



Pearson

Mark Scheme (Results)

Summer 2017

GCSE Computer Science (1CP0/01)
Paper 1: Principles of Computer Science

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Summer 2017

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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)(i)	0000 1100		1

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	5		1

Question Number	Answer	Additional Guidance	Mark								
1(b)	<table border="1"> <thead> <tr> <th>Term</th> <th>Capacity in bytes</th> </tr> </thead> <tbody> <tr> <td>Kilobyte</td> <td>1024 (2¹⁰)</td> </tr> <tr> <td>Megabyte</td> <td>1024 x 1024 (1048576) (2²⁰)</td> </tr> <tr> <td>Gigabyte</td> <td>1024 x 1024 x 1024 (1073741824)(2³⁰)</td> </tr> </tbody> </table>	Term	Capacity in bytes	Kilobyte	1024 (2 ¹⁰)	Megabyte	1024 x 1024 (1048576) (2 ²⁰)	Gigabyte	1024 x 1024 x 1024 (1073741824)(2 ³⁰)	<ul style="list-style-type: none"> Any equivalent arithmetic expressions should be awarded 	4
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Question Number	Answer	Additional Guidance	Mark
1(c)(iii)	4		1

Question Number	Answer	Additional Guidance	Mark
1(c)(iv)	<p>fibre='wool'</p> <p>Allow 'IS' for '='</p> <p>Allow '==' for '='</p>	<ul style="list-style-type: none"> Do not penalise capitalisation Ignore punctuation, spacing, and spelling 	1

Question Number	Answer	Additional Guidance	Mark									
1(d)(i)	<table border="1"> <thead> <tr> <th>Plain text</th> <th>Shift</th> <th>Cipher text</th> </tr> </thead> <tbody> <tr> <td>jump</td> <td>-2</td> <td>hskn</td> </tr> <tr> <td>wmtcq</td> <td>+3</td> <td>zpwft</td> </tr> </tbody> </table>	Plain text	Shift	Cipher text	jump	-2	hskn	wmtcq	+3	zpwft		2
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Question Number	Answer	Additional Guidance	Mark
1(d)(ii)	(When reaching the end of the alphabet), the algorithm does not go back to the beginning of the alphabet	<ul style="list-style-type: none"> • Only award responses which clearly identify the looping to make the required number of shifts • Ignore case. 	1

Question Number	Answer	Additional Guidance	Mark
1(e)(i)	<p>Any two of:</p> <ul style="list-style-type: none"> • An automated system can run 24/7 (1) • An automated system does not need to be paid (1) • Shouldn't make mistakes / more reliable / safer (1) • Cheaper than employing people (1) • Leaves road workers free to do other tasks (1) 		2

Question Number	Answer	Additional Guidance	Mark
1(e)(ii)	<ul style="list-style-type: none"> • Naming a suitable sensing device for this situation (1) (including pressure, light, ultrasonic, distance, motion) • Concept of detection / input (1) • Concept of the microprocessor having a process / program (1) • Microprocessor generating an output / signal change (1) 		2

Question Number	Answer	Additional Guidance	Mark
2(a)(i)	Any one of: <ul style="list-style-type: none"> • Predict weather patterns/storms/hurricanes/etc. (1) • Investigate scientific hypotheses/climate change/etc. (1) • Run experiments because they can't change the weather for real (1) 		1

Question Number	Answer	Additional Guidance	Mark
2(a)(ii)	Any one of: <ul style="list-style-type: none"> • rainfall amounts • hours of sunshine • wind direction/speed • temperatures • humidity • atmospheric pressure (air density) • elevation (above sea level) 	<ul style="list-style-type: none"> • Accept any plausible weather related item 	1

Question Number	Answer	Additional Guidance	Mark
2(a)(iii)	Any two of: <ul style="list-style-type: none"> • Very large amounts of data are collected (1) • Algorithms are mathematically complex/intensive (1) • Algorithms 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) 	<ul style="list-style-type: none"> • Do not award high-resolution graphics or high-density displays 	2

Question Number	Answer	Additional Guidance	Mark																				
2(b)(i)	<p>One mark for each column (maximum 2)</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>S</th> <th>W</th> <th>NOT S</th> <th>(NOT S) OR W</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td>1</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td>1</td> </tr> </tbody> </table>	S	W	NOT S	(NOT S) OR W	0	0	1	1	0	1	1	1	1	0	0	0	1	1	0	1		2
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Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	Q = R AND L AND W	<ul style="list-style-type: none"> • 'Q=' not required • Ignore () 	1

Question Number	Answer	Additional Guidance	Mark
2(c)	Any 2 of: <ul style="list-style-type: none"> • Chemical on surface of the disc (1) • The magnetic state (of the chemical) represents data (1) • The heads move in and out (1) • Heads change/detect the (magnetic) state (1) 		2

Question Number	Answer	Additional Guidance	Mark
2(d)(i)	Any 2 of: <ul style="list-style-type: none"> • Indentation (1) • Meaningful/sensible variable names (1) • Comments (1) • White space/spaces between sections of code (1) 		2

Question Number	Answer	Additional Guidance	Mark
2(d)(ii)	<ul style="list-style-type: none"> • Either 16 or 17 (1) 		1

Question Number	Answer	Additional Guidance	Mark
2(d)(iii)	<ul style="list-style-type: none"> • Either 20 - 24 or 20 only (1) 		1

Question Number	Answer	Additional Guidance	Mark
2(e)	<p>Any 2 of:</p> <ul style="list-style-type: none"> • Code is easier to read (1) • Code only needs to be written once / reduces the need to copy/paste code multiple times / shortens the code (1) • Code only needs to be debugged once / easier to find errors (1) • Reduces the size of the executable file (1) 		2

Question Number	Answer	Additional Guidance	Mark
2(f)	<ul style="list-style-type: none"> • A global variable can be accessed from anywhere in the whole program (1), local variable can only be accessed from the subprogram/block of code in which it is declared (1) • Globals are persistent while program is running (1), locals are created/destroyed with each call of the subprogram (1) • Globals can only have one instance (1), locals can have instance for each (running) subprogram (1) 	<ul style="list-style-type: none"> • Distinction between entire program and subprogram must be clear • Description of local variables in blocks must be clear 	2

Question Number	Answer	Additional Guidance	Mark
3(a)	<ul style="list-style-type: none"> • ASCII / American Standard Code for Information Interchange (1) • UTF-8 (1) 	<ul style="list-style-type: none"> • Ignore punctuation 	1

Question Number	Answer	Additional Guidance	Mark
3(b)	<ul style="list-style-type: none"> • b3r2y3r2 • 3b2r3y2r <p>One incorrect character or digit is maximum 1 mark</p>	<ul style="list-style-type: none"> • Ignore capitalisation and spacing 	2

Question Number	Answer	Additional Guidance	Mark
3(c)	<ul style="list-style-type: none"> • Input value taken in trapezoid box (1) • Two decision boxes, one for red and one for blue; contents must be answerable by yes/no (1) • Two process boxes, which follow the decision box and have an indication of an increment to the vote count (1) • An indication of some type of error output, like printing or file (1) <pre> graph TD Start([Start]) --> Input[/Input Vote/] Input --> DecB{Vote = 'B'} DecB -- Yes --> ProcB[BlueCount = BlueCount + 1] DecB -- No --> DecR{Vote = 'R'} DecR -- Yes --> ProcR[RedCount = RedCount + 1] DecR -- No --> Output[/Display "Error"/] ProcB --> Stop([Stop]) ProcR --> Stop Output --> Stop </pre>	<ul style="list-style-type: none"> • Ignore capitalisation and spacing • Ignore ordering across decision boxes • Last bullet must be output rather than error count increment because of shape of box 	4

Question Number	Answer	Additional Guidance	Mark
3(d)	<ul style="list-style-type: none"> • Four or five numbers from the nodes (1) • (40, 20) or (20) as first item (1) • (45, 10) in the correct sequence (1) • 30 as last number (1) 		4

Question Number	Answer	Additional Guidance	Mark
3(e)(i)	D (Label D)		1

Question Number	Answer	Additional Guidance	Mark
3(e)(ii)	Any value in the range of 13.7 to 14.0		1

Question Number	Answer	Additional Guidance	Mark
3(e)(iii)	<p>Analogue signals are all continuously variable / change all the time (1)</p> <p>Digital signals have only two states (0 or 1, high or low, on or off) (1)</p> <p>Digital signals represent analogue signals by sampling (1)</p>		2

Question Number	Answer	Additional Guidance	Mark
3(f)(i)	<ul style="list-style-type: none"> • One mark for multiplying by 1000 • One mark for multiplying 44.1 x 16 x 2 <p>Examples:</p> $\left(\frac{1000 \text{ bits}}{\text{kilobit}}\right) \left(\frac{44.1 \text{ kilobits}}{\text{sec}}\right) \left(\frac{16 \text{ bits}}{\text{sample}}\right) (2 \text{ channels})$ $1000 \times 44.1 \times 16 \times 2$	<ul style="list-style-type: none"> • Ignore units 	2

Question Number	Answer	Additional Guidance	Mark
3(f)(ii)	<ul style="list-style-type: none"> • One mark for (3 x 60 x 128000) • One mark for dividing by (8 x 1024 x 1024) <p>Examples:</p> $(3 \text{ minutes}) \left(\frac{60 \text{ sec}}{\text{minute}}\right) \left(\frac{128000 \text{ bits}}{\text{sec}}\right) \left(\frac{\text{byte}}{8 \text{ bits}}\right) \left(\frac{\text{kilobyte}}{1024 \text{ bytes}}\right) \left(\frac{\text{megabyte}}{1024 \text{ kilobytes}}\right)$ $\frac{3 \times 60 \times 128000}{8 \times 1024 \times 1024}$	<ul style="list-style-type: none"> • Ignore units 	2

Question Number	Answer	Additional Guidance	Mark
4(a)	<p>User support available:</p> <ul style="list-style-type: none"> • Open source software is supported usually by a group of volunteers on on-line forums (1) • Experienced programmers like these probably don't need much support (1) <p>Ability to customise the program solution</p> <ul style="list-style-type: none"> • Open source code is available to be changed in any way to suit the charities (1) • Changed code can be redistributed by charities because it is open source (1) 	<ul style="list-style-type: none"> • Maximum 2 marks from one section 	3

Question Number	Answer	Additional Guidance	Mark
4(b)(i)	<p>Any 1 of:</p> <ul style="list-style-type: none"> • Describes/defines the layout/formatting of (the content of) a web/HTML page (1) • Assigns properties to HTML tags (1) 		1

Question Number	Answer	Additional Guidance	Mark
4(b)(ii)	B ({ font-weight:bold; text-align:center; })		1

Question Number	Answer	Additional Guidance	Mark
4(b)(iii)	C (It takes the user to a different web page on this website.)		1

Question Number	Answer	Additional Guidance	Mark
4(c)	<p>Any two of:</p> <ul style="list-style-type: none"> • To share data (documents, pictures, files, chat, etc.) • To share hardware/peripherals (printers, scanners) • To share an Internet connection (including services WWW, email, FTP, etc.) • To distribute data or workload across different computers • To centralise support and maintenance of software • To allow remote access to machines • To allow collaboration / working together • To allow communication between users / email / instant messaging / VOIP 	<ul style="list-style-type: none"> • Allow examples such as to share printers • Max 1 mark per bullet including examples 	2

Question Number	Answer	Additional Guidance	Mark
4(d)	<ul style="list-style-type: none"> • Wireless (Wi-Fi, Li-Fi, IR, IrDA, microwave, Bluetooth) • Copper cable (accept copper alone) • Fibre optic cable (accept fibre alone) 		3

Question Number	Answer	Additional Guidance	Mark
4(e)	<p>One mark for a description:</p> <ul style="list-style-type: none"> • A cookie is a piece of text or a small file (stored on a user's hard disc by a web server) (1) • A cookie records/tracks/monitors data/activities (1) <p>AND one mark for any of:</p> <ul style="list-style-type: none"> • Which can be retrieved on a following visit to the web site (1) • Which uniquely identifies the visitor to the web site (1) • Any example of how a web site might use the information identified via the cookie, such as provide customised experience (1), target advertisement (1) 	<ul style="list-style-type: none"> • Do not award 'program' 	2

Question Number	Answer	Additional Guidance	Mark
4(f)	<ul style="list-style-type: none"> • A checksum number is calculated at the sending end (1) (based on the content of the data) • A checksum is appended to the packet (1) • The checksum is recalculated at the receiving end (1) • If the new checksum and the one in the packet do not match (1), there is an error 		2

Question Number	Answer	Additional Guidance	Mark
4(g)(i)	<ul style="list-style-type: none"> A MAC address is a unique identifier for a device (1), assigned by the manufacturer (when the device is made) (1), and cannot be changed (1). 		2

Question Number	Answer	Additional Guidance	Mark
4(g)(ii)	<ul style="list-style-type: none"> Domain name system / Domain name server / DNS 	<ul style="list-style-type: none"> Any combination of 'Domain Name' with any of Server, Service, System DNS is also allowed Ignore any additional words and plurals 	1

Question Number	Answer	Additional Guidance	Mark
4(h)	<ul style="list-style-type: none"> Computer systems/processes/devices cooperate with other computer systems/processes/devices to achieve goals. Systems/processes/devices cooperate without a master/ in a decentralised way 	<ul style="list-style-type: none"> Use of the word 'agent' in the response can only be awarded if there is a clear definition of the word 'agent.' 	1

Question Number	Answer	Additional Guidance	Mark
5(a)	<ul style="list-style-type: none"> Negative numbers (in sign-magnitude) have a 1 in the most significant or sign bit (1) (In binary) 1 + 1 gives a 0 in the most significant bit (1) A 0 in the most significant bit would change the result from negative to positive (1) 	<ul style="list-style-type: none"> An example alone is awarded maximum 2 marks. 	3

Question Number	Answer	Additional Guidance	Mark																					
5(b)	<p>One mark for each row</p> <table style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td style="padding: 2px 10px;">0</td> <td style="padding: 2px 10px;">1</td> <td style="padding: 2px 10px;">0</td> </tr> <tr> <td style="padding: 2px 10px;">0</td> <td style="padding: 2px 10px;">1</td> <td style="padding: 2px 10px;">1</td> </tr> <tr> <td colspan="3" style="border-top: 1px solid black; padding: 2px 10px;"></td> </tr> <tr> <td style="padding: 2px 10px;">0</td> <td style="padding: 2px 10px;">1</td> <td style="padding: 2px 10px;">0</td> </tr> <tr> <td style="padding: 2px 10px;">1</td> <td style="padding: 2px 10px;">0</td> <td style="padding: 2px 10px;">0</td> </tr> <tr> <td colspan="3" style="border-top: 1px solid black; padding: 2px 10px;"></td> </tr> <tr> <td style="padding: 2px 10px;">1</td> <td style="padding: 2px 10px;">1</td> <td style="padding: 2px 10px;">0</td> </tr> </tbody> </table>	0	1	0	0	1	1				0	1	0	1	0	0				1	1	0	<ul style="list-style-type: none"> All marks are awarded independently. Allow follow through errors for the addition only. That means, if row 2 or 3 is not correct, the third mark can be awarded if the addition is performed correctly. Ignore any additional rows before final answer 	3
0	1	0																						
0	1	1																						
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5(c)	<p>Any 4 components with a correct description:</p> <p>Control unit – coordinates the timing between the different components required to execute an instruction. In some instances, it is credited with doing the decode function.</p> <p>Arithmetic logic unit (ALU) – Performs arithmetic (+, -, *, /) and logic operations (AND, OR, NOT) on data</p> <p>Registers – Very fast (when compared with main memory RAM) memory that is used to hold the results of operations, data, or instructions. The instruction pointer is a register which holds the memory address of the next instruction to execute.</p> <p>Clock – A signal that is generated by a crystal which controls the timing of the fetch-decode-execute cycle. In a simple computer, one instruction is fetched, decoded, and executed on each clock cycle.</p> <p>Address bus – Holds the addresses of memory, input devices, or output devices needed for an instruction.</p> <p>Data bus – Holds the data that is being transferred between components such as a hard disc and memory. Instructions can move from memory to the registers over this bus.</p>	<ul style="list-style-type: none"> • Accept descriptions of specific registers 	4

Question Number	Answer	Additional Guidance	Mark															
5(d)	<ul style="list-style-type: none"> • 1 mark for any two correct. • 2 marks for all four correct <table border="1"> <thead> <tr> <th>Situation</th> <th>Compiler</th> <th>Interpreter</th> </tr> </thead> <tbody> <tr> <td>The company does not require fast execution, so a single line-by-line translation and execution method is acceptable.</td> <td></td> <td style="text-align: center;">X</td> </tr> <tr> <td>The company only wants to ship a single executable file to the client.</td> <td style="text-align: center;">X</td> <td></td> </tr> <tr> <td>The company wants to hide the source code from the client.</td> <td style="text-align: center;">X</td> <td></td> </tr> <tr> <td>The company has asked the client to load a special run-time environment onto their computers before they can execute the new program.</td> <td></td> <td style="text-align: center;">X</td> </tr> </tbody> </table>	Situation	Compiler	Interpreter	The company does not require fast execution, so a single line-by-line translation and execution method is acceptable.		X	The company only wants to ship a single executable file to the client.	X		The company wants to hide the source code from the client.	X		The company has asked the client to load a special run-time environment onto their computers before they can execute the new program.		X		2
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Question Number	Answer	Additional Guidance	Mark
5(e)	<p>Indicative content:</p> <p>Speed:</p> <ul style="list-style-type: none"> • Potentially slower than the computers we have now • Tasks are performed in parallel, so some problems could be solved much quicker than conventional computers <p>Cost:</p> <ul style="list-style-type: none"> • Because it's new and scarce, a DNA computer could be more expensive than the computers we have now • Because there is so much of it and is easy to produce, DNA is cheaper than conventional media • Storing at a molecular level provides much more data storage <p>Environment:</p> <ul style="list-style-type: none"> • There is a potential for using fewer toxic chemicals in creating DNA computers • There is a potential for DNA computers to require little or no electrical power to run • DNA manufacturing / growing is a quicker, cleaner process than manufacturing silicon chips <p>Reliability:</p> <ul style="list-style-type: none"> • DNA degrades very slowly • Currently needs a good deal of human assistance to complete solutions • Is time consuming to implement <p>Applicability:</p> <ul style="list-style-type: none"> • DNA computers may be made to work inside living organisms • Using DNA for storage/computation may have ethical issues (which 		6

we cannot anticipate)

- Because DNA is so small, it will allow very small computing devices
- DNA computing is in its infancy, we will see improvements the same as we did with silicon based computers

Quality of Written Communication:

- 1-2: Some basic points from **at least one** of the categories; little clarification or expansion of points; spelling, grammar, and punctuation **errors hinder meaning**.
- 3-4: At least one relevant point **from more than one category**; some clarification or expansion of points; spelling, grammar, and punctuation **errors occur**, but do not hinder meaning.
- 5-6: Relevant points from **more than one category**; comprehensive clarification or expansion of points; spelling, grammar, and punctuation are **used accurately** and meaning is clear.

Example:

DNA computers might be used inside the human body to control how it responds to diseases. One day they might be designed to help the body fight diseases. (One category; little expansion; QWC ok; 2 marks max)

Example:

DNA is really cheap because there is so much of it. It's living, so we can grow it. However, to make a DNA computer work is still very expensive, because it's a new technology. One day, a DNA computer could be faster than the ones we have now. (Three categories; little expansion; QWC ok; 4 marks max)

Example:

DNA computers could change the world because we may use them inside human bodies. They could be used to fight diseases. Right now it is expensive to make a DNA computer, but in the future it will get cheaper.

This is because there is so much DNA in the world that it is a cheap material. And, because it stores at a molecular level, we will be able to store a great deal of data. So, DNA, in the future, could really change our lives. (Four categories; some expansion; QWC ok; 6 marks max)

Example:

- DNA is cheap
- DNA computers could be used inside the human body
- DNA computers are slow
- DNA does not degrade

(Four categories; QWC no expansion; 2 marks max)

