCounter ← 1 To CounterLimit`
	`  INPUT Number`
	`  Total ← Total + Number`
	`NEXT LoopCounter`
	`OUTPUT "The average equals ", Total / CounterLimit`
		5

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(a)</td><td>
<table>
<tr><th rowspan="2">Index</th><th rowspan="2">Count</th><th rowspan="2">Value</th><th colspan="8">PassMarks</th><th rowspan="2">OUTPUT</th></tr>
<tr><th>[0]</th><th>[1]</th><th>[2]</th><th>[3]</th><th>[4]</th><th>[5]</th><th>[6]</th><th>[7]</th></tr>
<tr><td>0</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>0</td><td>0</td><td>58</td><td>58</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>1</td><td>1</td><td>40</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>1</td><td>2</td><td>67</td><td></td><td>67</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>2</td><td>3</td><td>85</td><td></td><td></td><td>85</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>4</td><td>12</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>5</td><td>13</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>3</td><td>6</td><td>75</td><td></td><td></td><td></td><td>75</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>7</td><td>82</td><td></td><td></td><td></td><td></td><td>82</td><td></td><td></td><td></td><td></td></tr>
<tr><td>5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Number passed 5</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>1 mark</td><td>1 mark</td><td>1 mark</td><td>1 mark</td><td colspan="7">1 mark</td><td>1 mark</td></tr>
</table>
</td><td>6</td></tr>
<tr><td>4(b)</td><td>One from:
• Stores numbers greater than 50 in an array
• Outputs number of times pass mark has been met
• Find the number of pass marks</td><td>1</td></tr>
</table>

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(a)</td><td>
<table>
<tr><th>Field name</th><th>Example of data</th></tr>
<tr><td>CarID</td><td>ID07</td></tr>
<tr><td>Model</td><td>Pegasus // Apollo // Cupid</td></tr>
<tr><td>BodyStyle</td><td>estate //saloon // hatchback</td></tr>
<tr><td>Doors</td><td>1 // 2 // 3 // 4 // 5</td></tr>
<tr><td>FuelType</td><td>batteries // petrol // diesel</td></tr>
</table>

One mark – 1 or 2 suitable names and corresponding examples of data // 5 suitable field names but all data incorrect
Two marks – 3 or 4 suitable names and corresponding examples of data
Three marks – 5 suitable names and corresponding examples of data
Notes: CarID can be anything that could be used as a unique identifier. e.g. Number Plate
Number of doors can be any number of sensible doors for a car – 1, 2, 3, 4, 5.
Other data must come from the given text. Allow codes for model and body style.
</td><td>3</td></tr>
<tr><td>5(b)</td><td>
• CarID
• Which contains unique values to identify each record
</td><td>2</td></tr>
<tr><td>5(c)</td><td>
<table>
<tr><td>Field:</td><td>Model</td><td>FuelType</td><td>Doors</td><td></td><td></td></tr>
<tr><td>Table:</td><td>CAR_RANGE</td><td>CAR_RANGE</td><td>CAR_RANGE</td><td></td><td></td></tr>
<tr><td>Sort:</td><td>Ascending</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Show:</td><td>☑</td><td>☐</td><td>☑</td><td>☐</td><td>☐</td></tr>
<tr><td>Criteria:</td><td></td><td>="Petrol"</td><td></td><td></td><td></td></tr>
<tr><td>or:</td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

1 mark for each completely correct column (maximum three marks)
</td><td>3</td></tr>
</table>

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COMPUTER SCIENCE **0478/22**

Paper 2 **October/November 2019**

MARK SCHEME

Maximum Mark: 50

Published

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Section A

Question	Answer	Marks
1(a)(i)	Data Structure(s) maximum two marks • Array • Variable • Constant Description maximum three marks • Name(s) one or more e.g. Colour • Data type(s) one or more e.g. String • Use(s) one or more e.g. To store the colour of the slab Additional data structure description using the same data structure type maximum one mark • Two or more full descriptions of the data structure including name, data type and use	**5**
1(a)(ii)	• Variable name e.g. ConcretePrice • Data type e.g. Real • Use e.g. To store the price of the grade of concrete	**3**
1(b)	**Three** from: • Using the shape, size and depth … • … the area of the shape is found … • … for all except round multiply length by breadth/show example … • … for round multiply Pi by half the diameter/radius squared … • … multiply the area by the depth to give the volume	**3**

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Question	Answer	Marks

1(c)	**Five** from:
	MP1 Enter number of slabs to purchase with prompt
	MP2 Check if less than 20 or greater than 100 …
	MP3 … if so, reject the number and re-enter a value
	MP4 Attempt to round the number of slabs to the next 20 …
	MP5 Accurate attempt to round <u>up to the next 20</u>
	MP6 Calculate the number of batches
	MP7 Calculate price to pay (number of batches × price per batch from Task 1)
	MP8 Display price and number of slabs produced …
	MP9 … Suitable output message(s)
	
	Sample answer
	`REPEAT`
	`  PRINT "Enter Number of slabs to purchase"`
	`  INPUT Number`
	`UNTIL Number >= 20 and Number <= 100`
	`PurchaseNo ← Number`
	`IF Number > 20 AND Number <= 40 THEN PurchaseNo ← 40 ENDIF`
	`IF Number > 40 AND Number <= 60 THEN PurchaseNo ← 60 ENDIF`
	`IF Number > 60 AND Number <= 80 THEN PurchaseNo ← 80 ENDIF`
	`IF Number > 80 THEN PurchaseNo ← 100 ENDIF`
	`BatchNo ← PurchaseNo / 20`
	`PriceToPay ← BatchNo * BatchPrice //BatchPrice calculated in Task 1`
	`PRINT "Price for ", PurchaseNo, " Slabs is $", PriceToPay`
		5

1 (d)	**Four** from explanations: • Enter the price of the concrete • Store the price of the concrete • Set up variable(s) for grades • Input the grade • The price that is input is used in the final price calculation instead of 0.05 • The price calculation depends on the grade input e.g. 1.07 × price or price + price × 0.07 for Best If no programming code seen to support at least one explanation maximum of three marks can be awarded.	**4**

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Section B

Question	Answer	Marks
2	**One** mark for each error identified and suggested correction: • `IF TotalTry > Number` should be `IF Guess > Number` • `IF Guess > Number` should be `IF Guess < Number` • `TotalTry ← Guess + 1` should be `TotalTry ← TotalTry + 1` • `UNTIL Guess <> Number` should be `UNTIL Guess = Number`	**4**

Question	Answer	Marks
3(a)		**4**

Reject	Count	Length	OUTPUT
0	0		
0	1	24.88	
1	2	25.01	
1	3	24.98	
1	4	25.00	
1	5	25.05	
1	6	24.99	
1	7	24.97	
1	8	25.04	
1	9	25.19	
2	10	25.07	Batch rejected

One mark for each correct column **max. 4**

3(b)(i)	• Remove `Length < 25.1 AND`	**1**
3(b)(ii)	**Two** from: • Check the reject counter after each incrementation/remove reject check after counter = 10 … • … as soon as Reject = 2 / >1 ... • … reject batch and end	**2**

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Question	Answer	Marks
4	 One mark for each correct line, up to maximum of three marks.	**3**

Question	Answer	Marks
5	Totalling: • Adding the weight of each basket to the total weight as each weight is entered • `Total = Total + Weight` Counting: • Adding one to/incrementing the number of baskets as each weight is entered • `BasketCount = BasketCount + 1`	**4**

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Question	Answer	Marks
6	Constants **Two** from: • The value cannot be changed accidentally … • … during the **execution** of the program • Value only needs to be changed once if circumstances change/during the initialisation process Variables **Two** from: • Stores a value that can change … • … during the **execution** of the program • Can use a variable without knowing its value Arrays **Two** from: • A list of items of the same data type … • … stored under a single name • To reduce the number of variables used • Any item can be found using an index number to show its place in the list	**6**

Question	Answer	Marks
7(a)	• Number is repeated/not unique	**1**
7(b)	• Item number not displayed/Amount column not required • Not Like ‘Delivered’ will also show cancelled items Field: Item number | Order number | Status | Table: SALES | SALES | SALES | Sort: | | | Show: ☑ | ☑ | ☐ | ☐ Criteria: | | Like "Not started" | or: | | Like "In progress" | • Correct Item number column • Correct Order number column and any additional column not shown • Correct status column	**5**

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Question	Answer	Marks
1(a)	Two examples of: Any meaningful name for an array related to **Task 1** – **one** mark, e.g. • `TileDescription` • `TilePrice` • `TileCode` Correct data type **and** purpose related to **Task 1** – **one** mark, e.g. • … string to store the name / description of the tiles • … real to store the price of the tiles • … string to store the tile codes	**4**
1(b)	Any meaningful name for a variable related to **Task 2** – **one** mark, e.g. • `NumberOfWalls` • `TotalArea` • `TotalCost` Relevant data type for the variable related to **Task 2** – **one** mark, e.g. • … Integer • … Real Relevant purpose for the variable related to **Task 2** – **one** mark, e.g. • … to store the number of walls that need to be tiled • … to store the total area / cost **One** mark for a correct reason, e.g. • Variables allow the storage of values within a program that may change as the program runs // Variables are used to store values that are input or calculated	**4**

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Question	Answer	Marks
1(c)	**Six** from: MP1 Input for height and width of the wall to tile and tile code MP2 Prompts for all inputs seen MP3 Validation of height and width MP4 Reasonable attempt at validation of tile code MP5 Calculation of the area of the wall MP6 Calculation of the number of boxes rounded up MP7 Looking up the cost of the tiles MP8 Calculation of the cost of the boxes of the tiles MP9 Output of area of the wall, the number of boxes and cost of tiles needed MP10 Appropriate message(s) with output Example algorithm	**6**

```
REPEAT
   OUTPUT "Please enter height of wall "
   INPUT Height
UNTIL Height > 0

REPEAT
   OUTPUT "Please enter width of wall "
   INPUT Width
UNTIL Width > 0

REPEAT
   Found ← FALSE
   Counter ← 0
   REPEAT
      OUTPUT "Please enter tile identification code "
      INPUT MyTileId
      IF MyTileId = TileCode(Counter)
         THEN
            MyCost ← TilePrice(Counter)
            Found ← TRUE
      ENDIF
      Counter ← Counter + 1
   UNTIL Found OR Counter = 10
UNTIL Found

Area ← Height * Width
NoBoxes ← Int(Round (Area + 0.5))
// Rounds up to nearest Integer
TotalPrice ← NoBoxes * MyCost

OUTPUT ("Area of wall is ", Area, " metres")
OUTPUT ("Number of boxes of tiles is ", Area, " NoBoxes)
OUTPUT ("Cost of Tiles is ", TotalPrice, " dollars"
```

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Question	Answer	Marks
1(d)	**Three** from: • Adding an extra user input for number of walls … • … using this value as a loop counter • … so that separate inputs of height and width can be made for each wall • Calculating a running total for the final area using the results of the area calculation for each wall • Rounding the final area or using previously rounded areas for the final total • Displaying with a suitable message final area, final number of boxes of tiles required and final cost If only program statements given with no explanation, **zero** marks.	**3**
1(e)	**Three** from: • Check that only numbers are accepted // type check • Check that the values are within boundaries // range check • Check that a value has been entered // presence check • Using an IF / conditional statement • Identification of suitable lower value / acceptable value • Identification of suitable upper value / unacceptable value • Alerting the user with an error message if the input is unacceptable	**3**

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Question	Answer	Marks
2	**Two** from • Sub-program / system not the whole program / system • To perform a frequently used operation within a program • That can be called when needed • That can be reused by another program	**2**

Question	Answer	Marks
3	• `FOR (… TO … NEXT)` loop • `WHILE (… DO … ENDWHILE)` loop • `REPEAT (… UNTIL)` loop	**3**

Question	Answer	Marks
4(a)	• Conditional / selection statement	**1**

4(b)	**Four** from:
	MP1 CASE statement with identifier Response
	MP2 Correct structure used for choices…
	MP3 …. correct statements used for choices
	MP4 OTHERWISE and correct statement
	MP5 Single ENDCASE included
	e.g.
	`CASE OF Response // CASE Response OF`
	`  1 : X ← X + Y`
	`  2 : X ← X - Y`
	`  3 : X ← X * Y`
	`  4 : X ← X / Y`
	`  OTHERWISE OUTPUT "No response"`
	`ENDCASE`
		4

Question	Answer	Marks
5(a)		**6**

First	Last	UserIn	Middle	Found	OUTPUT
0	16			FALSE	
0	16	10	8	FALSE	
0	7	10	3	FALSE	
4	7	10	5	TRUE	TRUE

One mark per correct column

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Question	Answer	Marks
5(b)	**Two** from: • Search for the value input … • … using an array… • … of sorted data	**2**

Question	Answer	Marks
6	**One** mark for each correct symbol **and** name / description / example of use (maximum four marks)	**4**

Symbol	Description of use
	Terminator – start / end the flowchart
	Process – to show calculations, etc.
	Input / Output
	Decision – to show condition
	Continuation – to extend the flowchart and allow it to join up

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>7(a)</td><td>• Number of Fields: 4
• Number of Records: 32</td><td>2</td></tr>
<tr><td>7(b)</td><td>• No field is suitable as a primary key …
• … because none of the data would be unique // duplicates could occur</td><td>2</td></tr>
<tr><td>7(c)</td><td>
<table>
<tr><td>Field:</td><td>FirstName</td><td>LastName</td><td>Y10TestScore</td><td></td></tr>
<tr><td>Table:</td><td>MARKBOOK</td><td>MARKBOOK</td><td>MARKBOOK</td><td></td></tr>
<tr><td>Sort:</td><td></td><td></td><td>Descending</td><td></td></tr>
<tr><td>Show:</td><td>☑</td><td>☑</td><td>☑</td><td>☐</td></tr>
<tr><td>Criteria:</td><td></td><td></td><td>>=50</td><td></td></tr>
<tr><td>or:</td><td></td><td></td><td></td><td></td></tr>
</table>

One mark for each completely correct column down to and including ‘Show’ row (maximum three marks)
One mark for correct search criteria rows
</td><td>4</td></tr>
</table>

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COMPUTER SCIENCE **0478/21**

Paper 2 Problem-solving and Programming **October/November 2019**

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In preparation for the examination candidates should attempt the following practical tasks by **writing and testing a program or programs**.

You have been asked to write a program to calculate the area of a patio and the cost of the stone slabs needed to cover it. The program should work for any patio that can be represented as a rectangle, or group of rectangles that are joined together, and only one type of stone slab may be used.

Type of stone slab	Price per square metre
Dover	$30.00
Exeter	$35.00
London	$42.00
Portland	$49.50
Shaftesbury	$55.00
York	$62.75

Write and test a program or programs to calculate the cost of the stone slabs for a patio.

- Your program or programs must include appropriate prompts for the entry of data; data must be validated on entry.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

Task 1 – Setting up the system for a simple rectangular patio.
Set up your program to:
- Store the type and price per square metre of the stone slabs using a suitable programming technique.
- Prompt and allow the user to input the length and width of their patio and the type of stone slab they would like.
- Calculate and display the number of square metres of stone slabs required, rounded up to the next whole square metre, and the total cost of the stone slabs.

Task 2 – Working on more complex shapes.
Assuming that a patio can be made up of a group of rectangles, extend your program to:
- Enter the number of rectangles making up the patio and the type of stone slab to be used.
- Allow the dimensions for each rectangle to be entered.
- Calculate and display the total area of the patio rounded up to the next whole square metre.
- Calculate and display the total cost of the stone slabs.

Task 3 – Allowing for waste.
It is likely that some of the stone will not be useable, so it is sensible to allow a percentage for wastage, for example, 10%. Alter your program to allow the user to input a percentage to calculate wastage and add this to the number of square metres of stone slabs to be purchased, rounded up to the next whole square metre. Display the revised total area and cost.

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COMPUTER SCIENCE **0478/22**

Paper 2 Problem-solving and Programming **October/November 2019**

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In preparation for the examination candidates should attempt the following practical tasks by **writing and testing a program or programs**.

A company supplies concrete slabs for paving. The slabs are made to order in batches of 20; all slabs in a batch are identical. Customers can order from a small range of standard sizes and colours. All measurements are given in millimetres. The price is calculated at \$0.05 for a volume of 100 000 mm^3 of grey concrete; red and green concrete are charged at 10% more. Customers can choose their own colours; a custom colour has an initial set up cost of \$5 then 15% more than the price for grey.

Colour of slab
Grey
Red
Green
Custom

Depth of slab
38
45

Shapes	Sizes for each shape
Square	600 □ 600 or 450 □ 450
Rectangular	600 □ 700 or 600 □ 450
Round	Diameter 300 or 450

Write and test a program or programs for the concrete slab company.

- Your program or programs must include appropriate prompts for the entry of data; data must be validated on entry.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

Task 1 – Price for a batch of 20 slabs

Using the information above set up a routine that allows a customer to choose the concrete slab they require and calculate a price for a batch of 20 slabs. The details of the slab chosen and the price for a batch of 20 should be displayed on the screen.

Task 2 – Customer places an order

Using the information from TASK 1, the customer places an order for the number of slabs they require. Orders for fewer than 20 slabs or more than 100 slabs are not accepted; orders that are not a multiple of 20 are rounded up to the next multiple of 20 slabs. Display the order price and the number of slabs to be produced.

Task 3 – Flexible pricing

The cost of concrete is variable. The cost for 100 000 mm^3 of grey concrete can be input and two grades are available; basic at the cost input and best at 7% more. Use a copy of your program for TASK 1 to develop TASK 3 to input the cost and grade of concrete before calculating the price for 20 slabs.

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In preparation for the examination candidates should attempt the following practical tasks by **writing and testing a program or programs**.

You have been asked to write a program to calculate the area of a wall and the cost of the tiles needed to cover it. The program should work for any room with up to four walls being tiled. Tiles are sold in boxes; each box covers one square metre.

Tile description	Price per box
Small black granite	$19.50
Small grey marble	$25.95
Small powder blue	$35.75
Medium sunset yellow	$12.50
Medium berry red	$11.00
Medium glitter purple	$52.95
Large oak wood effect	$65.00
Large black granite	$58.98
Large bamboo effect	$85.00
Extra-large white marble	$62.75

Write and test a program or programs to calculate the area of the walls and the cost of tiles needed to tile a room.

- Your program or programs must include appropriate prompts for the entry of data; data must be validated on entry.
- Error messages and other output need to be set out clearly and understandably.
- All arrays, variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

Task 1 – Setting up and using the system for a single wall.
Set up your program to:
- Store the tile description, price per box and an identification code using a suitable programming technique.
- Display the list of tiles including the identification code, description and price per box.
- Prompt the user to input the height and width of the wall, and the identification code of the tiles they would like.
- Calculate and display the area of the wall, the number of boxes of tiles required (tiles are sold in boxes of complete square metres) and the total cost of the tiles.

Task 2 – Adding additional walls.
Extend your program to:
- Enter the number of walls to be tiled and the identification code of the tiles to be used. Only one identification code to be used for all walls.
- Enter the dimensions for each wall to be tiled.
- Calculate and display the total area of all walls, the number of boxes of tiles required (tiles are sold in boxes of complete square metres) and the total cost of the tiles.

Task 3 – Allowing for waste.
It is likely that some of the tiles will not be useable so it is sensible to allow a percentage for wastage, for example 10%. Alter your program to allow the user to input a percentage to calculate wastage and add this to the total area to be tiled. Calculate and display the revised number of boxes of tiles to be purchased (tiles are sold in boxes of complete square metres) and the total cost of the tiles.

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/11**

Paper 1 Theory **October/November 2019**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs or rough working.
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DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

No marks will be awarded for using brand names of software packages or hardware.

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The number of marks is given in brackets [ ] at the end of each question or part question.

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1 Andrew wants to produce advertising material for his company.

(a) Andrew can use an **Inkjet printer** or a **Laser printer**.

Draw lines to connect each printer to a correct statement. More than one line may be used to connect to each printer or statement.

Printer	Statement
	Can print in colour
Inkjet printer	
	Uses a charged drum to create the printed item
	Uses powdered toner
Laser printer	
	Creates output line by line using a print head

[2]

(b) Andrew wants to print a single page A4 leaflet. He wants to print 10 000 copies.

State whether he should use an inkjet or a laser printer.

..... [1]

(c) Andrew wants to produce small 3D models of the company logo.

Explain how a 3D cutter could be used to produce the models.

.....

.....

.....

..... [2]

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2 An electronic guessing game compares denary integer values input by a user with pre-stored values. The pre-stored values are held in 10-bit binary format.

(a) Convert the binary values in the table to denary.

Binary	Denary
0001001110	
0110110111	
1000000001	

[3]

(b) When planning the game, the designer decided to use hexadecimal notation to represent the binary values.

Explain why the designer used hexadecimal notation.

.....

.....

.....

..... [2]

(c) State the hexadecimal equivalent of the binary value 1010110101

..... [3]

3 A company has several offices. It uses the Internet to transfer data between offices. The company also makes payments to staff and suppliers using online banking.

The company are concerned about spyware and other security aspects of using the Internet.

(a) Explain what is meant by spyware **and** how it is used to obtain data.

.....

.....

.....

.....

.....

..... [3]

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(b) The company uses a web page to log on to the online bank.

Identify **one** method that could be used by the online bank to reduce the impact of spyware when logging on.

State **how** the method prevents the use of spyware.

.....

.....

.....

..... [2]

(c) The company has installed a firewall as part of its data security.

Describe how a firewall can help protect against unauthorised access to data.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(d) State **two** other methods the company could use to help prevent unauthorised access to data.

Method 1 .....

Method 2 .....

[2]

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4 A zoo has an information point.

- Visitors use a menu to select information about animals.
- The menu includes 500 different animals.
- The information is provided only using high definition video with an audio track.

(a) State **one** input device that could be used for the information point.

..... [1]

(b) The output is shown on a monitor.

State **one** other output device that could be used for the information point.

..... [1]

(c) The video files are stored at the information point.

State **one** secondary storage device that could be used.

..... [1]

(d) The zoo decides to introduce Quick Response codes in different places in the zoo. These provide further information about the animals.

Describe how customers obtain the information from the Quick Response codes.

.....

.....

.....

.....

.....

.....

.....

..... [4]

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5 Sonia shares files with her friends. The method of data transmission she uses is half-duplex serial transmission.

(a) Describe how data is transmitted using half-duplex serial data transmission.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(b) The system uses parity bits to check for errors during data transmission.

The outcome of four bytes after transmission is:

Byte 1	Byte 2	Byte 3	Byte 4
00110011	01010100	10110100	01110111

One of the bytes has been transmitted incorrectly.

Identify the byte that was transmitted incorrectly.

Byte .....

Explain how you identified the byte that was transmitted incorrectly.

.....

.....

.....

.....
[4]

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6 Ishan is a member of a software community that develops computer games. He has programmed a new feature for one of the community's existing games.

(a) Ishan compiles the program before he issues it to the community.

(i) Explain **one** benefit of Ishan compiling the program.

.....

..... [1]

(ii) Explain **one** drawback of Ishan compiling the program.

.....

..... [1]

(b) Ishan shares the program with community members over the Internet, using Secure Socket Layer (SSL).

(i) Explain how Ishan will know he is on a secure website.

.....

..... [1]

(ii) Describe how an SSL connection is established.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

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(c) The community publishes completed games on the Internet as freeware.

Describe what is meant by freeware.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(d) The program files for the games are compressed before they are published on the Internet.

(i) Describe **one** benefit of compressing the program files.

.....

.....

.....

..... [2]

(ii) State whether **lossy** or **lossless** compression should be used.

..... [1]

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7 A factory manufactures plastic pipes. It uses logic circuits to control the manufacturing process.

(a) Consider the logic gate:

Complete the truth table for this logic gate.

Input A	Input B	Output
0	0	
0	1	
1	0	
1	1	

[1]

(b) Consider the truth table:

Input A	Input B	Output
0	0	0
0	1	1
1	0	1
1	1	0

State the **single** logic gate that produces the given output.

..... [1]

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(c) Plastic pipes of various sizes are manufactured by heating the plastic and using pressure.

The manufacturing system uses sensors to measure the pressure (P), temperature (T) and speed (S) of production.

The inputs to the manufacturing system are:

Input	Binary value	Condition
P	1	pressure is > 5 bar
	0	pressure is <= 5 bar
T	1	temperature is > 200 degrees Celsius
	0	temperature is <= 200 degrees Celsius
S	1	speed is > 1 metre per second
	0	speed is <= 1 metre per second

The system will sound an alarm (**X**) when certain conditions are detected.

The alarm will sound when:

Temperature is > 200 degrees Celsius and the pressure is <= 5 bar
or
Speed is > 1 metre per second and Temperature is <= 200 degrees Celsius

Draw a logic circuit to represent the above alarm system.

Logic gates used must have a maximum of **two** inputs.

[5]

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(d) Give **two** benefits of using sensors to monitor the manufacture of plastic pipes.

1 .....

.....

2 .....

.....
[2]

8 Explain how an instruction is fetched in a Von Neumann model computer.

.....

.....

.....

.....

.....

.....

.....

.....

..... [6]

9 HTML can be used to create the structure and the presentation of web pages.

(a) Describe what is meant by HTML structure.

.....

.....

.....

.....

..... [2]

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(b) Gloria writes a paragraph as an answer to an examination question about accessing a website.

Use the list given to complete Gloria's answer by inserting the correct **four** missing terms. Not all terms will be used.

- browser
- cookies
- Hypertext Markup Language (HTML)
- hypertext transfer protocol (http)
- hypertext transfer protocol secure (https)
- Internet Protocol address (IP address)
- Media Access Control address (MAC address)
- web server

The user enters the URL of the website. The ..... uses the DNS server to look up the ..... of the website.

The browser sends a request to the ..... to obtain the website files. The website files are sent as ..... that is interpreted by the browser.

[4]

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CANDIDATE NAME	

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COMPUTER SCIENCE **0478/12**

Paper 1 Theory **October/November 2019**

1 hour 45 minutes

Candidates answer on the Question Paper.

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1 Computer memory size is measured in multiples of bytes.

Four statements about computer memory sizes are given in the table.

Tick (✓) to show if the statement is **True** or **False**.

Statement	True (✓)	False (✓)
25 kB is larger than 100 MB		
999 MB is larger than 50 GB		
3500 kB is smaller than 2 GB		
2350 bytes is smaller than 2 kB		

[4]

2 The Von Neumann model for a computer system uses several components in the fetch-execute cycle. One component that is used is the Control Unit (CU).

Identify **four** other components that are used in the Von Neumann model for a computer system.

1 .....

2 .....

3 .....

4 .....

[4]

3 The data from a sensor must be converted from analogue to digital to be processed by a computer.

(a) State what is meant by analogue data.

.....

..... [1]

(b) State what is meant by digital data.

.....

..... [1]

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4 An 8-bit binary register contains the value:

0	0	1	1	0	1	0	0

(a) Convert the binary value to denary.

.....

..... [1]

(b) The contents of the register shifted one place to the right would give the result:

0	0	0	1	1	0	1	0

The contents of the register shown at the start of question 4 are shifted two places to the left.

Show the contents of the register after this shift has taken place.

[1]

(c) State the effect this shift has on the denary value in **part (a)**.

.....

..... [1]

5 Audrey wants to send a sound file to Nico using email.

The file is too large to attach to an email so Audrey decides to compress the file.

She uses lossy compression to reduce the size of the sound file.

(a) Describe how lossy compression reduces the size of the sound file.

.....

.....

.....

.....

.....

.....

.....

..... [4]

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(b) Nico asks Audrey why she used lossy compression rather than lossless.

(i) State **one** advantage Audrey could give of using lossy rather than lossless to compress the sound file.

.....

..... [1]

(ii) State **one** disadvantage Nico could give of using lossy rather than lossless to compress the sound file.

.....

..... [1]

(c) Audrey sometimes records MIDI files.

(i) Explain what is meant by a MIDI file.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(ii) MIDI uses serial data transmission.

Explain **two** advantages of using serial transmission rather than parallel transmission.

Advantage 1 .....

.....

.....

.....

Advantage 2 .....

.....

.....

..... [4]

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6 Touch screen technologies can be described as resistive or capacitive.

Six statements are given about resistive and capacitive technology.

Tick (✓) to show if the statement applies to **Resistive** or **Capacitive** technology.

Statement	Resistive (✓)	Capacitive (✓)
This touch screen has multi-touch capabilities		
This touch screen cannot be used whilst wearing gloves		
This touch screen is made up of two layers with a small space in between		
This touch screen uses the electrical properties of the human body		
This touch screen is normally cheaper to manufacture		
This touch screen has a quicker response time		

[6]

7 Gerald uses a keyboard to enter a website address into the address bar of his browser.

(a) Describe how Gerald's key presses on his keyboard are processed by the computer.

.....

.....

.....

.....

.....

.....

.....

..... [4]

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(b) State **three** functions of a browser.

1 .....

.....

2 .....

.....

3 .....

.....
[3]

(c) The website Gerald visits uses https.

Explain what is meant by https.

.....

.....

.....

.....

.....

..... [3]

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8 Consider the logic circuit:

(a) Write a logic statement to match the given logic circuit.

..... [3]

(b) Complete the truth table for the given logic circuit.

A	B	C	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

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9 Maisey purchases a new router and attaches it to her computer. The connection she sets up uses duplex data transmission.

(a) **Five** statements are given about duplex data transmission.

Tick (✓) to show if the statement is **True** or **False**.

Statement	True (✓)	False (✓)
Duplex data transmission can be either serial or parallel		
Duplex data transmission is when data is transmitted both ways, but only one way at a time		
Duplex data transmission is always used to connect a device to a computer		
Duplex data transmission is when data is transmitted both ways at the same time		
Duplex data transmission automatically detects any errors in data		

[5]

(b) Maisey's computer uses an integrated circuit (IC) for data transmission that sends multiple bits at the same time.

State whether the IC uses **serial** or **parallel** data transmission.

..... [1]

(c) Maisey purchases a new printer and connects it to her computer using the USB port.

Explain **two** benefits of using a USB connection.

Benefit 1 .....

.....

.....

.....

Benefit 2 .....

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.....

[4]

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10 Data is valuable to a company.

(a) Companies use error detection methods to make sure that data is accurate.

One error detection method is the use of a check digit.

Explain what is meant by a check digit and how it is used to detect errors.

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..... [4]

(b) Companies can use a range of security methods to keep their data secure.

Identify **two** security methods that a company can use to keep their data secure **and** explain how each method can keep the data secure.

Security method 1 .....

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Security method 2 .....

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[6]

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11 Robert has a mobile device that uses RAM, ROM and an SSD.

(a) State what the RAM, ROM and SSD are used for.

RAM .....

.....

ROM .....

.....

SSD .....

.....
[3]

(b) Give **two** reasons why an SSD, rather than a HDD, is used in the mobile device.

Reason 1 .....

.....

Reason 2 .....

.....
[2]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

2059267620

COMPUTER SCIENCE **0478/13**

Paper 1 Theory **October/November 2019**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

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Answer **all** questions.
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1 A library has a system that allows customers to check out the books that they want to borrow.

Each book has a barcode that can be used to identify the book.

(a) **(i)** Identify **two** input devices that may be used in the library's system.

Input device 1 .....

Input device 2 .....
[2]

(ii) Identify **two** storage devices that may be used in the library's system.

Storage device 1 .....

Storage device 2 .....
[2]

(iii) Identify **two** output devices that may be used in the library's system.

Output device 1 .....

Output device 2 .....
[2]

(b) The data stored by the library is archived at the end of each day. The archive is held on a server in the library office.

The data is encrypted with an 8-bit key. As some of the data is confidential, the library wants to make the encryption more secure.

(i) State how the library could make the encryption more secure.

.....

..... [1]

(ii) The term used to describe data before it is encrypted is plain text.

State the term used to describe encrypted data.

..... [1]

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(iii) The library's archive system uses an error detection and correction system that combines a parity check with an automatic repeat request (ARQ).

Describe how this system uses the parity check and ARQ.

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..... [6]

(c) The library has a website that customers can use to search for a book.

(i) The website has a background colour with the hexadecimal colour code #F92A10

The colour code is stored in two 12-bit binary registers.

Show how the colour code would be stored in the registers.

F92												
A10												

[6]

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(ii) Videos on the library website show customers which books the library will soon have in stock.

The library wants the file size of a video to be as small as possible.

Identify **and** describe a method the library could use to reduce the file size of a video as much as possible.

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..... [4]

(d) The library often holds events that introduce new authors.

At the events, the library has a Liquid Crystal Display (LCD) screen that displays data, including an image and information about the author.

Describe how an LCD screen operates to display this data.

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..... [5]

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2 A programmer uses a high-level language to write a computer program.

(a) **Four** statements are given about high-level programming languages.

Tick (✓) to show if each statement is **True** or **False**.

Statement	True (✓)	False (✓)
High-level languages need to be translated into machine code to run on a computer		
High-level languages are written using mnemonic codes		
High-level languages are specific to the computer's hardware		
High-level languages are portable languages		

[4]

(b) **Tick (✓)** to show which of the following is an example of a high-level language program.

Example program	Tick (✓)
1011100000110000 0000011011100010	
INP STA ONE INP STA TWO ADD ONE	

a = input()
b = input()
if a == b:
print("Correct")
else:
print("Incorrect")	

[1]

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3 Blair writes a paragraph about data transmission in her Computer Science examination.

Use the list given to complete Blair's paragraph by inserting the correct **five** missing terms. Not all terms will be used. Terms can be used more than once.

- duplex
- half-duplex
- parallel
- serial
- simplex

..... data transmission is when data is transmitted a single bit at a time. ..... data transmission is when multiple bits of data are sent all at once. If a user wants to transmit data over a long distance, with the highest chance of accuracy, ... data transmission should be used. If data needs to be transmitted in one direction only, for example from a computer to a printer, ... data transmission should be used. If a user has a large amount of data to transmit and this needs to be done as quickly as possible ..... data transmission should be used.

[5]

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Question 4 starts on page 8.

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4 A factory that manufactures cleaning products has a system that monitors conditions throughout the manufacturing process.

The inputs to the system are:

Input	Binary value	Condition
A	1	pH > 7
	0	pH < = 7
T	1	Temperature < 35 °C
	0	Temperature > = 35 °C
P	1	Pressure > = 80 %
	0	Pressure < 80 %

(a) The system will sound an alarm (**X**) when certain conditions are detected.

The alarm will sound when:

- The pressure > = 80 % and the temperature > = 35 °C

or

- The temperature < 35 °C and the pH > 7

Draw a logic circuit to represent the alarm system in the factory. Each logic gate must have a maximum of two inputs.

[4]

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(b) Complete the truth table for the given logic problem.

A	T	P	Working space	X
0	0	0		
0	0	1		
0	1	0		
0	1	1		
1	0	0		
1	0	1		
1	1	0		
1	1	1		

[4]

(c) A sensor and a microprocessor are used to monitor the pH of the cleaning products. The system records each reading that is taken. If the reading is greater than 7 a warning message is displayed on a monitor.

Explain how the sensor and microprocessor are used in the system.

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..... [6]

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5 The contents of three binary registers have been transmitted from one computer to another. **Odd parity** has been used as an error detection method.

The outcome after transmission is:

- **Register A** and **Register B** have been transmitted **correctly**.
- **Register C** has been transmitted **incorrectly**.

Write the appropriate **Parity bit** for each register to show the given outcome.

	Parity bit							
Register A		0	1	0	0	0	1	1
Register B		0	0	0	0	1	1	1
Register C		0	0	0	0	0	1	1

[3]

6 Jesse is taking his Computer Science examination. He answers **five** questions about ethics.

(a) For the first question, he writes the answer:

"This type of software can be copied and shared without the permission of the owner."

State what Jesse is describing.

..... [1]

(b) For the second question, he writes the answer:

"With this type of software, the owner still retains the copyright for the software, but he gives away copies of it for free."

State what Jesse is describing.

..... [1]

(c) For the third question, he writes the answer:

"This type of software is often a trial version of the full software. To use the full version the user normally needs to pay a fee."

State what Jesse is describing.

..... [1]

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(d) For the fourth question, he writes the answer:

"This is when a person copies another person's computer program and tries to claim it as his own."

State what Jesse is describing.

..... [1]

(e) For the fifth question, he writes the answer:

"This is the legal protection that a person can obtain, to provide protection against his work being stolen."

State what Jesse is describing.

..... [1]

7 The Von Neumann model for a computer system has several components that are used in the fetch-execute cycle.

(a) One component is main memory.

(i) Describe what is meant by main memory and how it is used in the Von Neumann model for a computer system.

.....

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..... [3]

(ii) State **two** other components in the Von Neumann model for a computer system.

1 .....

2 .....
[2]

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(b) Computer systems often use interrupts.

Five statements are given about interrupts.

Tick (✓) to show if each statement is **True** or **False**.

Statement	True (✓)	False (✓)
Interrupts can be hardware based or software based		
Interrupts are handled by the operating system		
Interrupts allow a computer to multitask		
Interrupts work out which program to give priority to		
Interrupts are vital to a computer and it cannot function without them		

[5]

8 A company discovers malware on its network.

Explain **two** ways that the malware could have been introduced to the company's network.

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..... [4]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/21**

Paper 2 Problem-solving and Programming **October/November 2019**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

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Section A

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Here is a copy of the pre-release material.

DO NOT attempt Tasks 1, 2 and 3 now.

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Pre-release material

You have been asked to write a program to calculate the area of a patio and the cost of the stone slabs needed to cover it. The program should work for any patio that can be represented as a rectangle, or group of rectangles that are joined together, and only one type of stone slab may be used.

Type of stone slab	Price per square metre
Dover	$30.00
Exeter	$35.00
London	$42.00
Portland	$49.50
Shaftesbury	$55.00
York	$62.75

Write and test a program or programs to calculate the cost of the stone slabs for a patio.

- Your program or programs must include appropriate prompts for the entry of data; data must be validated on entry.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

Task 1 – Setting up the system for a simple rectangular patio.
Set up your program to:
- Store the type and price per square metre of the stone slabs using a suitable programming technique.
- Prompt and allow the user to input the length and width of their patio and the type of stone slab they would like.
- Calculate and display the number of square metres of stone slabs required, rounded up to the next whole square metre, and the total cost of the stone slabs.

Task 2 – Working on more complex shapes.
Assuming that a patio can be made up of a group of rectangles, extend your program to:
- Enter the number of rectangles making up the patio and the type of stone slab to be used.
- Allow the dimensions for each rectangle to be entered.
- Calculate and display the total area of the patio rounded up to the next whole square metre.
- Calculate and display the total cost of the stone slabs.

Task 3 – Allowing for waste.
It is likely that some of the stone will not be useable, so it is sensible to allow a percentage for wastage, for example, 10%. Alter your program to allow the user to input a percentage to calculate wastage and add this to the number of square metres of stone slabs to be purchased, rounded up to the next whole square metre. Display the revised total area and cost.

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1 **(a)** All variables, constants and other identifiers must have meaningful names.

Name **two** variables that you could have used for **Task 1**. State the data type and purpose of each variable.

Variable 1 name .....

Data type .....

Purpose .....

.....

Variable 2 name .....

Data type .....

Purpose .....

.....
[6]

(b) Describe how arrays could be used to store the data about the types and price per square metre of the stone slabs for **Task 1**.

.....

.....

.....

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.....

.....

.....[2]

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(c) Write an algorithm to complete **Task 2**, using **either** pseudocode, programming statements **or** a flowchart. Assume **Task 1** has been completed.

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.....

.....

(d) Explain how your program completes **Task 3**. Any programming statements you use in your answer must be fully explained.

.....

.....

.....

(e) Name **two** validation checks that could be used when entering patio dimensions in **Task 1** or **Task 2** and describe their purpose.

Validation check 1 .....

Purpose .....

.....

.....

.....

Validation check 2 .....

Purpose .....

.....

.....

.....

[4]

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Section B

2 For each of the **four** descriptions in the table, place a tick in the correct column to show whether it describes a **Structure diagram**, a **Flowchart** or **Library routines**.

Description	Structure diagram	Flowchart	Library routines
A modelling tool used to show the hierarchy of a system.			
A collection of standard programs available for immediate use.			
A graphical representation used to represent an algorithm.			
A graphical representation to show how a system is broken into sub-systems.			

[4]

3 Examine the following pseudocode:

```
INPUT A
INPUT B
INPUT C
INPUT D
INPUT E
INPUT F
INPUT G
INPUT H
INPUT I
INPUT J
INPUT K
INPUT L
T ← A + B + C + D + E + F + G + H + I + J + K + L
OUTPUT "The average equals ", T/12
```

(a) Describe what happens in this pseudocode.

.....

.....

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.....

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.....[3]

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(b) Describe how this pseudocode could be altered to allow any number of values to be input.

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.....[3]

(c) Re-write the given pseudocode to allow any number of values to be input.

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.....[5]

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4 **(a)** Complete the trace table for this algorithm using the given input data.

```
Index ← 0
FOR Count ← 0 TO 7
  INPUT Value
  IF Value > 50
    THEN
      PassMarks[Index] ← Value
      Index ← Index + 1
  ENDIF
NEXT Count
PRINT "Number passed ", Index
```

Input data: 58, 40, 67, 85, 12, 13, 75, 82

Index	Count	Value	PassMarks								OUTPUT
			[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	

[6]

(b) Give the purpose of the algorithm shown in **part (a)**.

.....

.....

.....[1]

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5 A car manufacturer makes a range of car models named Pegasus, Apollo and Cupid. It keeps a database to store the records of its range and the different options for each car model. Within the table CAR_RANGE, the following data needs to be stored:

1. Car model
2. Body style – saloon, hatchback or estate
3. How many doors it has
4. Whether it uses petrol, diesel or batteries as fuel
5. An identifier for a specific car.

(a) Complete the table to show suitable field names and an example of appropriate data for each field in the database table CAR_RANGE.

Field name	Example of data

[3]

(b) State which of your fields would be most appropriate for a primary key and give a reason for your choice.

.....

.....

.....[2]

(c) Complete the query-by-example grid to provide a list of car models using petrol and the number of doors these cars have, in alphabetical order of car model. Display only the car models and the number of doors.

Field:					
Table:					
Sort:					
Show:	☐	☐	☐	☐	☐
Criteria:					
or:					

[3]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

1951238022

COMPUTER SCIENCE **0478/22**

Paper 2 Problem-solving and Programming **October/November 2019**

1 hour 45 minutes

Candidates answer on the Question Paper.

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Section A

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Here is a copy of the pre-release material.

DO NOT attempt Tasks 1, 2 and 3 now.

Use the pre-release material and your experience from attempting the tasks before the examination to answer Question 1.

Pre-release material

A company supplies concrete slabs for paving. The slabs are made to order in batches of 20; all slabs in a batch are identical. Customers can order from a small range of standard sizes and colours. All measurements are given in millimetres. The price is calculated at $0.05 for a volume of 100 000 mm^3 of grey concrete; red and green concrete are charged at 10% more. Customers can choose their own colours; a custom colour has an initial set up cost of $5 then 15% more than the price for grey.

Colour of slab
Grey
Red
Green
Custom

Depth of slab
38
45

Shapes	Sizes for each shape
Square	600 □ 600 or 450 □ 450
Rectangular	600 □ 700 or 600 □ 450
Round	Diameter 300 or 450

Write and test a program or programs for the concrete slab company.

- Your program or programs must include appropriate prompts for the entry of data; data must be validated on entry.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

Task 1 – Price for a batch of 20 slabs

Using the information above set up a routine that allows a customer to choose the concrete slab they require and calculate a price for a batch of 20 slabs. The details of the slab chosen and the price for a batch of 20 should be displayed on the screen.

Task 2 – Customer places an order

Using the information from TASK 1, the customer places an order for the number of slabs they require. Orders for fewer than 20 slabs or more than 100 slabs are not accepted; orders that are not a multiple of 20 are rounded up to the next multiple of 20 slabs. Display the order price and the number of slabs to be produced.

Task 3 – Flexible pricing

The cost of concrete is variable. The cost for 100 000 mm^3 of grey concrete can be input and two grades are available; basic at the cost input and best at 7% more. Use a copy of your program for TASK 1 to develop TASK 3 to input the cost and grade of concrete before calculating the price for 20 slabs.

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1 **(a)** All variables, constants and other identifiers must have meaningful names.

(i) Describe the data structures that you have used to store the data for the concrete slabs in **Task 1**, include the name, data type and use for each data structure.

.....

.....

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..... [5]

(ii) State **one** variable that you have used in **Task 3**.
Give the data type for the variable. State what it is used for.

Variable name .....

Data type .....

Use .....

.....
[3]

(b) Explain how you calculated the volume of a concrete slab in **Task 1**.

.....

.....

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..... [3]

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(c) Write an algorithm for **Task 2**, using **either** pseudocode, programming statements **or** a flowchart. Assume that **Task 1** has been completed.

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(d) Explain how you changed your program for **Task 1** to meet the requirements for **Task 3**. Include and fully explain any altered or additional programming statements.

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Section B

2 An algorithm has been written in pseudocode to select a random number using the function `RandInt(n)`, which returns a whole number between 1 and the argument n. The algorithm then allows the user to guess the number.

```
Number ← RandInt(100)
TotalTry ← 1
REPEAT
  PRINT "Enter your guess now, it must be a whole number"
  INPUT Guess
  IF TotalTry > Number
    THEN
      PRINT "Too large try again"
  ENDIF
  IF Guess > Number
    THEN
      PRINT "Too small try again"
  ENDIF
  TotalTry ← Guess + 1
UNTIL Guess <> Number
TotalTry ← TotalTry - 1
PRINT "Number of guesses ", TotalTry
```

Find the **four** errors in the pseudocode and suggest a correction to remove each error.

Error 1 .....

Correction .....

.....

Error 2 .....

Correction .....

.....

Error 3 .....

Correction .....

.....

Error 4 .....

Correction .....

.....

[4]

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3 **(a)** The flowchart checks the lengths of a batch of 10 ropes. For the batch to be accepted 90% of the lengths need to be between 24.9 and 25.1 metres.

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Complete the trace table for the input data:

24.88, 25.01, 24.98, 25.00, 25.05, 24.99, 24.97, 25.04, 25.19, 25.07

Reject	Count	Length	OUTPUT

[4]

(b) **(i)** It has been decided to only reject batches of rope that contain ropes that are too short.

State the change required to the algorithm.

.....

..... [1]

(ii) Explain how the algorithm to reject batches could be improved to make it more effective.

.....

.....

.....

..... [2]

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4 **Four** validation checks and **four** descriptions are shown.

Draw a line to connect each validation check to the correct description.

Validation Check	Description
Range check	Checks that some data is entered.
Presence check	Checks for a maximum number of characters in the data entered.
Length check	Checks that the characters entered are all numbers.
Type check	Checks that the value entered is between an upper value and a lower value.

[3]

5 A programmer writes a program to weigh baskets of fruit in grams, keeping a total of the weight and counting the number of baskets. The total weight is stored in a variable `Total` and the number of baskets is stored in a variable `BasketCount`.

Explain, including examples of programming statements, how totalling and counting could be used in this program.

Totalling .....

.....

.....

.....

.....

.....

Counting .....

.....

.....

.....

.....

.....

[4]

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6 Explain why constants, variables and arrays are used in programming.

Constants .....

.....

.....

.....

Variables .....

.....

.....

.....

Arrays .....

.....

.....

.....

[6]

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7 A database table, SALES, is used to keep a record of items made and sold by a furniture maker.

Item number	Order number	Notes	Amount	Status
CH001	1921	Smith – six dining chairs	6	Delivered
TB003	1921	Smith – large table	1	In progress
CH001	1924	Hue – extra chairs	4	In progress
CH003	1925	For stock	2	Cancelled
BN001	1927	Patel – replacement bench	1	Not started
ST002	1931	Sola – small table	1	Delivered
CH003	1927	Patel – eight dining chairs with arms	8	Not started
TB003	1927	Patel – large table	1	Not started

(a) Explain why the field **Item number** could not be used as a primary key.

.....

..... [1]

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(b) A query-by-example has been written to display only the order number and item numbers of any items in progress or not started.

Field:	Item number	Order number	Amount	Status
Table:	SALES	SALES	SALES	SALES
Sort:				
Show:	☐	☑	☑	☐
Criteria:				Not Like "Delivered"
or:				

Explain why the query-by-example is incorrect, and write a correct query-by-example.

Explanation .....

.....

.....

.....

.....

Field:				
Table:				
Sort:				
Show:	☐	☐	☐	☐
Criteria:				
or:				

[5]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/23**

Paper 2 Problem-solving and Programming **October/November 2019**

1 hour 45 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

No calculators allowed.

READ THESE INSTRUCTIONS FIRST

Write your centre number, candidate number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams, graphs or rough working.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.

DO NOT ATTEMPT TASKS 1, 2 AND 3 in the pre-release material; these are for information only.

You are advised to spend no more than **40 minutes** on **Section A** (Question 1).

No marks will be awarded for using brand names of software packages or hardware.

Any businesses described in this paper are entirely fictitious.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [ ] at the end of each question or part question.

The maximum number of marks is 50.

This syllabus is regulated for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **12** printed pages.

DC (SC) 162458/3
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[Turn over

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Section A

You are advised to spend no longer than 40 minutes answering this section.

Here is a copy of the pre-release material.

DO NOT attempt Tasks 1, 2 and 3 now.

Use the pre-release material and your experience from attempting the tasks before the examination to answer Question 1.

Pre-release material

You have been asked to write a program to calculate the area of a wall and the cost of the tiles needed to cover it. The program should work for any room with up to four walls being tiled. Tiles are sold in boxes; each box covers one square metre.

Tile description	Price per box
Small black granite	$19.50
Small grey marble	$25.95
Small powder blue	$35.75
Medium sunset yellow	$12.50
Medium berry red	$11.00
Medium glitter purple	$52.95
Large oak wood effect	$65.00
Large black granite	$58.98
Large bamboo effect	$85.00
Extra-large white marble	$62.75

Write and test a program or programs to calculate the area of the walls and the cost of tiles needed to tile a room.

- Your program or programs must include appropriate prompts for the entry of data; data must be validated on entry.
- Error messages and other output need to be set out clearly and understandably.
- All arrays, variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

Task 1 – Setting up and using the system for a single wall.
Set up your program to:
- Store the tile description, price per box and an identification code using a suitable programming technique.
- Display the list of tiles including the identification code, description and price per box.
- Prompt the user to input the height and width of the wall, and the identification code of the tiles they would like.
- Calculate and display the area of the wall, the number of boxes of tiles required (tiles are sold in boxes of complete square metres) and the total cost of the tiles.

Task 2 – Adding additional walls.
Extend your program to:
- Enter the number of walls to be tiled and the identification code of the tiles to be used. Only one identification code to be used for all walls.
- Enter the dimensions for each wall to be tiled.
- Calculate and display the total area of all walls, the number of boxes of tiles required (tiles are sold in boxes of complete square metres) and the total cost of the tiles.

Task 3 – Allowing for waste.
It is likely that some of the tiles will not be useable so it is sensible to allow a percentage for wastage, for example 10%. Alter your program to allow the user to input a percentage to calculate wastage and add this to the total area to be tiled. Calculate and display the revised number of boxes of tiles to be purchased (tiles are sold in boxes of complete square metres) and the total cost of the tiles.

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1 **(a)** All variables, constants and other identifiers must have meaningful names.

Name **two** arrays you could use for **Task 1**. State the data type and purpose of each one.

Array 1 .....

Data type 1 .....

Purpose .....

.....

Array 2 .....

Data type 2 .....

Purpose .....

.....
[4]

(b) Name a variable that you used for **Task 2**. State the data type and purpose of this variable. Explain why you chose to use a variable rather than a constant.

Variable .....

Data type .....

Purpose .....

.....

.....

Reason for use of a variable .....

.....

.....
[4]

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(c) Write an algorithm for **Task 1**, using **either** pseudocode, programming statements **or** a flowchart. Assume that the first part of **Task 1**, the storage and display of tile descriptions, prices per box and identification codes has already been done.

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[6]

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(d) Explain how you extended your program to complete **Task 2**. Any programming statements you use in your answer must be fully explained.

.....

.....

.....

(e) Explain how you could validate the input for percentage waste allowance in **Task 3**.

.....

.....

.....

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.....

.....

..... [3]

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Section B

2 Describe the use of a subroutine in a program.

.....

.....

.....

.....

..... [2]

3 Name the **three** types of loop structure used in pseudocode.

.....

.....

.....

.....

.....

..... [3]

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4 The following pseudocode algorithm uses nested IF statements.

```
IF Response = 1
  THEN
    X ← X + Y
  ELSE
    IF Response = 2
      THEN
        X ← X - Y
      ELSE
        IF Response = 3
          THEN
            X ← X * Y
          ELSE
            IF Response = 4
              THEN
                X ← X / Y
              ELSE
                OUTPUT "No response"
            ENDIF
        ENDIF
    ENDIF
ENDIF
```

(a) Name the type of statement demonstrated by the use of `IF … THEN … ELSE … ENDIF`

.....

..... [1]

(b) Re-write the pseudocode algorithm using a `CASE` statement.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

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5 The algorithm performs an operation on the array named `MyData`

`DIV` means integer division, so only the whole number part of the result is returned
e.g. `7 DIV 2` returns a value of `3`

```
First ← 0
Last ← 16
Found ← FALSE
INPUT UserIn
WHILE (First <= Last) AND (Found = FALSE) DO
  Middle ← (First + Last) DIV 2
  IF MyData[Middle] = UserIn
    THEN
      Found ← TRUE
    ELSE
      IF UserIn < MyData[Middle]
        THEN
          Last ← Middle - 1
        ELSE
          First ← Middle + 1
      ENDIF
  ENDIF
ENDWHILE
OUTPUT Found
```

This table shows the contents of the array: `MyData` e.g. `MyData[2]` stores the value `5`

	MyData																
Index	[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]	[13]	[14]	[15]	[16]
Value	2	3	5	6	8	10	12	13	14	16	18	20	25	27	29	34	36

(a) Complete the trace table for the input data: 10

First	Last	UserIn	Middle	Found	OUTPUT

[6]

(b) Describe the function being performed by the algorithm.

.....

.....

.....

..... [2]

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6 Draw **four** different flowchart symbols and describe how they are used in a program flowchart.

Flowchart symbol	Description of use

[4]

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7 A teacher has decided to use a database table as her mark book for her Computer Science class, which she has called MARKBOOK. For each student, the following data will be recorded: first name, last name, their year 10 test score and their year 11 test score. The class has 32 students.

(a) State the number of fields and records required for this database.

Number of Fields .....

Number of Records .....
[2]

(b) The data in MARKBOOK is stored under category headings: LastName, FirstName, Y10TestScore and Y11TestScore.

State, with a reason, whether any of these headings would be suitable as a primary key.

.....

.....

.....

..... [2]

(c) Complete the query-by-example grid to only display the first name, last name and year 10 test score of each student who achieved 50 or more in their year 10 test. The output should be in test score order with the highest marks at the top of the list.

Field:				
Table:				
Sort:				
Show:	☐	☐	☐	☐
Criteria:				
or:				

[4]

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CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/02**

Paper 2 Problem-solving and Programming **For examination from 2020**

SPECIMEN PRE-RELEASE MATERIAL

No additional materials are required.

To be given to candidates on receipt by the centre.

READ THESE INSTRUCTIONS FIRST

You should use this material in preparation for the examination. You should attempt the practical programming tasks using their chosen high-level, procedural programming language.

The specimen pre-release material is for general illustrative purposes.

Please see the *Cambridge Handbook* for the specific year in which candidates are taking the assessment. This will tell you when the pre-release material will be available and where to access the materials.

This document consists of **2** printed pages.

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Your preparation for the examination should include attempting the following practical **program coding** tasks.

A teacher needs a program to record marks for a class of 30 students who have sat three computer science tests.

Write and test a program for the teacher.

- Your program must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Set up arrays

Set-up one dimensional arrays to store:

- Student names
- Student marks for Test 1, Test 2 and Test 3
  - Test 1 is out of 20 marks
  - Test 2 is out of 25 marks
  - Test 3 is out of 35 marks
- Total score for each student

Input and store the names for 30 students. You may assume that the students' names are unique.

Input and store the students' marks for Test 1, Test 2 and Test 3. All the marks must be validated on entry and any invalid marks rejected.

TASK 2 – Calculate

Calculate the total score for each student and store in the array.
Calculate the average total score for the whole class.

Output each student's name followed by their total score.
Output the average total score for the class.

TASK 3 – Select

Select the student with the highest total score and output their name and total score.

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COMPUTER SCIENCE **0478/01**

Paper 1 Theory **For examination from 2020**

MARK SCHEME

Maximum Mark: 75

Specimen

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1 **(a)** 1 mark for the correct working in BOTH parts
1 mark for valid
1 mark for not valid

Identification number 1: working
= (4 × 6) + (2 × 5) + (1 × 4) + (9 × 3) + (2 × 2) + (3 × 1)
= 24 + 10 + 4 + 27 + 4 + 3
= 72 ÷ 11
= 6 remainder **6**
valid/not valid: NOT valid

Identification number 2: working
= (8 × 6) + (2 × 5) + (0 × 4) + (1 × 3) + (5 × 2) + (6 × 1)
= 48 + 10 + 0 + 3 + 10 + 6
= 77 ÷ 11
= 7 remainder **0**
valid/not valid: VALID [3]

(b) 1 mark for correct working + 1 mark for check digit

working
= (5 × 6) + (0 × 5) + (2 × 4) + (4 × 3) + (1 × 2)
= 30 + 0 + 8 + 12 + 2
= 52
need to add **3** to make the total **55** (i.e. exactly divisible by 11)

check digit: **3** [2]

(c) 1 mark for each description and example

2 digits transposed
(e.g. 280**41**9 becomes 280**14**9/two digits have been switched)
incorrect digit
(e.g. 2**8**0419 becomes 2**5**0419/one of the digits has been mistyped) [2]

2 – direct access because of concentric tracks
– can read and write at the same time because it has a read/write head [2]

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3 **(a)** 1 mark for each logic gate correctly connected

[5]

(b)

A	T	S	Y
0	*0*	*0*	**0**
0	*0*	*1*	**0**
0	*1*	*0*	**1**
0	*1*	*1*	**0**
1	*0*	*0*	**1**
1	*0*	*1*	**1**
1	*1*	*0*	**1**
1	*1*	*1*	**0**

1 mark

1 mark

1 mark

1 mark

[4]

4 **(a)** 1 mark for hours; 1 mark for minutes

1 6 : 4 9
1 mark 1 mark [2]

(b) 1 mark for each digit

0 0 0 1	1st digit
0 1 1 1	2nd digit
0 0 1 0	3rd digit
1 0 0 1	4th digit

[4]

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(c) Any **two** from:
- microprocessor compares present time with stored time
- if the values are the same
- sends signal to sound alarm [2]

5 **(a)** Yes [1]

(b) No [1]

(c)
- re-reading the byte that was sent
- request that the byte is resent [2]

6 **(a)** Only answers:
- temperature (sensor)
- oxygen (sensor) [2]

(b) Any **four** from:
- information from the sensors sent to microprocessor
- the ADC converts the analogue data into digital form
- if temperature < 25ºC OR <u>temperature</u> checked against stored value
- ...microprocessor sends signal to heater/actuator/valve...
- ...to switch on heater
- if oxygen level < 20 ppm OR <u>oxygen</u> level checked against stored value
- ...to open valve/oxygen supply
- use of DAC between microprocessor and devices
- sounds an alarm if system unable to respond
- continuously monitors sensor inputs
- any reference to feedback [4]

(c) Any **one** from:
- unsafe limit stored in memory
- warning sound/signal if too high a value reached
- fail safe switch off in case of a malfunction [1]

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7 (a)

5/6 matches – 5 marks
4 matches – 4 marks
3 matches – 3 marks
2 matches – 2 marks
1 match – 1 mark [5]

(b) any **two** from:
- to enable logon information to be kept on his computer
- to provide pages customised for Ahmed the next time he logs on
- to implement shopping carts and one-click purchasing
- to be able to distinguish between new and repeat visitors to the website [2]

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8 **(a)** **(i)** Any **one** from:
- unit of data/memory
- 8 bits
- used to represent a character [1]

(ii) 30 [1]

(b) Any **two** from:

Flash memory
- solid state memory
- no formatting issues
- plugs directly into the USB port
- direct transfer of data

CD-RW
- optical media
- slower access speed/flash memory has faster access speed
- requires a separate drive
- data needs to be burnt/finalised/finished (before being used on another device) [2]

9 **(a)** Any **one** from:
- buffer
- RAM [1]

(b) – interrupt [1]

10 **(a)** 1 mark for each correct word

(i) Hello World [2]

(ii) Vmilozgu Rvwgyvg [2]

(b) **(i)** Secure Socket Layer [1]

(ii) the key itself is encrypted using strong encryption [1]

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11

5/4 matches – 4 marks
3 matches – 3 marks
2 matches – 2 marks
1 match – 1 mark [4]

12 **(a)** code B [1]

(b) Any **one** from:
- no need to understand workings of a computer
- easier to understand for programmer/closer to English
- much easier to debug
- much easier to test
- one-to-many when writing commands
- not machine-specific/portable [1]

(c) Any **one** from:
- can address memory addresses directly
- no need for compilers/interpreters
- shorter code/code requires less storage/RAM
- can be written to run faster [1]

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(d) – compiler produces object code / interpreter doesn't produce object code
– compiler translates whole program in one go / interpreter translates and executes line at a time
– compiler produces list of all errors / interpreter produces error message each time an error encountered
– compiler produces "stand alone code" / interpreter doesn't produce "stand alone code"
– compilation process is slow but resultant code runs very quickly / interpreted code runs slowly [2]

13 (a) (i)

Location 1	0	1	0	0	0	0	0	1
Location 2	0	1	0	0	0	0	1	1

[2]

(ii) 41
43 [2]

(b) FA97 [4]

(c) – easier to identify values
– easier to spot errors [2]

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COMPUTER SCIENCE **0478/02**

Paper 2 Problem-solving and Programming **For examination from 2020**

MARK SCHEME

Maximum Mark: 50

Specimen

This document consists of **6** pages.

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Section A

1 (a) (i) Many correct answers, they must be meaningful. This is an example only.

`StudentNames[1:30]` [1]

(ii) Many correct answers, they must be meaningful. This is an example only.

`StudentMarksTest1[1:30]`
`StudentMarksTest2[1:30]`
`StudentMarksTest3[1:30]` (1 mark)
`StudentTotalScore[1:30]` (1 mark) [2]

(b) (i)
- outside loop zeroing total for loop (sum in example below)
- loop for all students
- input name and all test scores
- in loop adding a student's total
- storing the total
- inside loop printing student's name and total
- outside loop calculating class average
- printing class average

sample algorithm:

```
Sum ← 0
FOR Count ← 1 TO 30
   INPUT Name
   StudentName[Count] ← Name
   INPUT Mark1, Mark2, Mark3
   StudentMarksTest1[Count] ← Mark1
   StudentMarksTest2[Count] ← Mark2
   StudentMarksTest3[Count] ← Mark3
   Total ← Mark1 + Mark2 + Mark3
   StudentTotalScore[Count] ← Total
   Sum ← Sum + Total
   PRINT StudentName[Count], StudentTotalScore[Count]
NEXT Count
ClassAverage = Sum/30
PRINT ClassAverage
```
[8]

(ii) any relevant comment with regards to efficient code (e.g. single loop) [1]

(c) Many correct answers, these are examples only.
1 mark per data set and reason

Set 1: 20, 25, 35
Reason: valid data to check that data on the upper bound of each range check is accepted

Set 2: 21, 26, 36
Reason: invalid data to check that data above the upper bound of each range check is rejected [2]

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(d) (i) Maximum 5 marks **in total** for question part
Maximum 3 marks for algorithm

Description (max 3)
- set variable called HighestScore to zero and variable called BestName to dummy value
- loop 30 times to check each student's total score in turn
- check student's score against HighestScore
- if student's score > HighestScore then
- … replace value in HighestScore by student's score and store student's name in BestName
- output BestName and HighestScore outside the loop

Sample algorithm (max 3):

```
HighestScore ← 0
BestName ←  "xxxx"                                  (1 mark)
FOR Count ← 1 TO 30
   IF StudentTotalScore[Count] > HighestScore       (1 mark)
      THEN
         HighestScore ← StudentTotalScore[Count]
         BestName ← StudentName[Count]              (1 mark)
   ENDIF
NEXT Count                                          (1 mark)
PRINT BestName, HighestScore                        (1 mark)
```

If algorithm or program code only, then maximum 3 marks [5]

(ii) comment on which student(s)' name will be output
e.g. The first student with the highest score will be output [1]

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Section B

2 **(a)** 1 mark for value of c and message

51020: value of c: 5
message: PIN OK (1 mark)

5120: value of c: 4
message: error in PIN entered (1 mark) [2]

(b) length check [1]

3

Engine	Count	Number	Size	Average	OUTPUT
0	0	0	1.8		
1.8	1	1	2.0		
3.8	2	2	1.0		
4.8		3	1.3		
6.1		4	1.0		
7.1		5	2.5		
9.6	3	6	2.0		
11.6	4	7	1.3		
12.9		8	1.8		
14.7	5	9	1.3		
16.0		10	–1		
				1.6	
					1.6, 5
(1 mark)	(1 mark)	(1 mark)	(1 mark)	(1 mark)	(1 mark)

[6]

4 1 mark for each error identified + suggested correction

line 5: this should read ***IF x > h THEN h = x***

line 7: ***PRINT h*** should come <u>after the end of the repeat loop</u>

line 8: this should read ***UNTIL c = 20*** or ***UNTIL c >= 20*** or ***UNTIL c > 19*** [3]

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5 **(a)** 5 [1]

(b)

Field:	At Risk	Age in Years	Type	Map Position
Table:	TREES	TREES	TREES	TREES
Sort:				
Show:	☐	☐	☑	☑
Criteria:	True	>100		
or:				

One mark per correct column. [4]

6 **(a)** marking points:

the way to find and print the largest value a	1 mark
the way to find and print the largest value b	1 mark
the way to find and print the largest value c	1 mark

sample algorithm:

```
INPUT a, b, c
   IF a > b AND a > c THEN PRINT a                (1 mark)
      ELSE IF b > c THEN PRINT b                  (1 mark)
         ELSE PRINT c                             (1 mark)
```

[3]

(b) marking points:

loop construct	1 mark
check if number is an *integer*	1 mark
counting the number of integers input	1 mark
output count value (outside the loop)	1 mark

sample algorithm:

```
FOR x ← 1 TO 1000                                 (1 mark)
   INPUT Number
      Difference ← INT(number) - Number           (1 mark)
      IF Difference = 0 THEN Total ← Total + 1    (1 mark)
NEXT x
PRINT total                                       (1 mark)
```

(NOTE: alternative to lines 3 and 4:

```
IF INT(Number) = Number THEN Total ← Total + 1    (2 marks) )
```

[4]

(c) Description of any **two** sets of test data. Many correct answers, these are examples only.

1000 whole numbers to ensure that loop works properly

900 whole numbers and 100 numbers with decimal places to ensure that the routine distinguishes correctly [2]

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7 **(a)** 7 [1]

(b) Hg, Cs [2]

(c) Element symbol [1]

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CANDIDATE NAME	

CENTRE NUMBER						CANDIDATE NUMBER					

COMPUTER SCIENCE **0478/01**

Paper 1 Theory **For examination from 2020**

SPECIMEN PAPER

1 hour 45 minutes

Candidates answer on the question paper.

No additional materials are required.

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DO **NOT** WRITE IN ANY BARCODES.
Calculators must not be used in this paper.

Answer **all** questions.
No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The maximum number of marks is 75.

This document consists of **14** printed pages.

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1 A company selling CDs uses a unique 6-digit identification number for each CD title. The right-most digit (position 1) is a *check digit*.

For example,

6	5	4	3	2	1	← digit position
3	0	6	1	4	9	← identification number
					↑	
					check digit	

The validity of the number and check digit is calculated as follows:

- multiply **each** digit by its digit position
- add up the results of the multiplications
- divide the answer by 11
- if the remainder is 0, the identification number and check digit are valid.

(a) Show whether the following identification numbers are valid or not. You **must** show how you arrived at your answer.

Identification number 1: 4 2 1 9 2 3

working: .....

.....

.....

.....

valid or not valid? .....

Identification number 2: 8 2 0 1 5 6

working: .....

.....

.....

.....

valid or not valid? ..... [3]

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(b) Find the check digit for this identification number.

5 0 2 4 1 __

working: .....

.....

.....

.....

check digit: ..... [2]

(c) Describe, with examples, **two** different types of data entry errors that a check digit would detect.

1 .....

.....

2 .....

..... [2]

2 Kamil is setting up a new computer system to record television programmes. He wants to be able to record, view and then erase programmes that he does not want to keep. He has chosen to use DVD-RAM as an optical storage medium.

Explain to Kamil why it is better to use DVD-RAM rather than DVD+RW or DVD-RW.

1 .....

.....

2 .....

..... [2]

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3 An alarm, Y, sends a signal (Y = 1) when certain fault conditions in a chemical process are detected. The inputs are:

Input	Binary value	Condition
A	1	acidity > 5
	0	acidity <= 5
T	1	temperature >= 120°C
	0	temperature < 120°C
S	1	stirrer bar ON
	0	stirrer bar OFF

The alarm, Y, returns a value of 1 if:

either temperature >= 120°C AND stirrer bar is OFF

or acidity > 5 AND temperature < 120°C

(a) Draw the logic circuit for the above system using these logic gates.

[5]

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(b) Complete the truth table for this alarm system.

A	T	S	Y
0	0	0	
0	0	1	
0	1	0	
0	1	1	
1	0	0	
1	0	1	
1	1	0	
1	1	1	

[4]

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4 A digital alarm clock is controlled by a microprocessor. It uses the 24-hour clock system (i.e. 6 pm is 18:00).

Each digit in a typical display is represented by a 4-digit binary code.

For example:

(clock display)

is represented by:

0	0	0	0	1st digit (0)
1	0	0	0	2nd digit (8)
0	0	1	1	3rd digit (3)
0	1	0	1	4th digit (5)

(a) What time is shown on the clock display if the 4-digit binary codes are:

0	0	0	1
0	1	1	0
0	1	0	0
1	0	0	1

(clock display)

[2]

(b) What would be stored in the 4-digit binary codes if the clock display time was:

				1st digit
				2nd digit
				3rd digit
				4th digit

[4]

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(c) The clock alarm has been set at 08:00.

Describe the actions of the microprocessor which enable the alarm to sound at 08:00.

.....

.....

.....

.....

..... [2]

5 Bytes of data transferred using a serial cable are checked for errors at the receiving end using an even parity check.

Can these bytes of data pass the even parity check?

(a) 01010101

..... [1]

(b) 11001000

..... [1]

(c) How can any errors be corrected?

.....

.....

..... [2]

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6 The conditions in a fish tank are being controlled using sensors and a microprocessor. To keep the fish healthy, the temperature must be at 25°C and the oxygen content needs to be 20 ppm (parts per million). The tank contains a heater and an oxygen inlet controlled by a valve.

(a) Name the **two** sensors used in this application.

Sensor A .....

Sensor B ..... [2]

(b) Describe how the sensors and the microprocessor are used to maintain the correct conditions in the fish tank.

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

(c) What safeguards are needed to stop the fish tank temperature rising too high?

.....

..... [1]

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7 Ahmed uses the Internet for some time and is puzzled by the terminology.

(a) Draw a line to match each description to the appropriate technical term.

authoring language used to create documents to be viewed on the World Wide Web	Browser
computer that responds to requests to provide information and services over the Internet	HTML
defines how messages are transmitted and formatted over the Internet	MAC address
numerical ID for each device on the Internet	Internet Server
software that enables users to access/view documents and other resources on the Internet	IP address
unique ID for a network interface card	http

[5]

(b) Ahmed sees the message “Set your browser to accept cookies”.

Explain why some websites make this request.

.....

.....

.....

..... [2]

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8 Computer memories are measured in terms of the number of *bytes*.

(a) **(i)** What is meant by the term *byte*?

.....

..... [1]

(ii) The number of bytes in a Gigabyte can be written as 2^x

What is the value of x?

..... [1]

(b) Flash memories and CD-RWs are used as backing media for computers.

Give **two** differences between these two media.

1 .....

.....

2 .....

..... [2]

9 Andrew sends a large document to a printer.

(a) State the name for the area of memory used to store temporarily the data being sent to the printer.

..... [1]

(b) The printer runs out of paper during the printing job. A signal is sent back to the computer to stop temporarily its current task.

Name this type of signal.

..... [1]

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10 In a simple symmetric encryption system, each letter of the alphabet is substituted with another.

The plain text message:

The quick brown fox jumps over the lazy dog.

becomes the cypher text message:

Zag towvs jumpy dmh coilr mngu zag bfke qmx.

(a) **(i)** Decode this cypher text message.

Agbbm Pmubq

.....

..... [2]

(ii) Convert these words to cypher text.

Computer Science

.....

..... [2]

(b) Both the person who sends the message and the person who receives it need to know what the substitution key is, and they need to keep this secret. A copy of the substitution key has been sent using SSL transmission.

(i) What is meant by SSL?

..... [1]

(ii) How does SSL keep the copy of the key secret during transmission?

.....

..... [1]

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11 Five security or data loss issues are shown on the left-hand side.

Five possible methods of data recovery or protection are shown on the right.

Draw a line to match each definition/description of **Issues** to the most appropriate **Methods of Data Recovery**.

Issues	**Methods of Data Recovery**
data loss caused by hard disk head crash	anti-spyware software
hacking into files and changing or deleting data	anti-virus software
introduction of software that self-replicates and can cause data loss	back-up files
reading of illegally accessed documents	encryption
software that logs/records all key presses on your computer without you knowing	passwords and a firewall

[4]

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12 Look at these two pieces of code:

A:
```
      CLC
      LDX #0
loop: LDA A,X
      ADC B,X
      STA C,X
      INX
      CPX #16
      BNE loop
```

B:
```
FOR Loop = 1 TO 4
    INPUT Number1, Number2
    Sum = Number1 + Number2
    PRINT Sum
NEXT
```

(a) Which of these pieces of code is written in a high-level language?

..... [1]

(b) Give **one** benefit of writing code in a high-level language.

.....

.....

..... [1]

(c) Give **one** benefit of writing code in a low-level language.

.....

.....

..... [1]

(d) High-level languages can be *compiled* or *interpreted*.

Give **two** differences between a compiler and an interpreter.

1 .....

.....

2 .....

..... [2]

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13 When a key is pressed on the keyboard, the computer stores the ASCII representation of the character typed into main memory.

The ASCII representation for A is 65 (denary), for B is 66 (denary), etc.

There are two letters stored in the following memory locations:

Location 1	A
Location 2	C

(a) **(i)** Show the contents of Location 1 and Location 2 as binary using 8 bits.

Location 1								
Location 2								

[2]

(ii) Show the contents of Location 1 and Location 2 as hexadecimal.

Location 1 .....

Location 2 ..... [2]

(b) The following machine code instruction is stored in a location of main memory:

1	1	1	1	1	0	1	0	1	0	0	1	0	1	1	1

Convert this binary pattern into hexadecimal.

..... [4]

(c) Explain why a programmer would prefer to see the contents of the locations displayed as hexadecimal rather than binary, when debugging his program that reads the key presses.

.....

.....

.....

..... [2]

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COMPUTER SCIENCE **0478/02**

Paper 2 Problem-solving and Programming **For examination from 2020**

SPECIMEN PAPER

1 hour 45 minutes

Candidates answer on the question paper.

No additional materials are required.

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DO **NOT** WRITE IN ANY BARCODES.
Calculators must not be used in this paper.

Answer **all** questions.

DO NOT ATTEMPT TASKS 1, 2 AND 3 in the pre-release material; these are for information only.

You are advised to spend no more than **40 minutes** on **Section A** (Question 1).

No marks will be awarded for using brand names of software packages or hardware.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.
The maximum number of marks is 50.

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Section A

You are advised to spend no longer than 40 minutes answering this section.

Here is a copy of the pre-release material.

DO NOT attempt Tasks 1, 2 and 3 now.

Use the pre-release material and your experience from attempting the tasks before the examination to answer Section A Question 1.

Pre-release material

A teacher needs a program to record marks for a class of 30 students who have sat three computer science tests.

Write and test a program for the teacher.

- Your program must include appropriate prompts for the entry of data.
- Error messages and other output need to be set out clearly and understandably.
- All variables, constants and other identifiers must have meaningful names.

You will need to complete these **three** tasks. Each task must be fully tested.

TASK 1 – Set up arrays

Set-up one dimensional arrays to store:

- Student names
- Student marks for Test 1, Test 2 and Test 3
  - Test 1 is out of 20 marks
  - Test 2 is out of 25 marks
  - Test 3 is out of 35 marks
- Total score for each student

Input and store the names for 30 students. You may assume that the students' names are unique.

Input and store the students' marks for Test 1, Test 2 and Test 3. All the marks must be validated on entry and any invalid marks rejected.

TASK 2 – Calculate

Calculate the total score for each student and store in the array.
Calculate the average total score for the whole class.

Output each student's name followed by their total score.
Output the average total score for the class.

TASK 3 – Select

Select the student with the highest total score and output their name and total score.

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1 **(a)** All variables, constants and other identifiers should have meaningful names.

(i) Declare the array to store the students' names.

..... [1]

(ii) Declare the arrays to store each student's marks and total score.

.....

..... [2]

(b) **(i)** Show the design of your algorithm to complete **Task 1** and **Task 2** using pseudocode, programming statements or a flowchart. Do **not** include any of the validation checks or input prompts in your algorithm.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [8]

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(ii) Comment on the efficiency of your design.

.....

.....

..... [1]

(c) Show **two** different sets of student data that you could use to check the validation used in **Task 1**. Explain why you chose each data set.

Set 1 .....

Reason for choice .....

.....

.....

Set 2 .....

Reason for choice .....

.....

..... [2]

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(d) **(i)** Explain how you select the student with the highest score (**Task 3**). You may include pseudocode or programming statements to help illustrate your explanation.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [5]

(ii) How does your program work when there is more than one student having the highest score? Explain using your method given in **part (d)(i)**.

.....

.....

..... [1]

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Section B

2 Jatinder uses Internet banking.
This pseudocode checks her PIN.

```
c ← 0
INPUT PIN
x ← PIN
REPEAT
   x ← x/10
   c ← c + 1
UNTIL x < 1
IF c <> 5
   THEN
      PRINT "error in PIN entered"
   ELSE
      PRINT "PIN OK"
ENDIF
```

(a) What value of c and what message would be output if the following PINs were entered?

5 1 0 2 0 Value of c: .....

Message: .....

5 1 2 0 Value of c: .....

Message: ..... [2]

(b) What type of validation check is being carried out here?

..... [1]

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3 The flowchart inputs the size of a number of car engines; a value of –1 stops the input.

This information is output: *average engine size* and *number of engines with size > 1.5*

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Complete the trace table for the input data.

1.8, 2.0, 1.0, 1.3, 1.0, 2.5, 2.0, 1.3, 1.8, 1.3, –1

Engine	Count	Number	Size	Average	OUTPUT

[6]

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4 Read this section of program code that inputs twenty (20) numbers and then outputs the largest number input.

```
h = 0
c = 0
REPEAT
    READ x
    IF x > h THEN x = h
    c = c + 1
    PRINT h
UNTIL c < 20
```

There are **three** errors in this code.

Locate these errors and suggest a corrected piece of code.

1 .....

.....

.....

2 .....

.....

.....

3 .....

.....

..... [3]

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5 A database table, TREES, is used to keep a record of the trees in a park. Each tree is given a unique number and is examined to see if it is at risk of dying. There are over 900 trees; part of the database table is shown.

Tree Number	Type	Map Position	Age in Years	At Risk
TN091	Acacia	A7	250	Y
TN172	Olive	C5	110	N
TN913	Cedar	B9	8	N
TN824	Banyan	A3	50	Y
TN021	Pine	D5	560	Y
TN532	Teak	C8	76	Y
TN043	Yew	B1	340	N
TN354	Spruce	D4	65	N
TN371	Elm	B10	22	Y
TN869	Oak	C9	13	N
TN954	Pine	E11	3	N

(a) State the number of fields in the table.

..... [1]

(b) Using the query-by-example grid, write a query to identify at risk trees over 100 years old. Display only the type and the position on the map.

Field:					
Table:					
Sort:					
Show:	☐	☐	☐	☐	☐
Criteria:					
or:					

[4]

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6 **(a)** Write an algorithm, using pseudocode or flowchart only, which:

- inputs three numbers
- outputs the **largest** of the three numbers

.....

.....

.....

.....

.....

.....

.....

.....

..... [3]

(b) Write an algorithm, using pseudocode or flowchart only, which:

- inputs 1000 numbers
- outputs how many of these numbers were whole numbers (integers)
  (You may use INT(x) in your answer, e.g. y = INT(3.8) gives the value y = 3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

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(c) Describe, with examples, **two** sets of test data you would use to test your algorithm.

1 .....

.....

2 .....

..... [2]

7 A database was set up to show the properties of certain chemical elements. Part of the database is shown below.

Name of element	Element symbol	Atomic number	Atomic weight	Melting point (C)	Boiling point (C)	State at room temp
oxygen	O	8	16	–218	–183	gas
iron	Fe	26	56	1538	2861	solid
mercury	Hg	80	201	–38	356	liquid
bromine	Br	35	80	–7	59	liquid
osmium	Os	76	190	3033	5012	solid
caesium	Cs	55	133	28	671	solid
gallium	Ga	31	70	30	2204	solid
argon	Ar	18	40	–189	–186	gas
silver	Ag	47	108	961	2162	solid

(a) How many fields are in each record?

..... [1]

(b) The following search condition was entered:

(**Melting point (C)** < 40) AND (**Atomic weight** > 100)

Using **Element symbol** only, which records would be output?

.....

..... [2]

(c) Which field would be best suited as primary key?

..... [1]

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