Mark Scheme (Results)

November 2021

Pearson Edexcel International GCSE
In Computer Science (4CP0/01)

Paper 01: Principles of Computer Science

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November 2021
Question Paper Log Number P69297A
Publications Code 4CP0_01_2111_MS
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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.

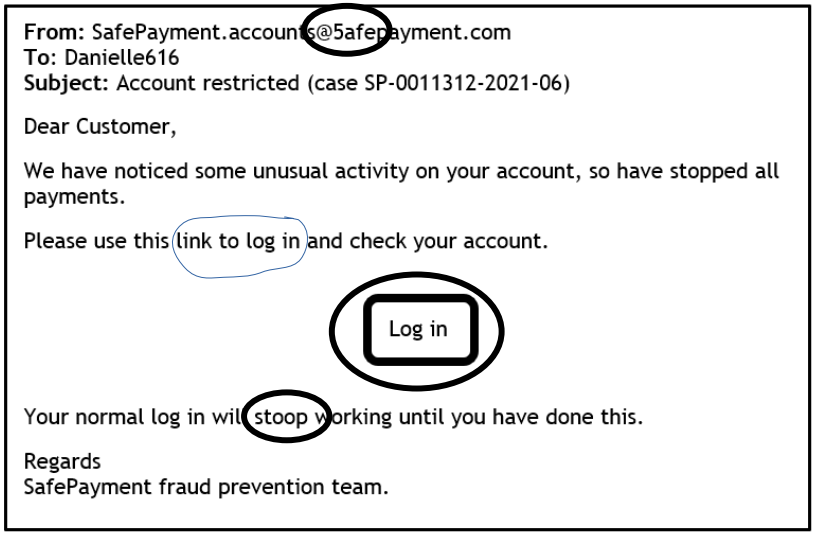
Question Number	Answer	Additional Guidance	Mark
1(ai)	0100 1101 100 1101 Award **one** mark for each correct nibble	Must be in the correct order	2
1(a)(ii)	1000 0010 Award **one** mark for each correct nibble	Must be in the correct order	2
1(a)(iii)	Award **one** mark for each of: • C (1) • 6 (1)	Must be in the correct order	2

Question Number	Answer	Additional Guidance	Mark
1(b)(i)	400 pixels x 200 pixels x 12 bits / 8 bits per byte Allow expression in word form $\frac{400 \times 200 \times 12}{8}$ 400 x 200 **OR** 80000(1) 12/8 **OR** 1.5 (1)	Accept any other use of 400, 200, 12, 8 that gives the correct answer Allow one mark for 120,000 with no expression	2
1(b)(ii)	Spaces are to help legibility. Award **three** marks for: Line 1 3W 1B 4W Line 2 1W 6B 1W Line 3 1B 2W 1B 1W 1B 2W Line 4 3W 2B 3W Award **two** marks for any three lines correctly encoded Award **one** mark for any two lines correctly encoded	Allow **one** error in the sequence Accept letter before number but must be consistently used	3
1(b)(iii)	Award **one** mark from: • None of the original (image) detail/quality is lost (when the image is stored) (1) • None of the data/information is (permanently) removed (1) • It can be decompressed without losing detail (1)		1

Question Number	Answer	Additional Guidance	Mark
1(c)(i)	Award up to **three** marks for a linked description: • set the sample rate/parameters/bit-depth (1) • sample (the analogue sound) (1) • measure the sound amplitude/volume/frequency (1) • give a (binary) value/number for each measurement (1) • store data as sample rate and values / digital signals (1)		3
1(c)(ii)	Award **one** mark from: • sound may be missing some frequencies (1) • some audio information/data is lost/deleted during the (compression) process (1)		1
		Total	**16**

Question Number	Answer	Additional Guidance	Mark
2(a)	**The only correct answer is B** *A is not correct because a password is needed to prevent unauthorised access to the network* *C is not correct because it only provides security after access to the network* *D is not correct because it only provides security after access to the network*		1

Question Number	Answer	Additional Guidance	Mark
2(b)(i)	Award **one** mark from: • the email should be addressed to Danielle by her (full) name (1) • the email should be personalised (1)		1

2(b)(ii)	Award up to **two** marks for identifications from:  **From:** SafePayment.accounts@5afepayment.com **To:** Danielle616 **Subject:** Account restricted (case SP-0011312-2021-06) Dear Customer, We have noticed some unusual activity on your account, so have stopped all payments. Please use this link to log in and check your account. Log in Your normal log in will stoop working until you have done this. Regards SafePayment fraud prevention team.	Allow link to log in OR circle around button	2

Question Number	Answer	Additional Guidance	Mark
2(c)(i)	Award up to **two** marks for a linked description such as: A hacker/third party spies on/watches the user (of an electronic device) (1) In order to obtain their personal identification number/password/login information/sensitive information (1)		2

2(c)(ii)	Award up to **two** marks for a linked explanation such as: • tilt the screen away from possible viewers/position yourself with your back to a wall (1) to ensure no one can see the screen (1) • shield your screen/keypad/keyboard when entering (sensitive/personal) information (1) to stop people seeing/memorising passwords/named sensitive item/sensitive/personal information (1) • use long/strong passwords (1) to prevent onlookers memorising them as you type (1) • use a screen/privacy filter (1) because it will prevent anyone not sitting directly in front of the screen from reading what is displayed (1) • sit where the information displayed on the screen (1) can't be captured on CCTV/by a drone-mounted camera or viewed by someone using binoculars (1)	Allow 1 mark for don't enter private information in a public place	2

Question Number	Answer	Additional Guidance	Mark
2(d)(i)	**The only correct answer is B** *A is not correct because this is not the purpose of penetration testing* *C is not correct because this is not the purpose of penetration testing* *D is not correct because this is not the purpose of penetration testing*		1
2(d)(ii)	Award up to **two** marks for a linked description such as: • compromised/unpatched software is more vulnerable to attack (1) and may allow an attacker control of the whole network (1) • unpatched software has known weaknesses (1) which can be exploited by a hacker (1)		2
		Total	**11**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>3(a)</td><td>Award one mark for correct network type
Award one mark for correct usage model
One mark for each column

<table>
<tr><th>Network type</th><th>Tick (✓)</th><th>Usage model</th><th>Tick (✓)</th></tr>
<tr><td>Local Area Network (LAN)</td><td></td><td>Client-Server</td><td></td></tr>
<tr><td>Wide Area Network (WAN)</td><td></td><td>Peer-to-peer</td><td>✓</td></tr>
<tr><td>Personal Area Network (PAN)</td><td>✓</td><td></td><td></td></tr>
</table>
</td><td></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>3(b)</td><td>Award one mark for each correct layer name up to a maximum of two
Award one mark per layer for a correct function associated with the correct layer up to a maximum of two

<table>
<tr><th>Layer</th><th>Function</th></tr>
<tr><td>Application</td><td>• Selects and uses the correct protocol to transmit data
• Interacts with the user</td></tr>
<tr><td>Transport</td><td>• Identifies the server port to use
• Identifies the client port to use
• Divides the data into packets
• Numbers the packets
• Adds the total number of packets
• Sets up communication between hosts / Establishes end to end communication
• Passes the packets to the network layer
• Checks the packets arrive at the destination
• Resends any packets that have not arrived</td></tr>
<tr><td>Network</td><td>• Adds the source/sender’s IP address
• Adds the destination IP address
• Routes the packets</td></tr>
<tr><td>Data link</td><td>• Controls physical connections between pieces of hardware
• Adds MAC addresses to the packets
• Sends the packets on their way
• Adds headers and trailers</td></tr>
</table></td><td>Accept functions at the receiving end too</td><td>4</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
3(c)	**The only correct answer is A** B *is not correct because* it is not a smartphone frequency band C *is not correct because* it is not a smartphone frequency band D *is not correct because* it is not a smartphone frequency band		1

Question Number	Answer	Additional Guidance	Mark
3(d)(i)	Award **one** mark from: • higher frequency has more waves per second/carries more data in the same time (1) • higher frequency gives greater bandwidth (1) • higher frequency is more stable/less prone to interference (1)		1
3(d)(ii)	Award up to **two** marks for a linked explanation such as: • gives Carlo faster responses to his communications/connections (1) allowing Carlo to move/download/share data in a shorter time (1) • gives Carlo more reliable communications/can access communications more widely/in more places (1) giving Carlo a better user experience (1) • gives Carlo more secure communications (1) improving his privacy/reducing other people's ability to intercept/spy on his communications (1)		2

Question Number	Answer	Additional Guidance	Mark
3(e)(i)	Award **one** mark from: • do not leave the smartphone on standby/turn off when not being used (1) • use (portable) solar cells/other renewable generation method (1) • unplug charger when not in use (1) • reduce screen brightness (1) • turn off WiFi/GPS/Bluetooth/location (when not in use) (1) • close apps that are not being used (1)		1

Question Number	Answer	Additional Guidance	Mark
3(e)(ii)	Award up to **two** marks for a linked explanation. Award **one** mark for the action • keep smartphone for longer (1) • repair/recycle smartphone if not working (1) • upgrade the operating system (1) Award **one** mark for the impact • less e-waste is generated (1) • manufacturing could be reduced (1)		2
		Total	**13**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>4(a)</td><td>Award one mark from:

• a step-by-step description of a process that completes a task (1)
• a set of instructions that describes how to get something done (1)</td><td></td><td>1</td></tr>
<tr><td>4(b)(i)</td><td>Award one mark each to a maximum of five marks for:

• two correct decisions in last two lines (1)
• two correct outputs (1)
• correct increment at Count=Count+1 (1)
• correct change for Number3=Number2+Number1 (1)
• correct change for Number1=Number2 AND Number2=Number3 (1)

<table>
<tr><th>Number 1</th><th>Number 2</th><th>Number 3</th><th>Count</th><th>Output</th><th>Count = 2?</th></tr>
<tr><td>1</td><td>1</td><td>-</td><td>0</td><td>1 1</td><td>False</td></tr>
<tr><td>1</td><td>2</td><td>2</td><td>1</td><td>2</td><td>False</td></tr>
<tr><td>2</td><td>3</td><td>3</td><td>2</td><td>3</td><td>True</td></tr>
</table>
</td><td>Ignore spelling errors

Allow true false, Y N etc. for decisions</td><td>5</td></tr>
</table>

4(b)(ii)	Award **one** mark each for: • helps visualise how the algorithm works (1) • helps detect (logic) errors (1)		1

Question Number	Answer	Additional Guidance	Mark

4(c)	Award **one** mark each to a maximum of **five** marks for:
	
	• SET count TO 0 (1)
	• IF statement checks for a match to 1 vowel (1)
	• IF statement checks for a match to all vowels (1)
	• count incremented correctly (1)
	• display count (1)
	• concatenates suitable message with the count (1)
	
	SET word TO "elephant"
	SET count TO 0
	
	FOR EACH letter FROM word DO
	IF letter = 'a' OR letter = 'e' OR letter = 'i' OR letter = 'o' OR letter = 'u' THEN
	
	SET count TO count + 1
	END IF
	
	END FOREACH
	
	SEND 'The number of vowels is ' & count TO DISPLAY
			5

		Total	**12**

<table>
<tr><th>Question Number</th><th>Answer</th><th>Additional Guidance</th><th>Mark</th></tr>
<tr><td>5(a)</td><td>Award one mark for each correct component:

<table>
<tr><th>Component</th><th>Letter</th></tr>
<tr><td>Control unit</td><td>B</td></tr>
<tr><td>Output device</td><td>G</td></tr>
<tr><td>Registers</td><td>C</td></tr>
<tr><td>Main memory</td><td>H</td></tr>
<tr><td>Cache</td><td>F</td></tr>
<tr><td>Input device</td><td>E</td></tr>
<tr><td>Arithmetic/logic unit (ALU)</td><td>D</td></tr>
<tr><td>Clock</td><td>A</td></tr>
</table></td><td></td><td>5</td></tr>
</table>

Question Number	Answer	Additional Guidance	Mark
5(b)(i)	Award **one** mark each to a maximum of **two** marks for: • stores a memory address (for the next instruction) (1) • memory address incremented/changed during the fetch process (1)		2
5(b)(ii)	**The only correct answer is B** A *is not correct because* there is no such signal C *is not correct because* as there is no such signal D *is not correct because* as that does not take place during the fetch stage		1
5(b)(iii)	Award **one** mark from: • processes more instructions in the same amount of time (1) • more cycles can be performed in the same amount of time (1) • fetch-execute-decode cycle runs faster (1)		1

Question Number	Answer	Additional Guidance	Mark
5(c)(i)	Award **one** mark from: • a system designed for one/a few specific functions/task(s) (1) • has both hardware and software (1) • has integrated memory (1) • has no or minimal user interface (1) • is power efficient/low power consumption (1) • its functionality cannot be changed/upgraded by users (1) • often use sensors and actuators to interact with the external environment (1) • functions in real time (1)		2
5(c)(ii)	Award up to **two** marks for a linked explanation such as: • Performance / number of cores / power consumption needs to be adequate for the task (1) because any more would waste money / power (1) • Size of cache can be small or non-existent (1) because there is no need to store frequently used instructions (1) • The RAM can be limited/very small (1) because it is only holding a limited number of instructions (1) • Only needs a small bus width (1) because the output signals are serial binary (1)		2
		Total	**13**

Question Number	Answer	Additional Guidance	Mark
6(a)(i)	Award **one** mark from: • faster translation/execution (1) • allows her to directly address components / make efficient use of available memory space (1) • can dispense with the need for an OS to make the code run faster/free up memory space (1)		1
6(a)(ii)	Award **one** mark from: • difficult to read/understand (1) • easy to make mistakes (1) • can be hard to find errors in the code (1) • time consuming (to write) (1) • not very portable / processor-specific (1) • lack of built-in functions/procedures (1) • few development/editorial tools available (1)		1

Question Number	Answer	Additional Guidance	Mark
6(b)(i)	Award **one** mark from: • virus detection/scanner (1) • threat identification (1) • real-time scanning (1) • scan scheduling (1) • quarantine files (1) • carry out automatic updates (1) • on-demand file scanning (1) • kill switch (1)		2
6(b)(ii)	Award **one** mark from: • anti-spyware (1) • anti-adware (1)		1
6(c)	A AND O AND (W OR D) Award **one** mark each to a maximum of **four** marks for: • A AND O (1) • W OR D (1) • Brackets around W OR D (1) • AND between A AND O (W OR D) (1)		4

6(d)	**Intellectual property**
	• Intellectual property is any work that is distinct, owned, and protected by patent or copyright laws
	• Akiko's software programs fall into this category
	• She will be able to protect her intellectual property
	• Her software is protected by copyright without her having to apply for it
	
	Licensing
	• Purchasing software does not mean you own it
	• Could add a licence key to the software.
	• Could require compulsory registration using the internet
	• Could allow proprietary licences, which do not allow code modification or code reuse.
	• Could allow Free and open-source software (FOSS), which would allow the user to modify and reuse the code.
	• Creative Commons (CC)
	  ○ Could use creative commons (CC) licences that would allow the free distribution of copyrighted work
	  ○ Would use if Akiko wanted to allow people to share, use and build on the programs.
	  ○ May mention some of the CC licences and conditions
		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.
		Total **15**

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