Mark Scheme (Results)

Summer 2023

Pearson Edexcel International GCSE
In Computer Science (4CP0)
Paper 01 Principles of Computer Science

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2023
Question Paper Log Number P72937A
Publications Code 4CP0_01_2306_MS

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)	Award **one** mark for any of the following up to a maximum of **two** marks: 1. Access (shared) peripherals (printers) (1) 2. Access the Internet (1) 3. Access shared file storage (server, cloud) (1) 4. Allows data/files/information to be shared (1) 5. Provide communication (email, social media, online meeting, chat) (1) 6. Provide collaboration (editing online documents, playing games) (1) 7. Allow hot-desking (1) 8. Allows centralised software updates/backups (1)	Award any example that can be categorised to a unique reason	2

Question Number	Answer	Additional Guidance	Mark
1(b)(i)	**The only correct answer is C** ***A*** *is not correct because compression does not encrypt a file* ***B*** *is not correct because* encryption does not ensure both sides use the same key ***D*** *is not correct because* encryption does not stop hackers accessing a network		1

Question Number	Answer	Additional Guidance	Mark
1(b)(ii)	Award **one** mark for any of the following up to a maximum of **two** marks: 1. (Electronic/combination) lock on doors (1) 2. Swipe/key cards/biometrics (1) 3. Security guards/security patrol (1) 4. CCTV cameras / surveillance technology (1) 5. Asset tagging/marking (1)		2

Question Number	Answer	Additional Guidance	Mark
1(b)(iii)	Award **one** mark for any of the following: 1. It exploits/relies on human behaviours/tricks people (to reveal sensitive information) (1)	Do not award examples e.g. Pharming without further information.	1

Question Number	Answer	Additional Guidance	Mark
1(c)	**The only correct answer is D** ***A*** *is not correct because 5G does not have* a **high transmission latency** ***B*** *is not correct because a 5G does not have* ***built-in security*** ***C*** *is not correct because* 5G does not have a **lower bandwidth than 3G and 4G**		1

Question Number	Answer	Additional Guidance	Mark
1(d)	Award **one** mark for: • Testing each block of code/subprogram/function independently (as it is written/finished) (1)	Do not accept module in isolation as this is in the question.	1

Question Number	Answer	Additional Guidance	Mark
1(e)	Award **one** mark for any of the following up to a maximum of **two** marks: 1. Belong to/have membership in a professional society (1) 2. Attend computer science related conferences/gatherings (1) 3. Attaining/gaining training/educational opportunities (1) 4. Behave in ethical/legal/moral ways (1) 5. Stay up to date with changes in the field/read up-to-date publications (1) 6. Use responsible programming practices e.g. due diligence / testing / commenting code for maintainability (1) 7. Avoid bias when making design choices (1)	Award examples if they can be categorised to a unique bullet point Answers must focus on computer science rather than being generic Do not accept things that would be expected as part of an employee's role e.g. writing code	2

Question Number	Answer	Additional Guidance	Mark
2(a)	Award **one** mark for each correct cell: Denary: 8 — Hexadecimal: 8 (1) Denary: 12 — Hexadecimal: C (1)		2

Question Number	Answer	Additional Guidance	Mark
2(b)	**The only correct answer is D** ***A*** *is not correct because* $\boldsymbol{6^2}$ *stores 36 patterns, not 64 patterns* ***B*** *is not correct because* **6 × 2** stores 12 patterns, not 64 patterns ***C*** *is not correct because* $\mathbf{6^2 - 1}$ stores 35 patterns, not 64 patterns		1

Question Number	Answer	Additional Guidance	Mark
2(c)(i)	Award **one** mark for: • 0001 0111 (1)	Ignore spaces	1

Question Number	Answer	Additional Guidance	Mark
2(c)(ii)	Award **one** mark for: • 1111 1000 (1)	Ignore spaces	1

Question Number	Answer	Additional Guidance	Mark
2(d)(i)	Award **one** mark for each correct nibble: • 0011 1100	Ignore spaces	2

Question Number	Answer	Additional Guidance	Mark
2(d)(ii)	Award **one** mark for each of: • Negative sign (1) • 22 (1) Example: • -22	Note 22 is calculated from 16 + 4 + 2	2

Question Number	Answer	Additional Guidance	Mark
2(d)(iii)	Award **one** mark for each correct nibble: • 0001 1011	Ignore spaces	2

Question Number	Answer	Additional Guidance	Mark
2(e)	Award **one** mark for each of: 1. 13 x 1000 // 13000 in the numerator (1) 2. 1024 in the denominator (1) Examples: $\frac{13 \times 1000}{1024}$ $\frac{13000}{1024}$ $\frac{13 \times 500}{512}$ $\frac{13 \times 250}{256}$ $\frac{13 \times 125}{128}$ $\frac{13 \times 10^3}{2^{10}}$	Award reduced expressions, if correct Allow all equivalent exponents Note 1000/1024 = 1.024, so could have 13 * 1.024	2

Question Number	Answer	Additional Guidance	Mark
3(a)	Award up to **two** marks for a linked explanation, such as: • If the data is incomplete/inaccurate (1) the answers from the model might not be right (1) • If the assumptions the model is based on are inaccurate (1) the answers from the model might be incomplete/inaccurate (1)	Award one mark for identifying a problem and one mark for a reason There must be a clear cause and consequence/effect	2

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	Award **one** mark for any of: • Pixels per inch/ppi (1) • Pixels per centimetre/ppc (1) • Dots per inch/dpi (1)	Ignore units cm^2 $inches^2$	1

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	Award **two** marks for a linked description such as: • Each pixel/colour in the image (1) will require more bits to store (1)	Giving for formula file_size = width*height*colour_ depth on its own is not enough	2

Question Number	Answer	Additional Guidance	Mark
3(c)	Award **two** marks for a linked description such as: • System software is used to maintain/run the operation of the system/hardware (1) whereas application software allows the user to carry out a task (1)	For both marks both categories must be addressed Allow clear examples	2

<table>
<tr><th>Question number</th><th>Answer</th><th>Additional guidance</th><th>Mark</th></tr>
<tr><td>3(d)</td><td>Award one mark for each of:

• All file blocks of each file are in numeric sequence/one after another in numeric order (1)

• All blank space is together at the front/at the end (1)

Examples:

<table>
<tr><td>W1</td><td>W2</td><td>W3</td><td>W4</td><td>Z1</td><td>Z2</td><td>Z3</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>Z1</td><td>Z2</td><td>Z3</td><td>W1</td><td>W2</td><td>W3</td><td>W4</td></tr>
<tr><td>Z1</td><td>Z2</td><td>Z3</td><td>W1</td><td>W2</td><td>W3</td><td>W4</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>W1</td><td>W2</td><td>W3</td><td>W4</td><td>Z1</td><td>Z2</td><td>Z3</td></tr>
</table>
</td><td>Note: Order of letter and number does not matter. W1 or 1W are equally acceptable</td><td>2</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
3(e)	Award up to **two** marks for a linked explanation such as: • The file size will not be decreased/will increase (1) because there are very few/no repeating patterns / because a run length of one would be added to each digit (1)		2

Question Number	Answer	Additional Guidance	Mark
3(f)	Award **one** mark for each correct cell:		4

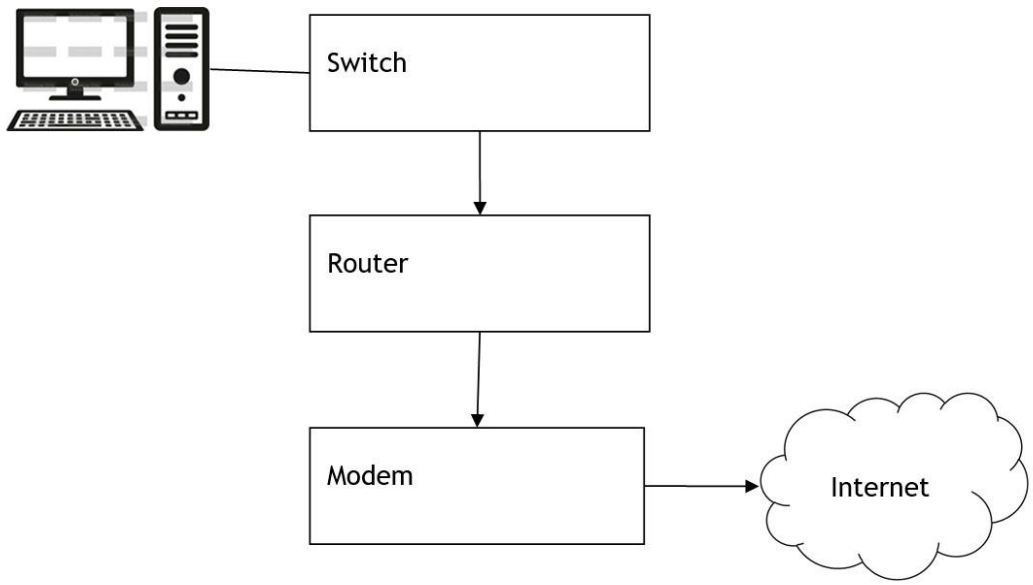
Task	Translator
A guessing game that can be used on different computing platforms	Interpreter (1)
A screen driver for a new smartphone	Assembler (1)
A new version of a spreadsheet program for sale next year	Compiler (1)
Control software for an embedded system inside a new washing machine	Assembler (1)

Question Number	Answer	Additional Guidance	Mark
4(a)	**The only correct answer is C** ***A*** *is not correct because* ***mebibits*** *is a measure of storage capacity* ***B*** *is not correct because* ***mebibytes*** *is a measure of storage capacity* ***D*** *is not correct because transmission speeds are measured only in bits per second, not* ***bytes per second***		1

Question Number	Answer	Additional Guidance	Mark
4(b)	Award **one** mark for each correct cell: **Type** / **Example** / **Number of bits** IPv4 / 192.169.0.3 / 32 (1) IPv6 / 1050:a500:00c0:0440:0006:0300:700d:436f / 128 (1)		2

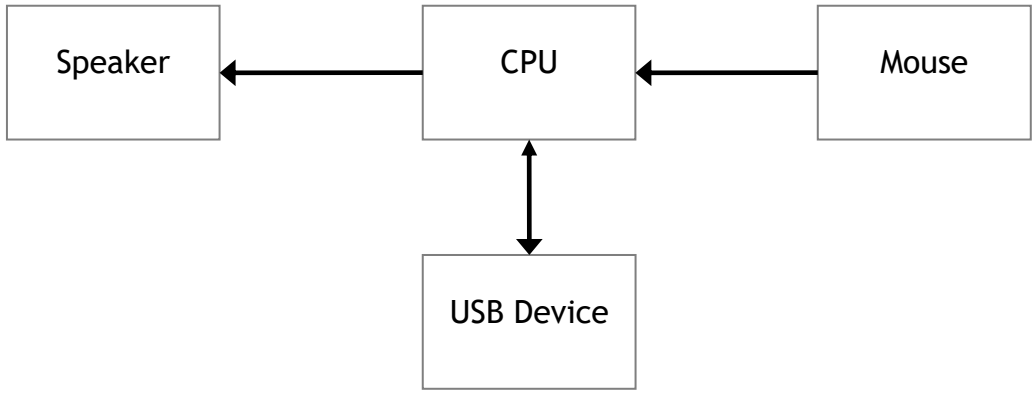
Question Number	Answer	Additional Guidance	Mark
4(c)(i)	Award up to **two** marks for a linked description, such as: • In a wired network packets travel over (copper/fibre-optic) cables (1), whereas in a wireless network packets travel over the air (1)	Allow radio signals, infra-red, microwave for air (must be more than just waves) Allow twisted pair, CAT for copper. Allow electrical/light signals (not just electricity)	2

Question Number	Answer	Additional Guidance	Mark
4(c)(ii)	Award **one** mark for any of the following up to a maximum of **two** marks: 1. A protocol (suite/group/family) (1) 2. Used on a wired network / wired connection (1) 3. Defines physical parts/type of cable(twisted pair, CAT6)/type of connector (1) 4. Defines how packets are checked for errors (1) 5. Defines the speed of transmission (1) 6. Operates at the link layer of the TCP/IP stack (1)		2

Question Number	Answer	Additional Guidance	Mark
4(d)	Award **three** marks for all of switch, router and modem in the correct order as in diagram Award **two** marks for all of switch, router and modem in any order Award **one** mark for any of switch or router or modem in any box  		3

Question Number	Answer	Additional Guidance	Mark
4(e)	Award up to **two** marks for a linked description, such as: Validation is used to check that the data/password entered by a user is fit for processing/meets specified requirements (1), whereas authentication is used to verify the identity of the user/prove that users are who they say they are (1)	For validation 'specified requirements' a good description of the check can be given e.g. presence check, length check, format check	2

Question Number	Answer	Additional Guidance	Mark
5(a)	Award **one** mark for each correct cell: **Req.** / **Example** Input: 1. Enter the direction the bee will face (1); 2. Enter the number of steps that the bee will move (1) Process: Calculate the path the bee will move along to its new position Output: 3. The bee appears in its new position (1); 4. The bee flies to its new position (1); 5. The bee faces its new direction (1)	Allow direct instructions as input e.g. 'Turn East' and consequences for output e.g. 'Bee turns to face East' if clear. The input/output do not have to be directly linked. E.g. Input Turn West, Output Has Moved 20 steps	2

Question Number	Answer	Additional Guidance	Mark
5b(i)	Award one mark for each: • Line between Mouse and CPU with arrow at CPU end only (1) • Line between CPU and Speaker with arrow at Speaker end only (1) • Line between CPU and USB Device with arrows on both ends (1) 	Allow two independent back/forth arrows between CPU and USB in place of a single bi-directional arrow. Ignore any additional lines.	3

Question Number	Answer	Additional Guidance	Mark
5(b)(ii)	**The only correct answer is B** ***A*** *is not correct because a* ***firewall*** *is an application that is loaded after the device is booted* ***C*** *is not correct because* ***the operating system*** *is loaded after the device is booted* ***D*** *is not correct because* ***the user interface*** *is loaded after the device is booted*		1

Question Number	Answer	Additional Guidance	Mark
5(b)(iii)	Award up to **two** marks for a linked explanation, such as: • Cache makes up for the difference in speed of two devices (1) because it is very high-speed memory (1) • Cache is high-speed memory (1) which acts as a buffer between a faster and a slower device (1) • It speeds up processing (1) because active/commonly used instructions and data are stored nearer to the CPU / the CPU doesn't have to wait while instructions/data are fetched from RAM (1)		2

Question Number	Answer	Additional Guidance	Mark
5(c)	Award up to **two** marks for a linked description, such as: • Uses a sensor (1) to check the water level in the machine (1) • Uses a thermometer (1) to check the water temperature (1) • Uses a timer (1) to control the time required for the wash cycle/rinse/drain/spin (1) • Uses a motor (1) to rotate the drum (1)	The first mark is for identification and the second is for the linked description. It is possible to gain one mark for a description without identifying the sensor/actuator.	2

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>5(d)(i)</td><td>Award one mark for each two correct rows.

<table>
<tr><th>A</th><th>B</th><th>C</th><th>A AND C</th><th>(A AND C) OR B</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table>
</td><td></td><td>3</td></tr>
</table>

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>5(d)(ii)</td><td>Award one mark for each of:

• M OR P (1)
• NOT C (1)
• <expr1> AND <expr2> (1)

Example statements:

(M OR P) AND (NOT C)
(M OR P) AND NOT C
(M AND NOT C) OR (P AND NOT C)
M AND NOT C OR P AND NOT C

For information only:

<table>
<tr><th>M</th><th>P</th><th>C</th><th>M OR P</th><th>NOT C</th><th>(M OR P) AND (NOT C)</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr>
</table>
</td><td>Third bullet awarded even if first two are not

Order of precedence is NOT, AND, OR

Check brackets carefully, if provided</td><td>3</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
5(e)	Award **one** mark for any of the following up to a maximum of **two** marks: 1. The operating system uses a scheduler to control processes (1) 2. The operating system holds processes in a queue (1) 3. Some processes may be given higher priorities than others (1) 4. Each process gains accesses to the CPU for a short time / time slice to execute (1) 5. Processes are swapped to/from (the queue / CPU)	Do not award responses about memory management, as the question is about sharing the CPU only	2

Question Number	Answer	Additional Guidance	Mark
6(a)	Award **one** mark for each of: Method • Flowchart (1) Justification • It is a visual representation / does not use many words / does not rely on use of English language (1) • It does not rely on understanding specific syntax (1) • Overview without unnecessary detail (1) OR Method • Pseudocode/structured English/written description (1) Justification • It does not rely on understanding specific syntax (1) • It uses English language words (1)	Valid method must be specified first before mark for justification can be awarded.	2

Question Number	Answer	Additional Guidance	Mark
6(b)	Award **one** mark for any of the following: • The test on line 3 has already limited the values to 1 and 2 (1) • The only value left for inNum to be (on line 7) is 2 (1)		1

Question Number	Answer	Additional Guidance	Mark
6(c)(i)	Award up to **two** marks for a linked description, such as: • The oldIndex value will go from highest to lowest (1) the step value is negative/decremented by 1 (each iteration) (1)	Allow 4 to 0 instead of highest and lowest	2

Question Number	Answer	Additional Guidance	Mark
6(c)(ii)	Award **one** mark for any of the following: • Reverse the (array of) scores (1) • Copy the oldScores into newScores, in reverse order (1)		1

Question Number	Indicative Content	Additional Guidance	Mark
6(d)	**Growth** • Higher bandwidth available both on wired and wireless networks • Reduced costs of large capacity storage devices • Improved levels of encryption / authentication • Increased trust in service providers • Growth of service provider options • Increased business models that aid scalability regarding storage capacity and costs **Benefits** • Sharing / collaboration on documents and setting of access permissions • Access from any location connected to a WAN • Reduced cost of local computing devices with less storage required • Built in backups of data on server-based systems **Drawbacks** • Increased security risks incurred from outsourcing a service • Relies on high-speed network connections • Reliance on service providers continuing to provide a high level of service • Increased chances of external data breaches • Identifying responsibilities for data breaches / legal jurisdiction • Increased power consumption from server systems and associated cooling systems • Increased use of networks and network traffic which will have an impact on other network users **Conclusion** • A conclusion does not have to be stated explicitly, but can be inferred from the discussion		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.

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London, WC2R 0RL, United Kingdom