Pearson Edexcel

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Mark Scheme (Results)

Summer 2021

Pearson Edexcel International GCSE
in Computer Science (4CP0_01)
Paper 01: Principles of Computer Science

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question Number	Answer	Additional Guidance	Mark
1(a)	**The only correct answer is B** ***A*** *is not correct because computers only understand binary* ***C*** *is not correct because Hex values will be held as binary so take up the same space* ***D*** *is not correct because Hex values are held as binary and so take the same time to execute*		1

Question Number	Answer	Additional Guidance	Mark
1(b)	Award **one** mark for each of: • 5 • A	Must be in the correct order	2

Question Number	Answer	Additional Guidance	Mark
1(c)	**The only correct answer is B** ***A*** *is not correct because this is the number of binary patterns that can be represented by 7 bits* ***C*** *is not correct because this is the number of binary patterns that can be represented by 9 bits* ***D*** *is not correct because this is the number of binary patterns that can be represented by 10 bits*		1

Question Number	Answer	Additional Guidance	Mark
1(d)	Award **one** mark for each nibble 0110 0101		2

Question Number	Answer	Additional Guidance	Mark
1(e)	Award **one** mark from: • 01000 (1) • 1000 (1)		1

Question Number	Answer	Additional Guidance	Mark
1(f)	7		1

Question Number	Answer	Additional Guidance	Mark
1(g)(i)	Award **one** mark from: • The smallest block (of colour) in an image (1) • A single dot in a picture (1) • A picture element (1) • A single element of a digital screen (1)		1
1(g)(ii)	Award **one** mark from: • 8 x 9 (1) • 9 x 8 (1)	Accept 72	1
1(g)(iii)	4		1

Question Number	Answer	Additional Guidance	Mark
2(a)	Award **one** mark from: • share peripherals/devices (e.g. printers, scanners) (1) • communicate (e.g. email, instant messaging, play games) (1) • share data (e.g. files/music/videos/backups on servers) (1) • deploy/update applications/software(1) • administrative purposes (e.g. remote access/desktop)		1

Question Number	Answer	Additional Guidance	Mark
2(b)	Award **one** mark from: • to allow (connected) machines to communicate (1) • to provide the rules of communication between (networked) devices (1)	Accept any other response indicating protocols enable communication between devices	1

Question Number	Answer	Additional Guidance	Mark
2(c)(i)	**The only correct answer is A** ***B*** *is not correct because FTP is an application protocol, which is added in the application layer* ***C*** *is not correct because FTP is an application protocol, which is added in the application layer* ***D*** *is not correct because FTP is an application protocol, which is added in the application layer*		1
2(c)(ii)	Award **one** mark from: • Adds the source/destination IP address (1) • Establishes sockets (an IP address followed by a port number) (1) • Moves packets onto the next network node (1) • Strips the source/destination IP addresses (when it arrives at its destination) (1) • Passes the packet to the transport/next layer (when it arrives at its destination) (1) • Adds/removes packet headers (1)		1

Question Number	Answer	Additional Guidance	Mark
2(d)	Award **one** mark for each of: **Domain Name** / **IP Address** / **URL** (blank) / (blank) / ✓ (blank) / ✓ / (blank) ✓ / (blank) / (blank)		3

Question Number	Answer	Additional Guidance	Mark
2(e)(i)	Bus		1
2(e)(ii)	Award **one** mark from: • Easy to connect/remove devices/computers (in a network) (1) • Cable cost less / fewer cables needed (compared to mesh/star topology) (1) • Easier to plan/setup/maintain (1)		1
2(e)(iii)	Award **one** mark from: • If the main cable/a terminator fails or gets damaged the whole network will fail (1) • The more workstations the slower it gets (1) • The more workstations the more collisions (1) • Every device 'sees' all of the data on the network (1)		1

Question Number	Answer	Additional Guidance	Mark
2(f)(i)	Award **two** marks from: • Reduces time taken to upload/download (1) • Reduces the bandwidth required/cost of data to upload/download (1) • (Usually) produces smaller file/reduces storage (on the web server/device) (1) • People have a limited hearing range / can't tell the difference (1) • People's brains will 'fill in the blanks' (1)		2
2(f)(ii)	**The only correct answer is C** ***A*** *is not correct because it is not compressed* ***B*** *is not correct because it uses lossless compression* ***D*** *is not correct because it uses lossless compression*		1
2(f)(iii)	Award **one** mark from: • 3c3w2c6w3c (1) • c3w3c2w6c3 (1)		1

Question Number	Answer	Additional Guidance	Mark
2(g)	Award **four** marks for a correct expression or correct answer **Examples of correct expressions:** 6 x 1000 x 1000 x 1000 x 8 (4) 54 x 1000 x 1000 1000 x 8 (4) 9 888.9 (4) For an incorrect or partial expression award **one** mark for each of: • **Bits to transfer** ○ 6×1000^3 (1) ○ x 8 (or equivalent) (1) • **Speed in bits per second** ○ 54×1000^2 (1) • Their bits divided by their speed (1)	• Units are not required • Equivalent expressions are accepted • Allow follow through for incorrect or partial expressions	4

Question Number	Answer	Additional Guidance	Mark
3(a)	Award **two** marks for an explanation that includes hardware **and** software. • The laptop is/contains the hardware (1) and the software allows the user to interact with it (1) • Hardware gives input and output devices (1) /memory, storage, cpu, processing ability • Software allows instructions to be passed to the hardware (1) so that it can carry out tasks (1) • Software is the set of instructions (1) that controls the hardware (1)		2

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	Award **two** marks from: • Lighter/thinner (1) • Less heat generated (1) • Faster access speed / faster booting of operating system / faster data transfer/read/write speeds (1) • Silent operation (1) • Less power required / longer battery life (1) • More robust (due to no moving parts) (1)		2
3(b)(ii)	Award **two** marks for a linked explanation such as: • Flash memory is non-volatile (1) whereas RAM is volatile (1) • Flash memory persists even when power is lost (1) whereas RAM clears its data whenever power is lost (1) • Flash memory is used for storage (1) whereas RAM is used in performing operations on data taken from storage (1)		2

Question Number	Answer	Additional Guidance	Mark
3(c)	Award **two** marks for a linked explanation such as: • Cache memory stores active/commonly used instructions / cache is a temporary storage (1) and is used to speed up processing. (1) stop data transfer bottlenecks between RAM and CPU (1)		2

Question Number	Answer	Additional Guidance	Mark
3(d)	Award **one** mark for two correct rows. Award **two** marks for four correct rows. **Device** / **Input** / **Output** / **Both** Headset / / / ✓ Mouse / ✓ / / Printer / / ✓ / Touch screen / / / ✓		2

Question Number	Answer	Additional Guidance	Mark
3(e)	Award **two** marks from: • Antivirus (1) • Anti-spyware (1) • (Software) firewall (1)	Do not award tradenames	2

Question Number	Answer	Additional Guidance	Mark
4(a)	Award **one** mark from: • Predict/model outcomes (1) • Investigate hypotheses (1) • Run experiments that cannot be run / are dangerous in real life (1) • Simulations can be speeded up/slowed down (1)		1

Question Number	Answer	Additional Guidance	Mark
4(b)	Award **two** marks from: • Simulations (may) use/collect large amounts of data (1) • Simulations (may) involve a large number of calculations (1) • Simulations may need more CPU cycles as the amount of data grows (1) • To be of value, the results must be calculated as quickly as possible (1) • Calculations may grow exponentially / become more complex as the simulation runs/is modified (1) • Simulation may output complex graphics (e.g. virtual world) (1)		2

Question Number	Answer	Additional Guidance	Mark
4(c)	<table><tr><th>NOT S</th><th>R AND W</th><th>(NOT S) OR (R AND W)</th></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr></table> Award **one** mark for each of: • Correct values in NOT S column (1) • Correct values in R AND W column (1) • Correct values in final column (1)	Allow follow through for incorrect mark point 1 and/or mark point 2	3

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>4(d)(i)</td><td>Award two marks for a linked description such as:

• Instructions (and data) are stored in (main) memory (1)
• Instructions (and data) are fetched, decoded, and executed (in a sequence by the CPU) (1)</td><td>Must include storage and execution for 2 marks</td><td>2</td></tr>
<tr><td>4(d)(ii)</td><td>Award two marks from:

• Program counter / PC (1)
• Current instruction (register) / CIR (1)
• Memory address (register) / MAR (1)
• Memory buffer/data (register) /MBR/MDR (1)
• Accumulator/ACC (1)</td><td></td><td>2</td></tr>
<tr><td>4(d)(iii)</td><td>Award two marks for a linked description such as:

Address of instruction carried on address bus (to main memory) (1) contents at that address carried back (to the CPU) on the data bus (1)</td><td></td><td>2</td></tr>
<tr><td>4(d)(iv)</td><td>Award two marks from:

<table><tr><th>Change made</th><th>Effect</th></tr><tr><td>Increasing the width of the data bus</td><td>Increases the number of bits/data/ size of word that can be transferred at one time / increases rate of data transfer (1)</td></tr><tr><td>Increasing the width of the address bus</td><td>Increases the number of memory addresses / increases the maximum amount of memory that can be addressed (1)</td></tr></table></td><td>Do not accept increases bandwidth without further explanation</td><td>2</td></tr>
</table>

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>5(a)(i)</td><td>Award five marks for:

• Count column correct (1)
• Temp column correct (1)
• Row 2 Numbers[Count value from row above] swapped with Temp value (1)
• Row 3 Numbers[Count value from row above] swapped with Temp value (1)
• All correct (1)

<table>
<tr><th></th><th></th><th></th><th></th><th colspan="5">Numbers array</th></tr>
<tr><th>Count</th><th>Length</th><th>Midpoint</th><th>Temp</th><th>0</th><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td>0</td><td>4</td><td>2</td><td>0</td><td>10</td><td>6</td><td>1</td><td>9</td><td>3</td></tr>
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</table>
</td><td>Ignore any numbers that are greyed out</td><td>5</td></tr>
<tr><td>5(a)(ii)</td><td>Award one mark from:

• To reverse the contents of the array (1)
• To reverse the order of the numbers (1)</td><td></td><td>1</td></tr>
<tr><td>5(a)(iii)</td><td>Award two marks for a linked explanation such as:

• You need to swap the contents of array values (1) and without Temp one of the values would be lost (1)</td><td></td><td>2</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
5(b)(i)	Award **two** marks for a linked explanation such as: • Isaac has included the -1 as a number in the addition (1) but the number has not been added to the count (1) • Isaac has misunderstood the WHILE loop (1) as it should not execute after the -1 has been input (1) • Isaac is expecting the wrong result (1) it should be 3 (1) • The count is 1 too many as the -1 is counted as a number (1) and the total is incorrect as 1 is subtracted from the total (1)		2
5(b)(ii)	Line 3 (1) Line 10 (1)		1
5(b)(iii)	SET count TO -1 (1) SET average TO (total + 1) / (count – 1)	Ignore brackets if the meaning is clear	1

Question Number	Answer	Additional Guidance	Mark
5(c)	Award **two** marks from: • Compiler produces object code to distribute that is difficult to reverse engineer / no need to distribute the source code (1) • Compiler optimises the code / object code (1) • Program runs faster (as it does not need translating) (1) • The target computer has no need to have the original compiler / does not need an interpreter (1) • Compiled code is smaller than the original code (1), which may not fit on the DVD (1)		2

Question Number	Answer	Additional Guidance	Mark
6(a)(i)	Award **two** marks for a linked explanation such as: • Uses DNA/biomolecular components (1) rather that standard hardware/silicon chips (1) • DNA uses four-character genetic alphabet (1) rather than binary digits (1) • DNA uses chemical reactions (1) rather than electrical states/properties (1) • DNA computing uses massive parallel processing/strands (1) to solve problems that otherwise would take impossible amounts of time (1)		2
6(a)(ii)	Award **one** mark from: • The ability of a system to be in multiple states at the same time (1) • Multiple probabilities at the same time (1) • One state combines all possibilities (1) • The state is not known until it is measured (1)		1

Question Number	Answer	Additional Guidance	Mark
6(b)	Award **two** marks from: • Some people may not want to use technology (1) • Some people may not be able to afford to use technology (1) • Some people may not have access to the technology/infrastructure (1) • Some people may not be allowed access to technology (1) • Some people may not be able to use it (disabilities etc.) (1)		2

Question Number	Answer	Additional Guidance	Mark
6(c)	Indicative content Impacts • Pollution (water, air, noise) resulting from the manufacturing process • High energy and water volumes needed for the manufacturing process • Mineral mining contaminates ground water • Mineral (copper, gold, silver, lithium) resource depletion • High energy use to keep machines cool with air conditioning or fans • Contain toxic components which means computing devices are hazardous waste • Batteries (laptop, lithium cells) disposal is hazardous and needs specialised disposal facilities • Computing devices sent to landfills contaminate ground and water resources Actions • Check national and local legislation • Some countries/states/regions require sellers to recycle own waste • Research recycling facilities to see if e-waste is acceptable • Find if local/national/regional government agencies charge for collection and disposal of e-waste • Find sellers offering exchange old for new + cost purchase options • Find charities (local, regional) which take donations of old devices • Turn off machines when not in use to save energy		6

Level	Mark	Descriptor
	0	No rewardable content
Level 1	1-2	Basic independent points are made showing elements of knowledge and understanding of key concepts/principles of computer science The discussion will contain basic information with little linkage between points made.
Level 2	3-4	Demonstrates adequate knowledge and understanding of key concepts/principles of computer science. The discussion shows some linkages and lines of reasoning with some structure.
Level 3	5-6	Demonstrates comprehensive knowledge and understanding by selecting relevant knowledge and understanding of key concepts/principles of computer science to support the discussion being presented. The discussion shows a well-developed, sustained line of reasoning which is clear, coherent and logically structured.

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