Chhetri Academy

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GCSE COMPUTER SCIENCE

1.2

OCR J277 | Specification point 1.2.4

Data storage

Untiered

Answers and examiner comments

13	2014-2025	Untiered
question groups	available papers	tier

Using this booklet

1. Answer numbers match the companion question booklet.
2. Follow the original question number on marking tables.
3. Examiner comments are included where available.

Name _____ **Date** _____

Some entries use full source marking material in an appendix. Any unavailable mark schemes are identified beside the relevant answer.

Question			Answer	Mark	Guidance
3	a		Answer: 1 1 1 0 1 1 1 1 One mark per nibble	2	
	b		• There is an extra carry/bit • As number cannot fit into 8 bits • Result is greater than 255/11111111	2	

Question			Answer	Mark	Guidance
9	a	i	• 6 * 16 + 2 / 0110 0010 • 98	2	Accept working where candidates write the least significant bit first in their binary representation (i.e. 01000110) as long as this is clear (e.g. by showing the place values)
		ii	• 62 ÷ 16 = 3 r 14 / 62 = 0011 1110 • 3E	2	Accept working where candidates write the least significant bit first in their binary representation (i.e. 01111100) as long as this is clear (e.g. by showing the place values)
	b		• Binary produces long strings/ Hex is shorter • … Binary is difficult to work with/Hex easier to work with • Hex can be easily converted to/from binary / 1 hex digit per nibble • Hex is less susceptible to error	3	

Question			Answer/Indicative content	Mark	Guidance
8	a		10111111	1	
8	b		1 mark per nibble 1100 0110	2	

Original question 2

The full source mark scheme begins on page 25. Use the original paper code, tier and question number shown above.

5	**(a)**	**(i)**	• 1000 0100	2	1 mark per nibble. Mark right to left.
5	**(a)**	**(ii)**	• B 5	2	1 mark per hex digit

J276/02 Mark Scheme June 2018

Question			Answer	Mark	Guidance
5	(a)	(iii)	1 mark per bullet, max 1. • 00001101 • Divides by 4	1	Accept 001101 / 1101. Allow any number of leading zeros.
5	(a)	(iv)	1 mark per bullet, max 2. • Left shift • one place	2	Do not accept answers that simply show the number shifted.
5	(b)	(i)	a 1100001 e 1100101	2	1 mark per row. Correct answer only. Do not allow leading zeros.
5	(b)	(ii)	1 mark per bullet, max 2. • Extended ASCII uses **more** bits // ASCII uses **fewer** bits • Extended ASCII can represent **more** characters // ASCII can represent **fewer** characters • … by example (e.g. extended ASCII can represent European symbols / other languages)	2	Allow numbers (e.g. ASCII has 7 bits, Ex. ASCII has 8 bits) for either bullet point but these must be realistic. Bullet point 1 and 2 must be a comparison (e.g. “ASCII is 7 bits” is not enough on its own). Do not accept answers that are technically wrong (e.g. “ASCII does not contain symbols such as ?, !, #”)

<table>
<tr>
<td>5</td>
<td>(e)</td>
<td></td>
<td>1 mark per missing bit
<table>
<tr><th>A</th><th>B</th><th>Q</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>4
AO2 1b (4)</td>
<td>Accept T / True</td>
</tr>
</table>

6	**(a)**	**(i)**	1 mark per bullet to max 6
			
			• Function ticketprice() **defined**
			• … that accepts two parameters and has no other inputs
			• Works out total ticket price for adult (eg adult * 19.99)
			• Works out total ticket price for children (eg child * 8.99)
			• Adds on **correct** booking fee
			• Returns the calculated value.
				6
				AO3 2b (6)
					Bullet points 3, 4, 5 can be awarded even if no mention of a function / parameters (for example, if candidate has inputted the number of tickets needed.
					
					Do not award return value if no attempt at a function. Return mark can be given if a good attempt made at calculating the total, even if this is incorrect.
					
					Allow 2.50 booking fee to be per order or per ticket
					
					Ticket prices must be stored appropriately if needed.
					
					example algorithm
					
					`function ticketprice(numadult, numchild)`
					`  price = (numadult * 19.99) + (numchild * 8.99) + 2.50`
					`  return price`
					`end function`
					
					Allow alternatives in high level languages (e.g. def in Python).
					
					Allow return as assigning the value to the name of the function (VB syntax)

6	**(a)**	**(ii)**	1 mark per bullet to max 2 • Real… • …Returned value may not be a whole number / may have a decimal point in	2 AO2 1a (1) AO2 1b (1)	Allow String only if matching justification shows understanding (e.g. £ sign attached, message returned alongside value).

6	**(b)**	**(i)**	1 mark per bullet to max 1 • Check that the code is valid / real • Check it has been entered / sent / received correctly. • Makes it harder for people to make up discount codes	1 AO2 1b (1)	Mark first answer only
6	**(c)**	**(i)**	• Not in order / sorted	1 AO2 1b (1)	Mark first answer only
6	**(c)**	**(ii)**	• Linear (search)	1 AO1 1b (1)	Mark first answer only Allow other valid searching algorithms as long as they work on an unsorted list (e.g front and back search)
6	**(d)**	**(i)**	1 mark per bullet to max 2 • Flag / record whether a swap has taken place or not • checked as condition to decide **whether to repeat**	2 AO2 1b (2)	The variable records whether a swap has taken place; it does **no**t perform the swap.
6	**(d)**	**(ii)**	1 mark per bullet to max 2 • Swaps.. • …values of `queuesize[p]` and `queuesize[p+1]` • …when `queuesize[p]` is larger than `queuesize[p+1]` • using a temporary variable //doesn't overwrite numbers //explanation of process	2 AO2 1b (2)	Do not accept "sorts numbers" "swaps numbers" meets BP1. Explanation of which values in the array are swapped meets BP1 and BP2. Do not accept direct word for word repetition from the program (e.g. `temp = queuesize[p]`) , question asks for an explanation. Explanation of temporary variable must be logically correct.

6	**(d)**	**(iii)**	1 mark per bullet to max 2. • Comments • … to enable programmers to understand the purpose of each line / section • …by example (e.g. on line 4 add the comment…) • Naming variables sensibly • … to enable programmers to understand the purpose of each variable • …by example (e.g. change identifier p to …) • Modularise • …to allow reuse / makes easier to test / reduces errors • …by example (e.g. create as a function)	2 AO2 1a (1) AO2 1b (1)	Mark first answer only Do not accept indentation (already done) Accept “show what each line does” for comments.
6	**(d)**	**(iv)**	1 mark per bullet to max 2. • Insertion (sort) • Merge (sort)	2 AO1 1a (2)	Accept “insert”. Do not penalise spelling. Do not accept bubble sort (given in previous questions) Do not award searching algorithms Allow other valid sorting algorithms. (e.g. quick sort, heap sort, shell sort, selection sort, radix sort, bucket sort, tim sort, comb sort, pigeonhole sort, etc.)

6	**(e)**		1 mark per bullet to max 8.
			
			• Input height
			• Accepts riders > / >= 140 with suitable message
			• Rejects riders < / <= 120 with suitable message
			• Checks if height between 120 and 140…
			• … If True, input whether accompanied
			• … Suitable output message for True AND False
			• Correctly counts number of riders <u>in all cases of being allowed to ride</u> *(do not penalise candidates for counting or not counting accompanying adults)*
			• Attempt to loop based on 8 riders allowed
			
			Some checks for rider height may be implicit (e.g. using ELSE after checking other heights). If the answer logically works to produce the correct output, it should be marked as correct.
			
			Loop will almost certainly be condition controlled (WHILE/DO UNTIL) to gain BP8; count controlled (FOR) loop requires significant manipulation to work successfully.
				8
				AO3 2b (8)
					Answers can be in any suitable format (including pseudocode, flowchart, etc). If flowchart used, accept any sensible shapes.
					
					Do not penalise for lack of initialisation of variables.
					
					Loop must repeat until 8 riders allowed, not just loop 8 times.
					
					Do not credit asking whether accompanied if in the wrong place.
					
					Condition for BP4 may be `120 < h < 140`
					
					<u>Example algorithm</u>
					`riders=0`
					`while riders <8`
					`  input height`
					`  if height >= 140 then`
					`  output "allowed"`
					`  riders = riders + 1`
					`  elif height >=120 then`
					`  input withadult`
					`  if withadult == "yes"`
					`  output "allowed"`
					`  riders = riders + 1`
					`  else`
					`  output "not allowed"`
					`  end if`
					`  else`
					`  output "not allowed"`
					`  end if`
					`endwhile`

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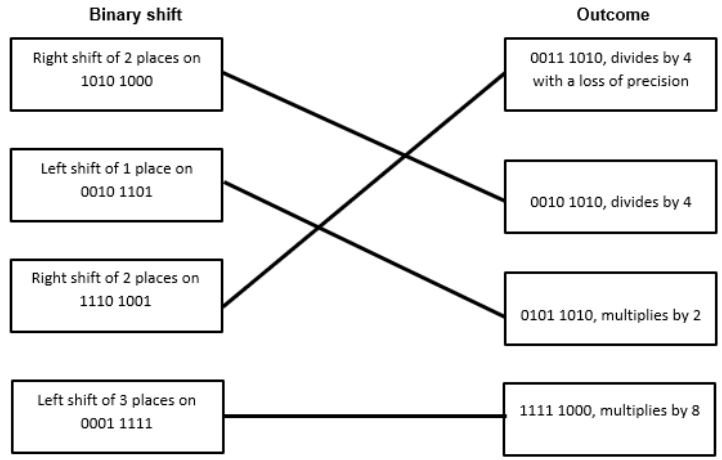
Original question 4

The full source mark scheme begins on page 43. Use the original paper code, tier and question number shown above.

Question			Answer	Mark	Guidance
5	(a)		1011 0010	2	1 mark per nibble. Mark right to left. Must be 8 bits (as per question)
	(b)		• Transistor has two **states** • 1 represents on, 0 represents off • Each transistor stores one bit • Multiple transistors used to store a binary value	2	Allow values for BP1
	(c)		C7	2	1 mark per hex digit, mark from right to left. Max 1 mark if more than 2 characters given.
	(d)		• Incorrect ticked • Data cannot be stored in hexadecimal // all data is stored in binary // hexadecimal is a shortcut for computer scientists	2	1 mark for identifying issue, 1 mark for reason why. Allow FT for BP2 if candidate agrees but provides further clarification that shows they understand.
	(e)			3	3 marks for all connections correctly made 2 marks for 2 or 3 connections correctly made 1 mark for any connection correctly made
	(f)		1100 1100	2	1 mark per nibble. Each pair of nibbles in question can be added individually so no requirement for FT marks.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>1 mark for each row

<table>
<tr><th>File size</th><th>2 megabytes</th><th>2 petabytes</th><th>2 kilobytes</th><th>2 bytes</th><th>2 gigabytes</th></tr>
<tr><td>2000 bytes</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>2000 terabytes</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>16 bits</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>4 nibbles</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
</table></td><td>4</td><td></td></tr>
<tr><td>1</td><td>(b)</td><td></td><td>1 mark for working
e.g. dividing by 2, or writing the powers/values with the binary below, subtracting.

1 mark for answer
11011101</td><td>2</td><td>No FT for answer from working.

Award the working mark if the binary is back-to-front i.e.
1 2 4 8 16 32 64 128
1 0 1 1 1 0 1 1</td></tr>
<tr><td>1</td><td>(c)</td><td></td><td>1 mark for working
e.g. multiplying by 16 (2 * 16 + 15), or converting to binary first (0010 1111)

1 mark for answer
47</td><td>2</td><td>No FT for answers from working.</td></tr>
<tr><td>1</td><td>(d)</td><td></td><td>1 mark for B0</td><td>1</td><td>Correct answer only</td></tr>
<tr><td>1</td><td>(e)</td><td></td><td>16</td><td>1</td><td>Correct answer only</td></tr>
<tr><td>1</td><td>(f)</td><td></td><td>00010001</td><td>1</td><td></td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>a</td><td></td><td>1 mark for:
• Binary is used because computers are made of switches that can only be on or off (box 3)</td><td>1</td><td>Accept cross or other indication as long as clear which one they intend.
2+ ticks = 0 marks</td></tr>
<tr><td>1</td><td>b</td><td></td><td>1 mark for each completed box
<table><tr><th>Denary</th><th>8-bit binary</th><th>Hexadecimal</th></tr><tr><td>7</td><td>00000111</td><td>7</td></tr><tr><td>49</td><td>00110001</td><td>31</td></tr><tr><td>102</td><td>01100110</td><td>66</td></tr><tr><td>244</td><td>11110100</td><td>F4</td></tr></table></td><td>4</td><td>Must be 8-bits.

Ignore case in hex.

Ignore calculations in answer box.</td></tr>
<tr><td>1</td><td>c</td><td></td><td>1 mark for:
• 200MB (box 3)</td><td>1</td><td>Accept cross or other indication as long as clear which one they intend.
2+ ticks = 0 marks</td></tr>
<tr><td>1</td><td>d</td><td></td><td>1 mark for both boxes:
• 4 500 000 bytes (box 1)
4.5 MB (box 3)</td><td>1</td><td>Accept cross or other indication as long as clear which one they intend.
1/3+ ticks = 0 marks</td></tr>
<tr><td>1</td><td>e</td><td></td><td>1 mark each:
• Answer (1) 0 0 0 0 1 1 1 1
• Correct working e.g. carrying (might be above, below etc.)
0 1 1 1 0 0 0 1
1 0 0 1 1 1 1 0
0 0 0 0 1 1 1 1
carries: 1 1 1</td><td>2</td><td>Do not award marking for converting each number to denary and adding them together. If the carries are present, and converting to denary is present – award the carries (conversion can be used to check their answer).
Marks are not dependent.</td></tr>
</table>

1	**f**		1 mark each: • Left shift • 3 places	2	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>3</td><td>a</td><td></td><td>1 mark for each completed space

A character set stores all of the characters that the computer can represent. Each character is given a unique/different binary code.
Lower-case and upper-case letters in a character set are given unique/different/similar binary codes.
One example of a character set is ASCII. This character set uses 8 bits for each character. If the ASCII value for the character 'F' is 70 Then the ASCII value for the character "L" is 76.</td><td>5</td><td>Award the same term used multiple times if used correctly</td></tr>
<tr><td>3</td><td>b</td><td>i</td><td>1 mark:
• Data about the data/image/file</td><td>1</td><td>Question is for a definition, not an example.
If the definition is not clear, for example details about the image, information about the image – this is NE, but read the example to see if it clarifies. For example: 'Information about the image, such as the number of pixels' give a BOD.

Data could be properties/characteristics.</td></tr>
<tr><td>3</td><td>b</td><td>ii</td><td>1 mark each:
• First row: red red purple
• Remainder correct and in correct order

<table><tr><td>red</td><td>red</td><td>purple</td></tr><tr><td>blue</td><td>green</td><td>blue</td></tr><tr><td>purple</td><td>purple</td><td>purple</td></tr><tr><td>red</td><td>green</td><td>blue</td></tr></table></td><td>2</td><td>Ignore case/spelling as long as legible.

If a candidate has completed the table in the incorrect layout e.g. right to left, or bottom to top, then award MP2 as a FT if they have done it all correctly.</td></tr>
<tr><td>3</td><td>b</td><td>iii</td><td>16</td><td>1</td><td>Accept any calculation that equates to 16 i.e. 2^4</td></tr>
</table>

3	**b**	**iv**	1 mark each to max 2: • The **quality** of the image can be improved • The **file** size will increase // takes up more **storage** space // image has/requires/takes up more data • The number of colours that can be represented/used will increase // BOD more colourful	2	Do not award higher resolution, image size increases, clearer image (NBOD) more detailed image (NBOD). Closer to original is NE on its own because there is not an original image in this context. Mark first answer in each answer space.

3	**c**	**i**	1 mark for lossless
			
			1 mark each to max 2 for justification:
			e.g.
			• Lossless will not remove any **data**
			// No **data** is lost with lossless
			// **File**/**data** can be fully reconstructed back to the original
			• Text files require all data to open/be used/work
			// text files will not work if any data is lost
			// lossy cannot (usually) be used on text files
			// none of the required characters / words / spaces / case / formatting / information would be lost
			// the text will remain accurate
			// the text will not have changed meaning
			// the text will still make sense
				3	Do not award an example of lossless for 1st mark (e.g. RLE), but FT for justification.
					
					Do not FT for lossy.
					
					Accept reverse for answers e.g. Lossy will remove data.
					
					If compression type is missing, read justification and if clearly stated which type is used then award justification.
					
					MP1 requires reference to the data (or equivalent) not information.
					MP2 requires reference to the text file context and information is allowed.
					
					If not valid compression – 0 marks.

3	**c**	**ii**	1 mark for lossy 1 mark each to max 2 for justification e.g.: • Will reduce the **file size more/significantly** (than lossless) • Image will only lose **quality** // changes may **not be noticed** by the user // remove **unnoticeable/unnecessary** detail/content	3	Do not award an example of lossy for 1st mark (e.g. reduce resolution), but FT justification. Do not award lossless but FT for justification for lossless: e.g. • Quality/detail of the image can be retained • No data will be lost (permanently) • File size may still be a substantial reduction If compression type is missing, read justification and if clearly stated which type is used then award justification. Do not award how the file can be compressed e.g. reduce number of colours – unless they also state that this change will not be noticed. MP1 it compresses the file more is NE – compression is in the question, the candidate needs to explain what this means. If not valid compression – 0 marks.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>a</td><td></td><td>1 mark each
<table><tr><th>8-bit Binary</th><th>Denary</th></tr><tr><td>11110000</td><td>240</td></tr><tr><td>01101001</td><td>105</td></tr><tr><td>00011110</td><td>30</td></tr></table></td><td>3</td><td>Binary must be 8-bits</td></tr>
<tr><td>1</td><td>b</td><td></td><td>1 mark each
<table><tr><th>Statement</th><th>Answer</th></tr><tr><td>The smallest denary number that can be represented by a 4-bit binary number.</td><td>0</td></tr><tr><td>The largest denary number that can be represent by a 6-bit binary number.</td><td>63</td></tr><tr><td>The maximum number of different colours that can be represented with a colour depth of 7-bits</td><td>128</td></tr><tr><td>The minimum number of bits needed to represent 150 different characters in a character set.</td><td>8</td></tr></table></td><td>4</td><td>Accept calculations that equate to the same answer.

Accept any number of 0s for the first answer.</td></tr>
<tr><td>1</td><td>c</td><td></td><td>11110000</td><td>1</td><td>Ignore leading 0s</td></tr>
</table>

1	d		1 mark for an example 2-digit hex number **correctly** converted into denary. 1 mark each to max 2 for describing/showing each stage. Either: Multiplying: • **Multiply** the **left/first** digit by **16** • **Add** value of **second** digit (without additional calculation) Or: Converting: • Convert each digit into **4-bit binary** • Combine and convert the **8-bit binary** to denary	3	No marks for converting denary to hex. If the example has an inaccurate result, for example they have converted A to 11. They can still get the method marks. No requirement to show how letters are used.
1	e		1 mark for correct working (4 carries) 1 mark for answer 01111010 Working showing carries e.g. 01101011 00001111 01111010 1 1 1 1	2	Do not award working mark for conversion to denary and back. Carries must be on the correct values, but could be above, below etc.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>5</td><td>(a)</td><td></td><td>1 mark for 2000000MB (last one)</td><td>1</td><td></td></tr>
<tr><td>5</td><td>(b)</td><td></td><td>1 mark for each completed box
<table>
<tr><th>Denary</th><th>8-bit Binary</th><th>2-digit Hexadecimal</th></tr>
<tr><td>38</td><td>00100110</td><td>26</td></tr>
<tr><td>78</td><td>01001110</td><td>4E</td></tr>
<tr><td>156</td><td>10011100</td><td>9C</td></tr>
<tr><td>215</td><td>11010111</td><td>D7</td></tr>
</table></td><td>4</td><td>Correct answers only – binary must be 8 bits.</td></tr>
<tr><td>5</td><td>(c)</td><td></td><td>1 mark for working all 3 carries.
1 mark for binary answer
e.g.
0 1 1 1 0 0 1 1
+ 0 0 1 1 0 1 0 0
1 0 1 0 0 1 1 1
1 1 1</td><td>2</td><td>Do not award conversion to denary as the only working.</td></tr>
<tr><td>5</td><td>(d)</td><td></td><td>1 mark for 00011101 (first one)</td><td>1</td><td></td></tr>
<tr><td>5</td><td>(e)</td><td></td><td>1 mark each
• Left shift
• 3 places</td><td>2</td><td>No marks for contradictions e.g. “shifting to left or right”</td></tr>
</table>

OCR
Oxford Cambridge and RSA

GCSE

Computing

Unit **A451**: Computer systems and programming

General Certificate of Secondary Education

Mark Scheme for June 2017

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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A451 **Mark Scheme** **June 2017**

Annotations

Annotation	Meaning
	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
	Omission mark
	Benefit of doubt
	Subordinate clause/Consequential error
	Cross
	Expansion of a point
	Follow through
	Not answered question
	Benefit of doubt not given
	Point being made
	Repeat
	Slash
	Tick
	Too vague
	Zero (big)

A451 **Mark Scheme** **June 2017**

MARK SCHEME

Question			Answer / Indicative Content	Mark	Guidance
1	a		1 mark per bullet to max 2 • Hardware • Software • Allows for input, process and output	2	All of input, process and output required for third bullet. Do not accept examples of hardware/software.
1	b	i	Input: to allow instructions/data/commands/destination to be input/entered/given/example (e.g. entering a post code)	1	Do not accept "information".
1	b	ii	1 mark for input device, 1 for sensible use of device e.g. • Microphone… • …to let the user say their destination/voice recognition • Touch screen… • …let the user press options/enter data • Keyboard / braille keyboard… • …to let the user enter their destination • Camera… • …to let the user enter/select options by moving their eye/use an eye typer • Puff/suck switch… • …to allow the users to select options	2	Allow any reasonable **input** device, do not accept software e.g. voice recognition. Do not accept "sensor" without detailing what type of sensor. Accept "braille keyboard" but do not accept "braille" on its own. Accept buttons. Second mark is awarded for a sensible use of the device – for example, what is inputted (eg the destination) or how it is inputted (eg inputted using your voice). If input device is incorrect, do not award follow on mark for use.
1	c	i	1 mark for why, 1 for application • Long term/permanent/non-volatile/persistent storage • Store maps//user preferences//journey history//operating system//sat nav software	2	Second bullet point must be related to the sat nav, not just generic "programs" or "data".

A451 **Mark Scheme** **June 2017**

1	**c**	**ii**	1 mark for identifying the reason why solid state was chosen, 1 for explanation e.g. • Is durable/robust//no moving parts • Less likely to be damaged//by example (eg dropped) • Faster <u>read/write speed</u> • Faster to boot//faster to load maps//more responsive • Small in size/light in weight • Reduces size of the sat nav// fit inside the sat nav • Lower power requirements • More suitable for running off batteries	**2**	Do not accept portability / reliability. Do not accept "faster" without clarification of what is faster.
1	**d**	**i**	1 mark per bullet to max 1 • <u>Fetch data/instructions</u> • <u>Decode data/instructions</u> • <u>Execute instructions</u> • Performs fetch-(decode)-execute cycle • Performs calculations/arithmetic/logical operations	**1**	Must include fetch / decode / execute as verb for first three bullet points. Must include reference to either data or instructions. Allow reference to tasks carried out by the Control Unit.
1	**d**	**ii**	1 mark per bullet to max 2 • Computers are made of logic gates/transistors/switches… • …which can only be two states / on or off / 1 or 0 /high or low	**2**	Second point dependent on first bullet point being awarded.

<table>
<tr><td>2</td><td>a</td><td>i</td><td>1 mark
e.g.
• Tags
• Hyperlinks
• Location/dimensions/name of images/videos/sound
• Structure / e.g. table
• Layout instructions
• Formatting e.g font/colour/style
• Metadata</td><td>1</td><td>Accept any valid item that could be in a HTML file e.g. a link to a CSS file

Accept other languages/scripting that could embedded into a HTML document, eg CSS/Javascript/etc.

Do not accept: image, video etc. The HTML file holds a link to the files, not the actual image or video itself.

Mark first answer only.</td></tr>
<tr><td>2</td><td>a</td><td>ii</td><td>1 mark per bullet to max 2
• All webpages are made using HTML
• All browsers read/understand HTML
• Allows for compatibility
• Allows devices to understand the same code/display the webpage correctly</td><td>2</td><td></td></tr>
<tr><td>2</td><td>b</td><td>i</td><td>1 mark for getting 1 correct
2 marks for getting both correct
<table><tr><td></td><td>Red</td><td>Green</td><td>Blue</td></tr><tr><td>Decimal</td><td>111</td><td>58</td><td>156</td></tr><tr><td>Hexadecimal</td><td>6F</td><td>3A</td><td>9C</td></tr></table></td><td>2</td><td></td></tr>
<tr><td>2</td><td>b</td><td>ii</td><td>1 mark per bullet to max 1
• Easier to remember/to enter/to read
• Faster to enter/read
• Fewer digits to remember/to enter/to read
• Less prone to error when entering/reading/communicating
• Quick to convert into binary</td><td>1</td><td>Do not accept “easier to understand”

“Less prone to error” requires further detail as shown.</td></tr>
</table>

2	**c**		1 mark per bullet to max 2 • Compression makes the file size smaller//takes up less space (on Shannon's computer) • File(s) upload more quickly / lower bandwidth required • File(s) take up less storage space on the web server • File(s) can be downloaded/streamed more quickly by the end user//website will load more quickly	**2**	
2	**d**		1 mark per bullet, to max 3 • URL/domain name is sent to the DNS • DNS has a list/database/table of URLs **and** matching IP addresses. • DNS looks up/translates/resolves/searches/finds the IP address • DNS sends back IP address (to web browser) • If not found, refers to higher/other DNS/returns error • DNS updates from other DNS • Browser uses IP address to retrieve webpage / connect to web server.	**3**	Do not accept "each URL has an associated IP address" on its own.

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3	**a**		1 mark for each pseudocode statement
			
			`Total = Total + NumberArray(`**`Count`**`)`
			
			`Mean =` **`Total/Quantity`**
			`or`
			`Mean =` **`Total/Count`**
			`or`
			`Mean =` **`Total/10`**
				2	Ignore capitalisation.
					
					Accept any correct symbol or structured English meaning division for mean calculation.
					
					Accept mean calculations that refer to 11 numbers:
					e.g.
					• Total/11
					• Total/(Count+1)
					• Total/(Quantity+1)

3	**b**		1 mark per bullet, max 2 for definition, 1 for example Definition: • A location in memory • A value/data that cannot be changed (whilst the program is running) Example: • `Quantity`	**3**	0 marks for "stays the same" / “does not change”. Must have the idea that it cannot / is impossible to change. Correct answer only (“Quantity”) for the example. Do not accept other surrounding code (eg “Const Quantity = 10” is incorrect). Do not accept incorrect spellings. Ignore capitalisation. Do not accept “a constant is a variable that…”
3	**c**		1 mark for data type, 1 for justification Data type: Real/Float/Single/Double/Decimal Justification: can be decimal/fractional/not a whole number	**2**	If candidate uses “decimal” as data type, do not accept “can be decimal” for the justification. Do not award justification if data type is incorrect.
3	**d**	**i**	1 mark per bullet, to max 2 • A construct • Code is executed/run repeatedly//is looped • Until a condition is met/while a condition is true/a set number of times	**2**	Do not accept only an example (eg “for loop”).
3	**d**	**ii**	• While/do while • Repeat/ Repeat until/do until/ Until	**2**	Do not accept “do loop”.

3	**e**		1 mark for sensible borderline data, 1 mark for sensible invalid data. • Borderline – 0, 100 • Invalid – number less than 0 (eg -1, -12) / number more than 100 (eg 101, 206) / non-numeric data (eg “test”, “#!*%”)	**2**	
4	**a**		1 mark per bullet to max 2 • The data is stored permanently / is unchanging / remains when the DBMS or application is closed / non-volatile / on secondary storage • The data has a structure / stored in tables / fields / records	**2**	Accept rows / columns as alternative to records / fields for second bullet point.
4	**b**	**i**	1 mark for data type, 1 for justification Data type: Text/String Reason: leading 0s/will not be treated as a number	**2**	Accept Alphanumeric/Varchar/Char as alternatives for Data type. Do not award reason if data type is incorrect.
4	**b**	**ii**	4	**1**	Correct answer only.
4	**b**	**iii**	1 mark for Field name, 1 for reason Field: RequestID Reason: it will be unique/each request will have a unique number/it will not be repeated/other fields can be repeated	**2**	Do not award reason if field is incorrect. Do not penalise incorrect spelling or capitalisation.
4	**c**	**i**	Max 1 mark per validation rule. Both rules must be different, e.g. cannot both be presence TeacherID e.g. • Presence check//must be entered • Format check//must be letters then numbers • Existence check//must already exist in the database • Lookup//must be selected from a list of valid teachers • Type/character check//must be string • Length check//must be (minimum of) 3 characters long	**2**	Accept any reasonable validation rule for a field Accept name of a rule, or example Mark first answer only if candidates have provided multiple validation techniques for each.

			Date e.g. • Range check//must be within certain dates • Presence check//must be entered • Format/character check//must be DD/MM/YYYY • Type check//must be a valid date • Length check//must be 8/10 characters • Lookup/existence check//must be a valid date (eg from calendar)		
4	**c**	**ii**	3 marks for each feature, 1 for identifying, 1 for description, 1 for example use e.g • Query • Use to select specific information // find records that match a criteria // search for records // extract data • e.g. Find all requests made on a specific date • Form • User friendly way to enter data // uses drop down boxes etc. • e.g. form to enter a new request • Report • User friendly/formatted copy of results // can be used as a hard copy // method of outputting data • e.g. report of all requests made by one teacher for printing • Security • Stop unauthorised access or modification • e.g. usernames and passwords	**6**	The feature identified must be a feature of a DBMS and not a database. Allow any sensible example that relates to this database. If feature is incorrect, do not award marks for description or example. If feature is poorly identified (eg search instead of query), give credit for matching description / example but not for identification. Mark feature/description/example together. Allow table creation / editor / modules / integrity checks / access control / concurrent access / creating links between tables. Do not accept validation (in the question) Do not accept tables / fields/ key fields (all features of a database, not a DBMS).

5*			Points may include: Ethical issues: • Safer driving as no room for human error • Can machines make snap judgements, taking into account all factors – can impact safety • Cars can react to the facts, i.e. avoid accidents • Can record where people go and when they go – how is this data going to be stored, or used? • Impact on pollution (negative and positives) • Impact on employment (taxis / delivery drivers) Legal issues: • Cars will not break traffic laws, e.g. run red lights • Issues with who is legally the driver • Is a drivers' licence needed? • Who is legally liable/responsible in an accident? • Insurance requirements • Data Protection issues with data generated • Possibility of "hacking" into cars • May need to change or adapt existing laws Many points can be considered from both an ethical and legal point of view. Candidates may refer to other valid scenarios of automated technology, not just driverless cars.	**6**	**High Level Response (5-6):** A detailed discussion of at least one ethical and one legal issue, with clear explanations that are linked to the scenario. There will be few if any errors in spelling, grammar and punctuation. Technical terms will be used appropriately and correctly. **Medium Level Response (3-4):** A description of an ethical and/or a legal issue with some explanation/justification that may be weak at times. Material may not be explicitly linked to the context. There may be occasional errors in spelling, grammar and punctuation. Technical terms will be mainly correct. **Low Level Response (1-2):** There is an attempt to describe either a legal issue or ethical issue. The points are poorly expressed or are not related to the context. There is limited, if any, use of technical terms. Errors in grammar, punctuation and spelling may be intrusive. 0 marks, response not worthy of credit

A451 **Mark Scheme** **June 2017**

6	**a**		Max 2 per explanation, 1 for example e.g. • Share files between computers/employees // by example • Centralised data storage // by example • Allows for collaborative working // by example • More efficient working practices // by example • e.g. OCR Accounts use a shared drive to share work • Share devices / printers / routers // by example • Fewer peripherals / printers required// by example • Save money in purchasing equipment// by example • e.g. OCR Accounts only needs 1 printer, rather than 1 per employee • Improved communication // by example • Can use e-mail/other appropriate means // by example • e.g. OCR Accounts can e-mail documents/work • Central management of security // by example • Anti-virus/firewall/security is configured for all computers // by example • e.g. each computer at OCR Accounts does not need its own security • Centralised backups // by example • Can backup all computers automatically // by example • e.g. OCR Accounts can backup data for all staff • • Centralised updates // by example • Can update all computers at the same time // by example • e.g. OCR Accounts can update software without having to visit everyworkstation.	**6**	Accept any other reasonable benefit for using a network in this scenario, except for monitoring. Mark question as a whole. 3rd mark is awarded for example linked to the scenario, so max 2 per benefit if no example given.

A451			Mark Scheme		June 2017
6	b	i	Modem/Router	1	

6	**b**	**ii**	max 2 marks per hardware device e.g. • NIC… • …to connect Ethernet cable to computer • Router… • …to receive and transmit data within the network/to send data around a network/to join networks together/to connect to the Internet • Bridge… • …connect networks together • Switch… • …to connect multiple devices together / directs traffic to its destination. • Hub… • …to connect multiple devices together. • Server… • …to store the data/manage the network/store backups • Wireless Access Point/WAP… • …to allow for wireless transmission of data • Cables… • …to connect devices together • Modem… • …to connect computers via telephone lines // to covert digital data to analogue / to convert analogue data to digital.	**4**	Accept any hardware device that can be used to create/set up/produce a network. Device must be different than answer given in 6bi Accept repeater / range extender / powerline adaptor etc.

6	**c***		Points may include:
			• Acceptable use
			  ○ Define what employees can/cannot do on a network
			  ○ Restrict employees to only performing work tasks
			  ○ Stop illegal activities such as accessing inappropriate material, downloading software
			• Disaster recovery
			  ○ A plan in case something happens to the computers/network/data
			  ○ A plan to allow recovery to avoid downtime/restore the network/data
			• Failover
			  ○ Backup devices ready to automatically take over if a device fails
			  ○ Allows the company to continue working
			  ○ Avoids downtime
			• Backup
			  ○ A plan for when data is backed up
			  ○ How it is backed up
			  ○ Who is responsible for it
			  ○ Where it is backed up etc.
			• Archiving
			  ○ Removing old data that is no longer needed but kept in case needed
			  ○ Free up memory space in a computer
			  ○ Plan of when data will be archived, what will be archived etc.
			• Security
			  ○ Levels of access
			  ○ Usernames / passwords / authentication
			  ○ Encryption
				6	**High Level Response (5-6):**
					A detailed discussion of network policies, covering points from at least **two** different policies, with clear explanations of purpose that are linked to the scenario.
					There will be few if any errors in spelling, grammar and punctuation. Technical terms will be used appropriately and correctly.
					
					Medium Level Response (3-4):
					A description of some network policies, covering points from at least **two** policies, with some explanation/justification that may be weak at times. Material may not be explicitly linked to the context. There may be occasional errors in spelling, grammar and punctuation. Technical terms will be mainly correct.
					
					Low Level Response (1-2):
					There is an attempt to describe at least **one** network policy. The points are poorly expressed or are not related to the context. There is limited, if any, use of technical terms. Errors in grammar, punctuation and spelling may be intrusive.
					
					0 marks, response not worthy of credit

7			1 mark per bullet:
			• Storing a number for the user to guess
			• Loops 10 times correctly
			• Inputs the user's guess
			• If correct, outputs congratulations **and** stops the loop / ends the game (any appropriate method of breaking out of loop)
			• If the guess is greater than stored number, outputs lower (or similar)
			• If the guess is lower than stored number, outputs higher (or similar)
			
			e.g. using while loop
			`num = 50 //(could be a random number)`
			`x = 0`
			`while x < 10`
			`  input guess`
			`  if guess == num then`
			`  output "Congratulations"`
			`  x = 10`
			`  elseif guess > num then`
			`  output "lower"`
			`  else`
			`  output "higher"`
			`  endif`
			`x = x + 1`
			`end while`
			
			e.g. example using for loop
			`num = 50 //(could be a random number)`
			`for x = 1 to 10`
			`  input guess`
			`  if guess == num then`
			`  output "Congratulations"`
			`  end //(could be break / exit, or x = 10)`
			`  elseif guess > num then`
			`  output "lower"`
			`  else`
				6	Allow pseudocode, flowchart, or structured English as long as it is not just repeating the instructions and where it meets the bullet points.
					
					If candidate uses FOR loop, accept 0 to 9 / 0 to 10 / 1 to 10 / 1 to 11 (or equivalent) as valid for 2nd bullet point.

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			output "higher" endif next		

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PART OF THE CAMBRIDGE ASSESSMENT GROUP

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PMT

GCSE (9–1)

Computer Science

J276/02: Computational thinking, algorithms and programming

General Certificate of Secondary Education

Mark Scheme for November 2020

Oxford Cambridge and RSA Examinations

PMT

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations

Annotation	Meaning
SEEN	Answer seen – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
	Omission mark
	Benefit of doubt
	Cross
	Follow through
	Not answered question
	Benefit of doubt not given
	Repeat
	Tick

Each question must include annotation. All marks credited on point-based marking must be given a tick.

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<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>1 mark for each letter

<table><tr><td>Decomposition</td><td>D</td></tr><tr><td>Abstraction</td><td>B</td></tr><tr><td>Input Sanitisation</td><td>A</td></tr><tr><td>Casting</td><td>F</td></tr></table></td><td>4

AO1
1a(4)</td><td>Accept answers that write the definition instead of the letter.</td></tr>
<tr><td>1</td><td>(b)</td><td>(i)</td><td>• <code>timer = 7.3</code></td><td>1

AO3
2b(1)</td><td>Ignore dim / define / etc and data types
Do not allow use of string delimiters or other unsuitable data types.
Allow other suitable assignment symbols (e.g. :=) Do not allow == for assignment.
Do not penalise case. Spelling must be accurate</td></tr>
<tr><td>1</td><td>(b)</td><td>(ii)</td><td>• Real // Float</td><td>1

AO2
1b(1)</td><td>Allow decimal, single, double or equivalent</td></tr>
<tr><td>2</td><td>(a)</td><td></td><td><table><tr><td>Line</td><td>Program code</td><td>Output</td></tr><tr><td>08</td><td><code>print score</code></td><td>18</td></tr><tr><td>09</td><td><code>print "name"</code></td><td>name</td></tr><tr><td>10</td><td><code>print newscore(score,2)</code></td><td>37</td></tr><tr><td>11</td><td><code>print score</code></td><td>18</td></tr></table></td><td>4

AO2
1b(4)</td><td></td></tr>
</table>

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2	**(b)**		1 mark per bullet to max 2 • **Easier/quicker** for humans to **write** • **Easier/quicker** to **read / understand / remember** • **Easier/quicker** to **maintain / debug / spot errors** • …because code is closer to English / uses English words • Less code to write • …because one HLL instruction represents many assembly instructions • Portable (between processors) // will work with different types of computer	2 AO1 1b(2)	Accept “human language” as English for BP4 “Easier to use” is too vague.
2	**(c)**		1 mark per bullet to max 2 • Each character (in character set) has a **unique** (binary) number/value • Each character in the **string** is assigned its associated number/value • The (binary) value of each character is stored/combined (in order) • … by example e.g. The binary value for D, then for r, then for u • Uses ASCII/Extended ASCII/Unicode	2 AO2 1a(2)	

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Question			Answer	Mark	Guidance

3	(a)	(i)	1 mark per bullet to max 2
			e.g.
			• Check the program meets the **user requirements**
			• Check the program works (as intended) // detect logic / syntax errors
			• Check the program does not crash (under invalid entry) // check error messages are suitable
			• …allow these errors to be fixed
			• …make sure there are no problems when released
			• Any suitable example **related to the vending machine** e.g. gives correct change
				2
				
				AO1 1b(2)
					Allow two any suitable examples for two marks
					
					BOD "find errors", "find bugs" for BP2
					
					"fix errors" by itself is one mark (BP4)

3	(a)	(ii)	1 mark per bullet to max 2 • Iterative is during development // repeatedly testing after/while making changes • Final is when the development is (almost) complete // done after iterative testing	2 AO1 1b(2)	Do not accept just "repeatedly testing" for iterative BOD "iterative testing tests modules/sections"
3	(a)	(iii)	<table><tr><th>Code entered</th><th>Money inserted</th><th>Expected result</th></tr><tr><td></td><td></td><td></td></tr><tr><td>**C2**</td><td></td><td></td></tr><tr><td></td><td>**£0.49** **(or any value less that £0.50)**</td><td></td></tr><tr><td></td><td></td><td>**Invalid Selection** **(or any suitable error message)**</td></tr></table>	3 AO3 2b(3)	For £0.49 accept any value <£0.50. Must be a specific value, not a description. Accept any suitable error message for invalid selection

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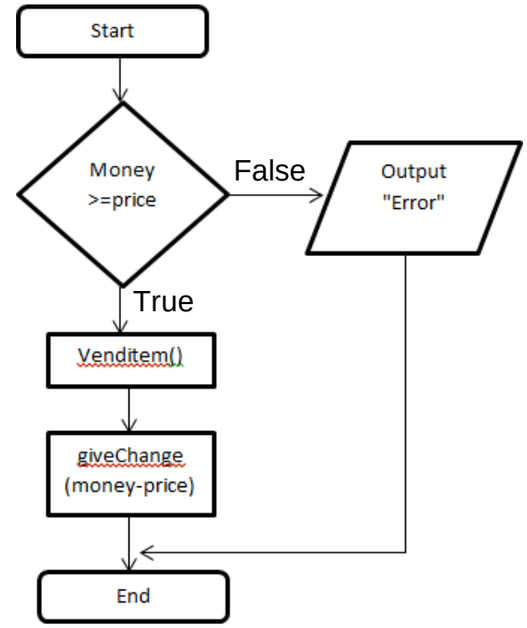
3	**(b)**	**(i)**	• `money` • `price`	1 AO1 1b(1)	Must be an identifier, not description. Ignore case.
3	**(b)**	**(ii)**	• one	1 AO2 1b(1)	
3	**(c)**		1 mark per bullet • Checking if `money>=price`… • …decision (diamond shape) used • …`venditem()` and `giveChange(money-price)` if True/Yes • …output an error if False / No • Terminator used to start and end the program and all paths terminated	5 AO3 2b(5)	Reasonable attempt at BP1 needed for credit BP2, 3 and 4 Ignore other additional code. BP3 and BP4 must follow on from True/False // Yes/No decision to be credited. Subroutines names and parameters must be correct. Ignore missing brackets on `venditem`. 

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Question			Answer	Mark	Guidance
3	d	i	1 mark per bullet to max 2 • Indentation // whitespace • Appropriately named variables / identifiers • Modularisation / use of subroutines	2 AO2 1b(2)	
3	d	ii	• Comments • Use of constants	1 AO2 1b(1)	
3	e		• `SELECT ItemCode // *` • `FROM ITEMS` • `WHERE` • …`Stock < 10`	4 AO3 2b(4)	Accept other fields shown in addition to `ItemCode` Accept `Stock <=9` / etc. Ignore case. Spelling of fields and table must be correct. If `WHERE` missing, `Stock < 10` must be after `FROM` clause.

3	f		1 mark per bullet
			• Input from user
			• Check IF input value is "**on**"…
			• … if so, assign **1** to `statevalue`
			• Correct assignment of **2 for "off"** and **3 for "suspended"** with correct state and `IF`
			• Correct logical check (else) to output "invalid state" <u>if no state set</u>
				5
				
				AO3
				2b(5)
					Accept alternative error messages. Variable names must not include obvious spaces.
					
					BP3 dependent on BP2. BP2 and BP4 must be a logical comparison using `IF` and not just the CASE statement. NE to simply replace CASE with `IF`.
					
					Penalise each error once then apply FT.
					
					e.g.
					`newstate = input("Enter the new state : ")`
					`if newstate == "on" then`
					`  statevalue = 1`
					`elseif newstate = "off" then`
					`  statevalue = 2`
					`elseif newstate = "suspended"`
					`  statevalue = 3`
					`else`
					`  print("Invalid state")`
					`endif`

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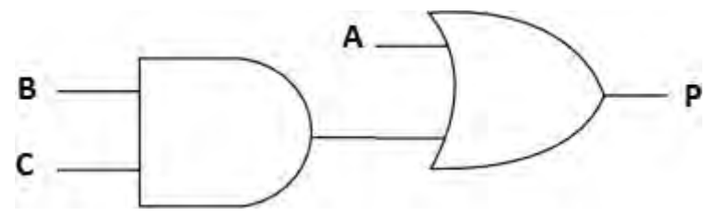
4	**(a)**		• E 3	2 AO1 1b(2)	1 mark per digit (mark right to left) Max 1 if any additional leading values
4	**(b)**		• 0110 1001 must be 8 bits	2 AO1 1b(2)	1 mark per nibble (mark right to left). Max 1 if any additional leading values
4	**(c)**		1 mark per bullet to max 2 • Easier/quicker to communicate / enter / write / read / remember • Less chance of input errors // easier to spot errors • They are smaller / shorter • Easy to convert between binary and Hexadecimal	2 AO1 1b(2)	Mark response as a whole. Do not accept answers simply describing what hexadecimal is. “easier to understand” or “easier to use” on its own is NE BP3 (smaller) must refer to size when written down, NOT size when stored which is unaffected)
4	**(d)**	**(i)**	• 3	1 AO1 1b(1)	CAO
4	**(d)**	**(ii)**	• 1	1 AO1 1b(1)	CAO
4	**e**		• 00001111	1 AO1 1b(1)	Ignore missing or additional leading zeros
4	**f**	i	1 mark per bullet point • B AND C • OR gate with two inputs, one of which is A • …correct connection of these two gates with no additional gates / connections	3 AO1 1b(3)	Shape must be accurate 

PMT

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4	**f**	ii	1 mark per bullet point • Correct completion of A and B inputs as **1 1** • 0 output for 01 input • 0 output for 10 input • 0 output for 11 input	4 AO1 1b(1) AO2 1b(3)	CAO

A	B	P
0	**0**	**1**
0	**1**	**0**
1	**0**	**0**
1	**1**	**0**

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Question			Answer	Mark	Guidance
5	a		• Number of pixels (in an image) • Height and width (of an image)	1 AO2 1b(1)	Accept pixels per inch / mm / unit area (density)
5	b		• 90 (pixels in an image) // 15 x 6 (pixels in image) • Multiply pixels x bits per pixel • …2 bits required per pixel (because 3 colours) • **180** bits overall answer	4 AO1 1b(2) AO1 1b(2)	Must clearly show multiplication for 3rd BP
5	c		• Reduce number of pixels / resolution • Reduce number of colours • Use lossy compression • Use lossless compression	2 AO2 1a(2)	Accept descriptive answers linked to given logo (e.g "change to black and white only") “Make image smaller” is NE Allow compression by itself for one answer.
5	d	i	• Data about data / the image/file // properties of the file	1 AO1 1b(2)	Do not accept examples without a definition.
5	d	ii	e.g. • height • width • colour depth • resolution • geolocation • date/time **created/last edited //** timestamp • file type • author details	1 AO1 1a(2)	Accept any sensible data that could be stored alongside an image. Do not accept filename
6	(a)		• Access “Rob” / studentnames[0]… • …does **not** equal “Anna” // not desired item // move on • Access “Anna” / studentnames[1] • …does equal “Anna” // stop // item found	4 AO2 1b(4)	Answer must refer to this array, not a generic description of linear search. “Access first item” is NE for BP1 or BP3. Must refer to this scenario. Max 1 for “Compare ‘**Anna**’ to **each item** in list” if nothing else credited.

J276/02 Mark Scheme November 2020

<table>
<tr>
<td>6</td>
<td>(b)</td>
<td></td>
<td>
• Anna inserted before Rob as first two elements…
• …Huw correctly inserted into sorted list…
• …Emma correctly inserted into sorted list …
• …Patrice correctly inserted into sorted list …
• …Iqbal correctly inserted into sorted list and no further changes made.
</td>
<td>5

AO2
1b(5)</td>
<td>
<table>
<tr><td>Rob</td><td>Anna</td><td>Huw</td><td>Emma</td><td>Patrice</td><td>Iqbal</td></tr>
<tr><td>Anna</td><td>Rob</td><td>Huw</td><td>Emma</td><td>Patrice</td><td>Iqbal</td></tr>
<tr><td>Anna</td><td>Huw</td><td>Rob</td><td>Emma</td><td>Patrice</td><td>Iqbal</td></tr>
<tr><td>Anna</td><td>Emma</td><td>Huw</td><td>Rob</td><td>Patrice</td><td>Iqbal</td></tr>
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<tr><td>Anna</td><td>Emma</td><td>Huw</td><td>Iqbal</td><td>Patrice</td><td>Rob</td></tr>
</table>
Sorted list highlighted
</td>
</tr>
<tr>
<td>6</td>
<td>(c)</td>
<td></td>
<td>
• Use of iteration (any use) …
• ...loops for each item in array // loops 6 times
• …to print out each item in <code>studentnames</code>
• …input attendance
• Add up/calculate students present and absent
• …Outputs present and absent (in suitable message)
</td>
<td>6

AO3
2b(6)</td>
<td>
BP 2 and 3 may be met together with suitable input statement. Both dependent on attempt at iteration.

BP5 not dependent on correct previous parts.

BP6 needs reasonable attempt at totalling present and absent figures.

Ignore non-initialisation of counter variables.

Flowcharts are acceptable but must show how to solve the problem, not simply repeat the question.

<u>Example algorithm</u>

<pre>
present=0
absent=0
for i = 0 to (studentnames.length) -1
    print(studentnames[i])
    attendance=input("absent or present?")
    if attendance=="present" then
        present=present+1
    else
        absent=absent+1
    endif
next i
print ("Present students: " + present)
print ("Absent students: " + absent)
</pre>
</td>
</tr>
</table>

PMT

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Question 1 (a)

1 Computers represent data in binary form.

(a) Tick (✓) **one** box in each row to identify the binary unit equivalent of each of the given file sizes.

File size	2 megabytes	2 petabytes	2 kilobytes	2 bytes	2 gigabytes
2000 bytes					
2000 terabytes					
16 bits					
4 nibbles					

[4]

Candidates needed to calculate each file size into a different binary unit to identify which is the equivalent. This question was often answered well by candidates who were able to accurately identify the equivalent binary units. Most commonly accurate were the 200 bytes into kilobytes and 16 bits into 2 bytes. Fewer candidates converted 2000 terabytes into 2 petabytes.

Question 1 (b)

(b) Convert the denary number 221 into 8 bit binary. Show your working.

.....

.....

.....

..... **[2]**

Candidates were required to convert 221 into binary and to include their working. Most candidates included. Candidates used a range of methods to calculate the 8 bit binary number.

A common method was to write the binary header numbers and then use subtraction from 221.

Some candidates put the binary header numbers the wrong way around, going from left to right, getting the binary number reversed.

Some candidates did not accurately double the binary header numbers each time, including additional numbers such as 24.

Question 1 (c)

(c) Convert the hexadecimal number 2F into denary. Show your working.

.....

.....

.....

..... **[2]**

Candidates needed to convert the hexadecimal number 2F into denary and to show their working. Candidates showed a range of methods, most commonly converting each digit into 4-bit binary and then adding the sum of the final binary number.

Some candidates did not accurately convert F to binary, for example giving 1101 instead of 1111 which then left the final conversion incorrect.

Question 1 (d)

(d) Convert the binary number 10110000 into hexadecimal.

.....

..... **[1]**

This required the conversion of a binary number into hexadecimal. Working was not required to be shown to gain the mark available.

A common error was giving the final hexadecimal number as B, with the 0 missing. As 0 is the right most digit this will alter the value produced. When converting numbers between bases some candidates might find it beneficial to use their final answer to do the reverse calculation as a check. For example, if a candidate got the answer B, they then convert B back into binary which gives them 1011. 1011 does not equate to 10110000.

Question 1 (e)

(e) Identify how many unique values can be represented by 4 bits.

..... **[1]**

There were a range of responses to this question, commonly 15, 8, 4 and 2 were given. Candidates who gave 15 often had calculations to identify the highest number that can be represented in 4 bits; missing the number 0 that can also be represented.

Question 1 (f)

(f) Perform a binary shift of 3 places right on the binary number 10001110.

..... **[1]**

This question was often answered well with many candidates correctly shifting the number. Some candidates attempted to include a binary point to show where the binary numbers moved to. This is not part of the specification and should not be included.

Question 1 (a)

1 Computers represent data in binary form.

(a) Tick (✓) **one** box to identify the statement about binary that is true.

- ☐ Binary digits can only be the values 0, 1 and 2
- ☐ The left-most bit of a binary integer has the smallest value
- ☐ Binary is used because computers are made of switches that can only be on or off
- ☐ The smallest whole number that can be stored in 8 bits is the number 1

[1]

This question required candidates to identify the true statement. Many responses identified that the third statement was true. Statement 1 was incorrect because binary digits cannot include the value 2. Statement 2 was incorrect because the left-most bit is the largest value. Statement 4 was most commonly given as an incorrect choice, the smallest whole number that can be stored in 8 bits is the number 0, not the number 1.

Question 1 (b)

(b) Complete the table by writing the missing denary, 8-bit binary or hexadecimal values.

Denary	8-bit binary	Hexadecimal
	00000111	7
49		31
	01100110	66
244	11110100	

[4]

This question required candidates to translate denary, binary and hexadecimal numbers into each of the other forms.

Many responses accurately converted the 8-bit binary to denary. The binary conversion was often correctly converted. However, some candidates did not include the required 0s at the start to make the answer an 8-bit binary number as required.

The conversion of the third binary number to denary was more challenging. A range of responses were often seen including 114, and conversion to hexadecimal.

The final conversion to hexadecimal was often given inaccurately, for example E4 or F2 being given instead.

Question 1 (c)

(c) Tick (✓) **one** box to identify the largest file size.

- ☐ 2 000 000 bytes
- ☐ 2300 KB
- ☐ 200 MB
- ☐ 0.1 GB

[1]

There were a range of responses given by candidates. Many candidates identified 200MB as the correct response. 2300 KB was commonly given as an incorrect response.

Question 1 (d)

(d) Tick (✓) **two** boxes to identify the two file sizes that are equal to each other.

- ☐ 4 500 000 bytes
- ☐ 450 KB
- ☐ 4.5 MB
- ☐ 0.45 GB

[1]

This question required candidates to work out which of the two file sizes were the same. Candidates had to tick two boxes. Many candidates identified the two correct answers. Correct responses often had working at the side of the answer.

There was a range of incorrect answers given where different combinations were selected.

Question 1 (e)

(e) Complete the binary addition by adding these two 8-bit binary numbers.

Show all your working.

```
  0 1 1 1 0 0 0 1
+ 1 0 0 1 1 1 1 0
-----------------
```

[2]

Candidates were required to complete the addition in binary.

Some responses converted each binary number to denary, added these, and then converted them back to binary. This allowed them to access the final answer mark, but **not** the mark for showing their working. The mark for showing working out required candidates to show how the data was carried.

Some responses correctly identified the inclusion of an overflow. The overflow was not required for the mark this time but is good practice.

Incorrect answers must be clearly crossed out. The new answer must be written clearly and separately. Some candidates overwrite a 1 with a 0, or vice-versa, making it impossible to identify the intended answer.

Question 1 (f)

(f) Identify the binary shift that has been applied to the 8-bit binary number 10110000 to get the result 10000000.

.....

..... **[2]**

This question was often answered well. For full marks, candidates needed to accurately identify that it was a left 3-place shift. Some responses only gave the direction, i.e. left, and did not note the number of marks (2) that can identify the level of response required.

Question 3 (a)

3 Binary numbers can represent different forms of data.

(a) One form of data is characters.

Complete the description of how computers represent characters in binary using the given list of terms. Not all terms will be used.

2	4	8	9	16	32	256	
71	72	74	76	78	80	81	
all	different	identical	one	repeated	similar	some	unique

A character set stores ..... of the characters that the computer can represent. Each character is given a ..... binary code. Lower-case and upper-case letters in a character set are given ..... binary codes.

One example of a character set is ASCII. This character set uses ..... bits for each character. If the code value for the character 'F' is 70 then the code value for the character 'L' is ..... .

[5]

This question required candidates to use the given terms to complete the description of character sets.

Many responses accurately identified that a character set stores all the characters. Some candidates identified each character as being given an identical code or a repeated code. This is incorrect.

The code for L was often given accurately.

The number of bits for each character had a range of responses given, commonly 256 bits for each character. The specification for J277 states that in the exam ASCII will be described as having 8-bits to avoid confusion between ASCII and extended-ASCII, which are not differentiated in the specification.

Question 3 (b) (i)

(b) Binary numbers can also represent images.

The table shows the colours that are used in an image and the binary value for each colour.

Colour	Binary value
Red	0000
Green	0010
Blue	1000
Purple	0110

The metadata states that the image is 3 pixels wide by 4 pixels high.

The data in the file starts in the top left of the image and goes from left-to-right, top-to-bottom.

(i) State what is meant by **metadata** in an image file.

.....

..... **[1]**

This question required a definition of the term metadata and many responses correctly defined it as the data about the image, or the data about the file.

Some candidates used information, for example the information about the file, which was not precise enough - but they often carried on with an example that supported their statement and demonstrated their understanding.

Misconception

A common misconception was that metadata identifies the colour of each pixel in the image.

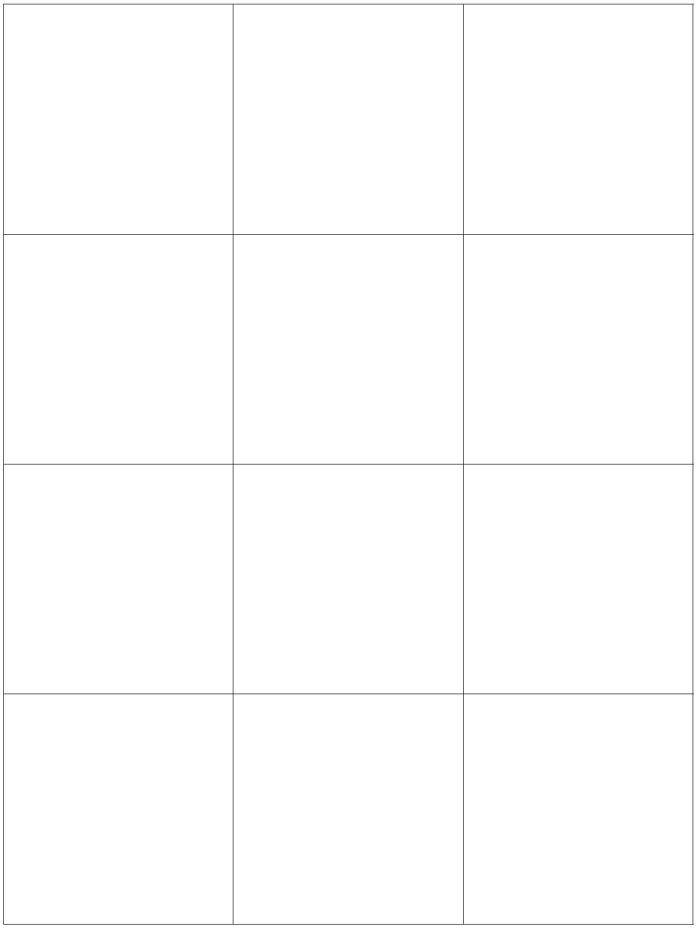
Question 3 (b) (ii)

(ii) The binary data stored for the image is given:

00000000011010000010100001100110011000000010100 0

A grid is given for the image. Each square is one pixel.

Write the name of the colour in each square that the pixel will show for this image.



[2]

This question required candidates to consider the binary number and the binary value for each colour, divide the binary number into groups of 4 bits and match them to the appropriate colour. This was completed accurately by many candidates who were able to match the codes and colours.

The instructions stated that the image starts in the top left, but some candidates started in the bottom right instead.

Some responses did not use the colours provided in the question and created their own colour scheme for the image, commonly just using black and white.

Question 3 (b) (iii)

(iii) A colour depth of 4 is used. This means 4 bits are used to store the colour for each pixel.

State the maximum number of different colours that can be represented in 4-bits.

..... **[1]**

Candidates were required to calculate the number of different colours that can be represented in 4-bits. This was done by working out how many binary numbers can be created using 4-bits. A common error was giving four colours, or in some cases only one or two colours.

Question 3 (b) (iv)

(iv) The colour depth is increased to 2 bytes.

State **two** effects that this change can have on the image.

1 .....

.....

2 .....

.....

[2]

This question was often answered well. Candidates commonly identified that the file size will increase with an increase in colour depth. Some responses also identified that this increase would allow the image to use more colours.

Misconception



A common misconception is that colour depth increases the resolution of the image. This would need to be an increase in the resolution (the number of pixels) as opposed to the number of bits per pixel.

Question 3 (c) (i)

(c) A student has a text document and an image file that need to be compressed separately.

The student needs to reduce the file size of both of these files as much as possible.

(i) Identify the most suitable type of compression for the **text** document. Justify your choice.

Type of compression .....

Justification .....

.....

.....

.....

[3]

Lossless compression was often correctly identified as the type of compression used for text.

Some candidates justified this in context either by explaining why lossless is required for text files, or by explaining why lossy was not appropriate.

Question 3 (c) (ii)

(ii) Identify the most suitable type of compression for the **image** file. Justify your choice.

Type of compression .....

Justification .....

.....

.....

.....

[3]

Many candidates correctly identified that lossy is the most appropriate. Lossless could be used but is not as appropriate in this scenario. Candidates who stated lossy compression were often able to describe how the loss of data would not be noticed, and some responses also identified that the file size could be decreased more.

Candidates that gave lossless were able to gain marks for the justification. However, often candidates could not justify it appropriately, for example by describing how it would be compressed instead of why this was appropriate.

Question 1 (a)

1

(a) The following table has either the binary or denary value of 3 numbers.

Complete the table by converting the 8-bit binary number into denary and the denary number into 8-bit binary.

8-bit Binary	Denary
11110000	
	105
00011110	

[3]

Candidates were often able to correctly convert the numbers between the two forms. The conversion from binary to denary was most commonly accurate with more candidates inaccurately converting from denary to binary.

Question 1 (b)

(b) Complete the table by writing the answer to each statement.

Statement	Answer
The smallest denary number that can be represented by a 4-bit binary number	
The largest denary number that can be represented by a 6-bit binary number	
The maximum number of different colours that can be represented with a colour depth of 7-bits	
The minimum number of bits needed to represent 150 different characters in a character set	

[4]

This question required candidates to consider the storage of denary numbers in binary in ways other than converting them. Candidates commonly gave the correct smallest denary number, although a common error was giving 1 instead of 0. Some candidates used 7-bit or 8-bit binary numbers for the second response or gave the next value of 64. Candidates found the third response more challenging with many giving 256 for an 8-bit binary number or giving the largest value of 127. The final response had the greatest variance of answers ranging from 1, 2 up to 16 or even 32.

Question 1 (c)

(c) Show the result of a left binary shift of 4 places on the binary number 00001111.

..... **[1]**

Candidates often gave the correct response by shifting the digits accurately. Some candidates did not shift the correct number of places, for example moving 3 places.

Question 1 (d)

(d) Describe how to convert a 2-digit hexadecimal number into denary.

Use an example in your answer.

.....

.....

.....

.....

.....

..... **[3]**

Candidates that did well on this question used the example to show how they converted a value from hexadecimal to denary. They included annotations to show what they were doing at each stage. Candidates often chose a hexadecimal value that included a letter. Some candidates chose hexadecimal values that were straightforward to convert, for example A0 where they multiplied 16 by 10 and then added 0. Some candidates chose a more complicated calculation and did not always calculate the correct result.

Question 1 (e)

(e) Add these two 8-bit binary numbers using binary addition.

Show your working out.

```
  0 1 1 0 1 0 1 1
+ 0 0 0 0 1 1 1 1
-----------------
-----------------
```

[2]

Most candidates attempted to show their working, commonly by including the carries in an appropriate place. Where the working was correct the answer was also often accurate. Some candidates converted the binary numbers to denary, added them and then converted the result back into denary. This method allowed them to get the answer but did not gain the working marks.

Question 5 (a)

5

(a) Tick (✓) **one** box to identify the quantity of megabytes that is the same as 2 terabytes.

- ☐ 2000 MB
- ☐ 20 000 MB
- ☐ 200 000 MB
- ☐ 2 000 000 MB

[1]

Candidates were often able to correctly identify 2 000 000 as the correct response.

Question 5 (b)

(b) Each row in the table contains a number that is written as a denary value, 8-bit binary value and a 2-digit hexadecimal value. Some values are missing.

Complete the table by writing in the missing value for each number.

Denary	8-bit binary	2-digit hexadecimal
38		26
	01001110	4E
156	10011100	
215		D7

[4]

Candidates were often able to correctly convert the numbers between the different bases.

Question 5 (c)

(c) Complete the binary addition of these two 8-bit binary numbers.

Show your working out.

$$\begin{array}{r} 0\ 1\ 1\ 1\ 0\ 0\ 1\ 1 \\ +\ 0\ 0\ 1\ 1\ 0\ 1\ 0\ 0 \\ \hline \end{array}$$

[2]

Candidates often gained the correct final answer. Some candidates did this by converting the binary numbers into denary and then converting the result back, which did not gain the working mark for binary addition. Some candidates did not include the final carry in their working, only showing two carries and writing the final carry direct into the position of the most significant bit.

Question 5 (d)

(d) Tick (✓) **one** box to identify the result of a 2-place right binary shift on the binary number 01110111.

- ☐ 00011101
- ☐ 11101110
- ☐ 00111011
- ☐ 11011100

[1]

Candidates were often able to correctly identify the result of the shift.

Question 5 (e)

(e) Describe the binary shift that can be used to multiply any number by 8.

.....

..... **[2]**

Candidates commonly identified that a left shift was required. Fewer candidates identified the correct number of positions with common errors including four or eight positions.