Cambridge Assessment International Education

Cambridge IGCSE™

COMPUTER SCIENCE **0478/12**

Paper 1 Computer Systems **February/March 2023**

MARK SCHEME

Maximum Mark: 75

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the February/March 2023 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Mark scheme abbreviations

/	separates alternative words / phrases within a marking point
//	separates alternative answers within a marking point
underline	actual word given must be used by candidate (grammatical variants accepted)
max	indicates the maximum number of marks that can be awarded
( )	the word / phrase in brackets is not required, but sets the context

Note: No marks are awarded for using brand names of software packages or hardware.

Question	Answer	Marks
1(a)	D	**1**
1(b)	**One** mark for identification. E.g. **One** mark per bullet for description to **max two** each. Virus • Software/code that replicates • …when the user runs it // with an active host • Deletes/damages/corrupts data/files // takes up storage/memory space Worm • Software/code that replicates itself on a **network** • …without user input // without active host • Takes-up bandwidth • Deletes/damages/corrupts data/files // takes up storage/memory space • Opens back doors to computers over the network • Used to deposit other malware on networked computers Trojan horse • Software/code that is hidden within other software // Software that is disguised as authentic software • …when **downloaded/installed** the other **malware**/**by example** it contains is **installed** Adware • Software/code that generates/displays (unwanted) adverts on a user's computer • Some may contain spyware/other malware • Some when clicked may link to viruses • Reduces device performance // reduces internet speed • Redirects internet searches/user to fake websites Ransomware • Software/code that stops a user accessing/using their computer/data • …by encrypting the data/files/computer • A **fee** has to be paid to decrypt the data // A **fee** has to be paid to 'release' the computer/device/data	**6**

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Question	Answer	Marks
1(c)	**One** mark for each similarity to **max two**. **One** mark for difference (both sides needed unless clearly and accurately implied). Similarities e.g. • Check incoming and outgoing signals // filter traffic • Store whitelist/blacklist • Block incoming/outgoing signals • Both block unauthorised access • Keep a log of traffic • Both can be hardware or software (or both) Differences e.g. • Proxy can hide user's IP address, firewall does not hide the user's IP address • Proxy intention is to divert attack from server, firewall is to stop unauthorised access • Proxy protects a server, firewall protects individual computer • Proxy examines/processes requests for a website but a firewall does not (checks type of signal) // Proxy **processes** client-side requests whereas firewall **filters** packets • Proxy transmits website data to the user, but a firewall does not (it allows valid signals) • Proxy allows faster access to a web page using cache, but a firewall does not (allow faster access or have cache) • Proxy can hide internal network from internet, but a firewall cannot	**3**

Question	Answer	Marks
2(a)	No mark for choice. Any **four** from matching choice. High-level • Easier for programmer to read/write/understand/edit • … therefore, the programmer is less likely to make mistakes // can write in shorter timeframe • Easier to **debug** // Easier to find/correct **errors** • …so, the programmer can find and correct errors in less time • Game will be machine independent // Game will be portable (between hardware) • …the game can be used on any computer without a need for understanding of the hardware / compilation for that hardware • Programmer can focus on the problem instead of the manipulation of memory/hardware Low-level • More **memory/RAM** efficient • … 3D graphics will have high memory consumption anyway • Allows direct manipulation of memory • … allows for more efficient control/response time • Allows for use of specialised hardware	**4**
2(b)	**Two** from for each compiler and interpreter. Compiler • Checks all code **before** executing any code • Produces error report with all errors found for the whole code (before translating/running any of the code) • Produces executable file Interpreter • Checks/translates one line of code **and then** executes it before moving on to the next line • Stops when an error is found • … when corrected the program can be run from the same position // allows error correction in real time	**4**

Question	Answer	Marks
3(a)	**One** mark each: 8 bytes = **16** nibbles 512 KiB = **0.5** MiB 4 GiB = **4096** MiB 1 EiB = **1024** PiB	**4**
3(b)	Any **three** from: • Currently running data • Currently running (application) software • Currently running instructions • Currently running parts of OS • Currently running utility software	**3**
3(c)	Any **two** from: • For non-volatile/permanent/long-term storage of files/data • To store data that is not currently required by the **CPU** • To store data to transfer it to another computer	**2**

Question	Answer	Marks
4(a)	**One** mark each: Pixel: • **One** square/circle of **one** colour // the **smallest component** of the image Resolution: • The number of pixels per set area/cm/inch // the number of pixels wide by the number of pixels high // number of pixels in an image	**2**
4(b)	**One** mark for answer: • 2 000 000 bytes **One** mark for working from: • 1000 × 1000 (= 1 000 000) • 1 000 000 * 2 (= 2 000 000)	**2**
4(c)	**One** mark for each term: Solid-state storage is **non-volatile**. This means that the data is **not** lost when the power is turned off. Solid-state storage is made of **transistors** that are laid out in a **grid**. Gates are used to control the flow of the **electrons** through the transistors. This changes the data in the transistors from 1 to 0, or from 0 to 1.	**4**
4(d)	Any **one** from: • Reduce the file size • Increase transmission speed // Reduce transmission time • Reduce **storage** space required • Less bandwidth required for transmission	**1**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(a)(i)</td><td>Any two from:
e.g.
• Destination IP/address
• Packet number
• Originators IP/address
• Error detection method</td><td>2</td></tr>
<tr><td>5(a)(ii)</td><td>One mark each:
• Payload
• Trailer</td><td>2</td></tr>
<tr><td>5(b)(i)</td><td>No mark for choice.
Three from for justification that matches choice.

Serial
• Data arrives in order sent // does not need reordering
• Less likely to experience interference
• … less likely to have errors
• Can transmit over a longer distance (i.e. another room)
• Still fast transmission…
• …sufficient for this purpose

Parallel
• Faster transmission speed than serial
• … faster response to requests
• Very long connection not needed
• …next room is (likely) within distance for parallel
• … unlikely to error/arrive out of sequence/skew</td><td>3</td></tr>
<tr><td>5(b)(ii)</td><td>One mark each:
• Data goes in both directions…
• …at the same time</td><td>2</td></tr>
<tr><td>5(c)(i)</td><td>One mark each:
<table><tr><td>0</td><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td></tr><tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr></table></td><td>2</td></tr>
<tr><td>5(c)(ii)</td><td>One mark each:
• In parity check, interchange of bits will not be detected // Parity check cannot detect even number of changes // Parity check cannot detect error if parity stays correct …
• …the (possible) position of all changes will be highlighted // will identify the horizontal and vertical position of all differences/changes</td><td>2</td></tr>
<tr><td>5(c)(iii)</td><td>One mark each:
• Bit 6
• Byte 4</td><td>2</td></tr>
</table>

Question	Answer	Marks
5(d)(i)	Any **two** from: e.g. • Storing bookmarks/favourites • Storing history • Allow multiple tabs/web pages to be open • Allow movement back and forth between web pages // provides navigation tools • Allows the user to enter a URL/IP into the address bar • **Manages** HTTP/HTTPS protocol • Search cache for IP // Request IP from DNS // Send URL to DNS • Sends a request to the **IP address/web server** (to obtain the contents of a web page) • Runs active script/JavaScript/client-side script • Allows **files** to be downloaded from **website/internet**	**2**
5(d)(ii)	Any **two** from: e.g. • Storing preferences // so the user does not have to select their preferences each time they visit the site • Storing account details // so the user does not have to remember/enter their username and password each time they visit the site • Storing recent purchases // to allow the user to quickly re-order more items • Storing the pages visited/items selected // to display relevant adverts • Storing shopping basket // so when the user leaves the site the items are still in their basket	**2**

Question	Answer	Marks
6(a)	One mark each **Movement** / **Binary** / **Denary** / **Hexadecimal** forward 1 step / 00011111 / 31 / **1F** back 1 step / **10001100** / 140 / 8C turn right / 01011010 / **90** / 5A turn left / **(0)1111000** / 120 / 78	**4**
6(b)	Any **two** from: • The design of robots (to perform tasks/operations/functions) • The construction of robots (to perform tasks/operations/functions) • The operation of robots (to perform tasks/operations/functions)	**2**

Question	Answer	Marks
6(c)	**Seven** from: • Uses an infra-red/proximity sensor • Sensor **continuously** sends the **digitised** value/reading/distance to the microprocessor • Microprocessor compares the data/signal to the stored value of **10**(cm) • If the **data**/**signal** is **greater** than the stored value/10 … • …a **signal** is sent to make the **robot move** forward • If the **data**/**signal** is **less than or equal** to the stored value/10 … • …a **signal** is sent to make robot **turn** • An **actuator** is used to make the robot **turn**/**move forward** • The whole process repeats continuously **until** turned off/stopped	**7**
6(d)(i)	Any **three** from: e.g. • Collects data • Stores rules for using the data • The ability to reason • The ability to learn // uses machine learning • … by adapting what it does • … for example, from mistakes to not make them again // result from previous decisions impacts future • … by changing its own rules • …by changing its own data • …by being trained • Makes one or more predictions (to make a decision) • Find/analyse patterns	**3**
6(d)(ii)	**Four** from: e.g. • Use **machine learning** algorithms • Collects data about where it has been • Collect data about obstacles/problems • Store successful actions • Stores unsuccessful actions • Identify/store patterns • … to make sure it does not repeat the same incorrect route • … so, it knows how to react to obstacles next time • …so, it knows what is most likely to work next time	**4**

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