Mark Scheme (Results)

Summer 2023

Pearson Edexcel GCSE In
Computer Science (1CP2/01)
Paper 1: 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

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>1(a)(i)</td><td>Award one mark for each correct cell:

<table>
<tr><th>Bus</th><th>Role</th></tr>
<tr><td>Control (1)</td><td>Carries a read signal to main memory</td></tr>
<tr><td>Address (1)</td><td>Carries the memory location of a piece of data</td></tr>
<tr><td>Data (1)</td><td>Carries an instruction from main memory to the CPU</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>1(a)(ii)</td><td>The only correct answer is D

A is not correct because the ALU carries out operations, rather than stores data
B is not correct because the clock is an electrical signal, it does not store data
C is not correct because main memory is not a component within the CPU</td><td></td><td>(1)</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
1(b)(i)	Award **one** mark for any of the following: • Machine code (1) • Binary (1) • Object code (1) • Executable code / an executable (1)		**(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: • Compile/Compilation (1) • Interpret/Interpretation (1) • Assemble (1)	Allow compiler/compiling, interpreter/interpreting, assembler/assembling	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(c)	**The only correct answer is C** *A is not correct because optical media does not use magnetic charges, unlike a hard disc* *B is not correct because the portability does not affect how data is read from it* *D is not correct because volatility is not what makes the media readable*		**(1)**

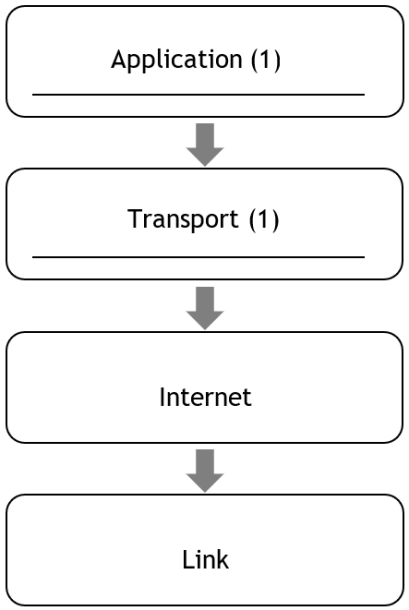
Question Number	Answer	Additional Guidance	Mark
1(d)	Award **one** mark for any of the following: • Forms part of another device / system (1) • Performs a single/dedicated/specific task (1)		**(1)**

Question Number	Answer	Additional Guidance	Mark
1(e)	Award **one** mark for each correct cell: **Code review carried out by** / **Disadvantage** By a programmer: • Adds additional/significant time (to the development cycle) (1) • Introduces human error (1) • Requires an extra person/resource/labour (1) • Requires more experienced programmer (1) By an automated system: • May not identify all issues (that it is not programmed to find) (1) • May only find well known problems (1)	Do not award cost of buying software or paying additional programmer, as given in the question. Do not accept: - 'algorithmic bias' - 'does not find logic errors'	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(f)	**The only correct answer is C** *A is not correct because defragmentation software does not compress data* *B is not correct because defragmentation software does not encrypt data* *D is not correct because defragmentation software does not protect data*		**(1)**

Question Number	Answer	Additional Guidance	Mark
1(g)(i)	Award **one** mark for any of the following up to a maximum of **two** marks: • A scheduler/scheduling algorithm controls processes (1) • Each process gets a time slice/small amount of (CPU) time (1) • Processes are held in a data structure (1) • Each process may be held in order / priority (1) • Incomplete processes go to the back of the queue (1)	Allow use of 'program' instead of 'process' Award examples e.g. 'round-robin'. For MP3 – award any example of a data structure e.g. array, list, queue.	**(2)**

Question Number	Answer	Additional Guidance	Mark
1(g)(ii)	Award **one** mark for any of the following: • File management (1) • Peripheral management (1) • User management (1) • User interface (1)	Allow memory management Allow a specific example, only if it can clearly be attributed to one of the bullets	**(1)**

Question Number	Answer	Additional Guidance	Mark
2(a)	Award **one** mark for each of:  	Award one mark if both layers are named correctly, but in the wrong order Allow alternatives, such as Process and Host-to-host	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(b)	Award **one** mark for: • Bus (topology) (1)		**(1)**

Question Number	Answer	Additional Guidance	Mark
2(c)	**The only correct answer is D** *A is not correct because files can be encrypted without the computers holding them being connected in a network* *B is not correct because unconnected computers are at less risk than connected computers* *C is not correct because latency is a network metric, not a reason to connect devices*		**(1)**

Question Number	Answer	Additional Guidance	Mark
2(d)	Award **one** mark for any of the following: • HTTP (1) • HTTPS (1) • Hypertext Transfer Protocol (1) • Hypertext Transfer Protocol Secure (1)		**(1)**

Question Number	Answer	Additional Guidance	Mark
2(e)	Award up to **two** marks for a linked explanation such as: • Emails can be accessed from multiple devices (1) because IMAP does not remove/delete emails (from the server) (1) • Emails can be accessed through a browser (1) because IMAP doesn't need a client application to download messages (1)	For both marks, the expansion must associate with the statement.	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(f)	Award up to **two** marks for a linked explanation such as: • (Digital/biometric) locks / magnetic card scanners / security personnel could be put on the office door (1) to prevent unauthorised access (1) • Movement sensors (1), to activate an alarm/ a light (1) • Security lights / alarms (1), so that intruders would be scared off / identified (1) • Alarms / alerts could trigger (1) because there is unauthorised access (1) • The servers/assets could have security tags (1), so that the owner can be tracked if stolen (1) • ID cards could be issued to all staff (1) to prevent impersonation/to allow unknown people to be challenged (1) • Warning posters could be positioned at entrances (1) to make people aware of shouldering/tailgating/two people entering together (1)	CCTV given in the question For both marks, the expansion must associate with the statement.	**(2)**

Question Number	Answer	Additional Guidance	Mark
2(g)	Award **one** mark for any of the following: • The **maximum** volume/amount of data that can be transmitted (in one second/unit of time) (1) • The **full capacity** of data that can be transmitted (in one second) (1)	Response must be about **capacity** of transmission, i.e. the **maximum** that can be transmitted, not how much/how fast data is currently being transmitted.	**(1)**

Question Number	Answer	Additional Guidance	Mark
2(h)	Award **one** mark for any of the following up to a maximum of **two** marks: • Read the destination/recipient's IP address (in each packet) (1) • Uses a routing table (1) • Sends the data packet **to the next router** (1) • Uses the fastest/least congested route/pathway (1) • Keeps track / informs other routers of traffic conditions (1)		**(2)**

Question Number	Answer	Additional Guidance	Mark
3(a)	Award up to **two** marks for a linked explanation, such as: • Worms make copies of themselves (1) and send them to everyone in the computer's email contacts list / send them via previous connections used by the computer (1) • Worms can spread (themselves) through emails (1) and do not need a user to unknowingly distribute/execute them (1) • Worms self-replicate (1) and spread without the need for a host file (1)	For both marks, the expansion must associate with the statement. **Do not accept:** Worms spread through links in emails.	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(b)	Award **one** mark for: • Licensing (1)		**(1)**

Question Number	Answer	Additional Guidance	Mark
3(c)	Award up to **two** marks for a linked explanation, such as: • The landing program may crash / display incorrect data / not deal with extreme scenarios (weather / wind / animal / visual / emergency) (1) because: • the system could be out of date / have errors / bugs / not been tested enough • the scenario is beyond the range of what it has been programmed to respond to (1) • A computer's input may be wrong/compromised (1) because of a sensor/hardware/mechanical error (1) • A computer cannot make moral/ethical judgements (1) because it is only capable of following instructions (1)	For both marks, the expansion must associate with the statement.	**(2)**

Question Number	Answer	Additional Guidance	Mark
3(d)	Award up to **two** marks for a linked description, such as: • The land/rivers/seas will be polluted (1) if contaminated/uncleaned waste water is released (1) • Homes/businesses/agriculture/wildlife/people may not have enough water (1) if too much is taken from the rivers/reservoirs (1) • Water is polluted/contaminated (during the manufacturing process) (1) and could pose a health risk (1) • Large amounts of energy is required (to extract/clean water) (1) resulting in more use of CO2 / CO2 contributes to global warming (1)	For both marks, the expansion must associate with the statement. **Do not accept** responses that refer to global warming due to the use of water without implying associated energy use.	**(2)**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>3(e)</td><td>Award one mark for each correct cell:

<table>
<tr><th>Situation</th><th>Ethical or legal concern</th></tr>
<tr><td>A teacher uses another teacher's login to change student grades</td><td>Misuse (1)

Hacking (1)

Unauthorised access/changing/ editing/modification (1)</td></tr>
<tr><td>A school displays closed-circuit television (CCTV) screens in a public area</td><td>Privacy (1)

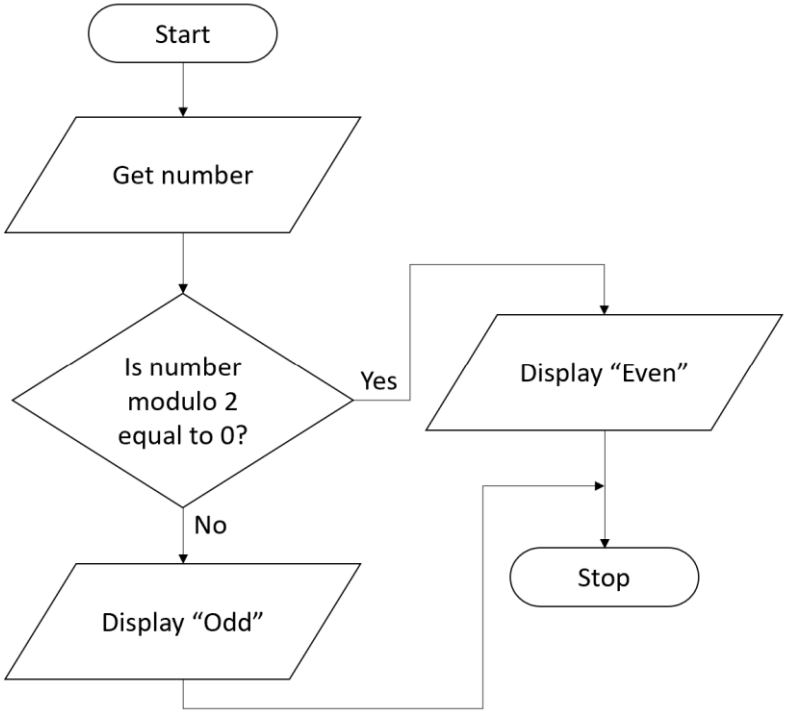
Consent/Permission (1)

Data Protection / GDPR / General Data Protection Regulations (1)</td></tr>
</table></td><td></td><td>(2)</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
4(a)	Award up to **two** marks for a linked explanation, such as: • It helps the programmer visualise the steps in a program / find errors/bugs / check the algorithm gives the correct output (1) because they can see the value a variable holds at a given point in an algorithm (1)	For both marks, the expansion must associate with the statement.	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(b)	Award up to **two** marks for a linked description, such as: • A list / data structure / collection of elements/fields/values (1) where each element/field/value may be a different data type / is related to the others (1)	For both marks, the expansion must associate with the statement.	**(2)**

Question Number	Answer	Additional Guidance	Mark

4(c)	Award **one** mark for each of:
	
	• Input symbol to get number from user (1)
	• Decision symbol (disregard test inside), with exactly two arrows and labels for yes and no (1)
	• Correct relational test matches labels and output messages (1)
	• Accurately connected (1):
	  ○ outputs 'Display Even' **or** 'Display Odd', not both
	  ○ no hanging symbols
	  ○ connection to terminator
	
	 
	
		Arrows must match symbols for use of symbol to be awarded
		
		Each symbol should have only a single input arrow
		
		Input/output symbols should have only a single output arrow
		
		The decision symbol must have exactly two output arrows
		
		Relational tests:
		• X % 2 == 0
		• X MOD 2 == 0
		• X modulus 2 == 0
		
		Allow = for == in relational test
			(4)

Question Number	Answer	Additional Guidance	Mark
4(d)	Award up to **four** marks for a linked description, such as: • Start at the first position / Iterate/Traverse (through the array) (1), compare the item with the target (1), stop when the target is matched (1), or stop when the end of the list is reached (and the item is not matched) (1)		**(4)**

Question Number	Answer	Additional Guidance	Mark
4(e)	Award **one** mark for each of: • Four unique rows for the values of S and M, indicating binary representation of 0, 1, 2, and 3 (1) • Four correct results of applying AND to the values in S and M (1) Example: S | M | S AND M 0 | 0 | 0 0 | 1 | 0 1 | 0 | 0 1 | 1 | 1	Ignore order of rows Award both marks only if completely correct Award carry through in final column, if error in S or M columns Only award: - 1/T/True/On - 0/F/False/Off	**(2)**

Question Number	Answer	Additional Guidance	Mark
4(f)	Indicative content: **Definition** • Decomposition is breaking down into smaller parts. Problems, solutions, and algorithms can be decomposed. • Abstraction is the process of removing or hiding unnecessary detail. **Benefits** • It is usually easier to solve several smaller problems, such as checking if touching a wall or updating the score display, than solve one big problem, such as making a game. • Different parts of the program can be shared between the class members to speed up development, for example, one group could work on the code to control the character, while another works on creating and playing the sounds. • Once all the pieces, like sounds, movement, and score are working correctly, the smaller solutions can be combined to make a larger solution, with fewer errors. • The individual parts of the program, such as updating the score can be ignored by the group of students writing the code for moving the character with the arrows / allowing each group of students to focus only on the small problem they have been given means time is not wasted on analysis not relevant to the solution. **Appear in program code** • Different blocks of code logic show decomposition, such as		**(6)**

	moving the character and updating the score. These blocks could be shown separated by white space. • Subprograms are decompositions because they're blocks of code logic, separated from the main program. Subprograms could be used for updating the score and resetting the character back to the starting position. • Abstraction is used each time a subprogram, either built-in, in a library, or in the code file is called. Library routines in the game would include one to play the sounds and to get the keyboard input. • Subprograms are abstractions because their names hide how they work internally, even if their name is not descriptive. A subprogram to update the score should have a descriptive name, such as updateScore, but could just be called X. Either way, how it works internally is still hidden from the caller.		

Level	Mark	Descriptor
	0	No rewardable content.
Level 1	1–2	Basic, independent points are made, showing elements of understanding of key concepts/principles of computer science. (AO1) The discussion will contain basic information with little linkage between points made or application to the context. (AO2)
Level 2	3–4	Demonstrates adequate understanding of key concepts/principles of computer science. (AO1) The discussion shows some linkages and lines of reasoning with some structure and application to the context. (AO2)
Level 3	5–6	Demonstrates comprehensive understanding of key concepts/principles of computer science to support the discussion being presented. (AO1) The discussion is well developed, with sustained lines of reasoning that are coherent and logically structured, and which clearly apply to the context. (AO2)

Question Number	Answer	Additional Guidance	Mark
5(a)	Award up to **two** marks for a linked description, such as: • (Removed) data (1) cannot be restored / means that the original file/information cannot be fully recreated/represented (1) • When data is removed (1) humans may perceive/interpret the image/sound/text/information differently (1)	For both marks, the expansion must associate with the statement. Award both marks for reference to loss of data and an example of the effect of that. Do not accept reference to 'quality' as an effect.	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(b)	Award up to **two** marks for a linked explanation, such as: • One bit can only have two values (1), so can only represent black and white (1) • The three colours in this image cannot be represented (1) because one bit can only have two values (1) • It is not possible to represent each pixel with three colours / as greyscale / as anything other than black and white (1) because one bit can only represent two unique values (1)	For both marks, the expansion must associate with the statement.	**(2)**

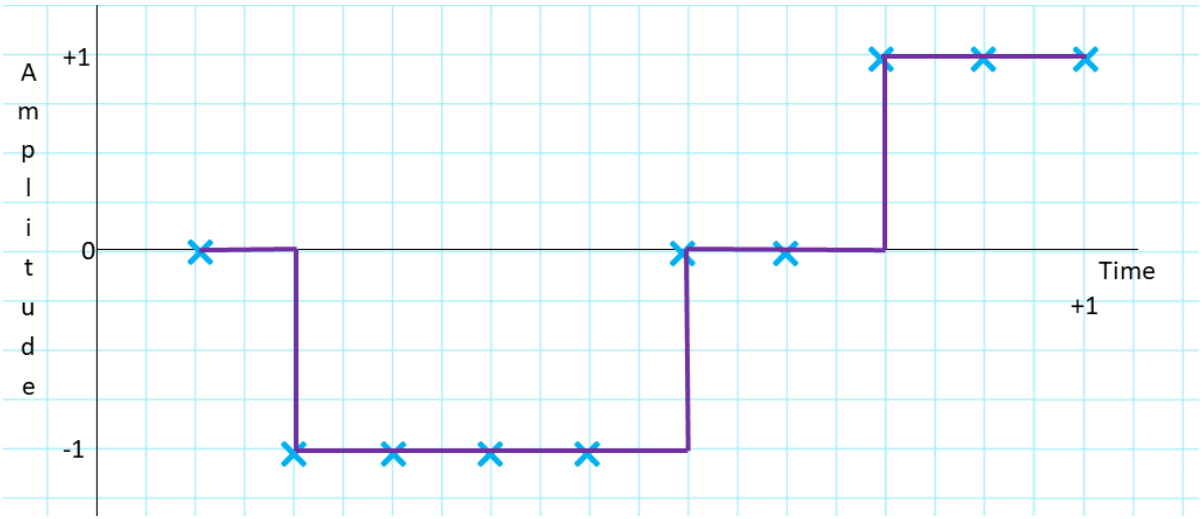
Question Number	Answer	Additional Guidance	Mark
5(c)	Award up to **two** marks for a linked description, such as: • An arithmetic shift fills from the left with a copy of the most-significant bit (MSB) (1), whereas a logical shift fills from the left with a 0 (1) • An arithmetic shift keeps the most-significant bit (MSB) the same (1) whereas a logical shift always fills the MSB bit with a 0 (1)	Both statements must be provided for two marks, as an arithmetic shift will fill with 0s, if the MSB is 0. Read carefully responses that indicate what the fill character is. Allow 'sign bit' for MSB	**(2)**

Question Number	Answer	Additional Guidance	Mark
5(d)(i)	Award **one** mark for: • 66 (1)		**(1)**

Question Number	Answer	Additional Guidance	Mark
5(d)(ii)	Award **one** mark for each correct digit in the correct order: • 5B		**(2)**

Question Number	Answer	Additional Guidance	Mark
5(e)(i)	Award **one** mark for any of the following: • 64 (1) • 2^6 (1) • 2^6 (1) • 2**6 (1) • 2 x 2 x 2 x 2 x 2 x 2 (1)	Allow any expression that evaluates to 64	**(1)**

Question Number	Answer	Additional Guidance	Mark
5(e)(ii)	Award **one** mark for any of the following up to a maximum of **two** marks: • Sight of 100 x 600 (1) • x 32 in numerator **and** 8 in the denominator (1) • + 1024 applied to whole expression (1) Award **three** marks for all three elements presented as a correct expression such as: • $\frac{100 \times 600 \times 32}{8} + 1024$ • ((100 x 600 x 32) / 8) + 1024	Consider order of operations (BIDMAS) Award mental reductions, such as (100 x 600 x 4) + 1024	**(3)**

Question Number	Answer	Additional Guidance	Mark
5(f)	Award **one** mark for any of the following up to a maximum of **six** marks: • x-axis labelled correctly as time/seconds (1) • y-axis labelled correctly as amplitude/value/sample (1) • value labels on x-axis as 0 and 1 (1) • value labels y-axis as -1 and 1 (1) • all 10 values plotted to correct points (1) • points joined to form a square wave, even if not all points are there or some are plotted inaccurately (1) 	Allow first sample at time 0 Award inverse (vertical flip) if y-axis labels also flipped, i.e. must recognise 11111 as -1. Ignore any other values on x and y axes Accept binary representation for value labels on y axis.	**(6)**