



# Cambridge IGCSE™

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**COMPUTER SCIENCE**

**0478/01**

Paper 1 Computer Systems

**For examination from 2023**

MARK SCHEME

Maximum Mark: 75

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**Specimen**

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This document has **10** pages. Any blank pages are indicated.

**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.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>GENERIC MARKING PRINCIPLE 1:</p> <p>Marks must be awarded in line with:</p> <ul style="list-style-type: none"> <li>the specific content of the mark scheme or the generic level descriptors for the question</li> <li>the specific skills defined in the mark scheme or in the generic level descriptors for the question</li> <li>the standard of response required by a candidate as exemplified by the standardisation scripts.</li> </ul>                                                                                                                                                                                                                                                                                                                                              | <p>GENERIC MARKING PRINCIPLE 2:</p> <p>Marks awarded are always <b>whole marks</b> (not half marks, or other fractions).</p>                                                                          |
| <p>GENERIC MARKING PRINCIPLE 3:</p> <p>Marks must be awarded <b>positively</b>:</p> <ul style="list-style-type: none"> <li>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</li> <li>marks are awarded when candidates clearly demonstrate what they know and can do</li> <li>marks are not deducted for errors</li> <li>marks are not deducted for omissions</li> <li>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.</li> </ul> | <p>GENERIC MARKING PRINCIPLE 4:</p> <p>Rules must be applied consistently, e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.</p> |
| <p>GENERIC MARKING PRINCIPLE 5:</p> <p>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).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                       |

**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.

**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)     | <p>One mark per each correct four bits.</p> <div><div>97</div><table><tr><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td></tr></table><div>5C</div><table><tr><td>0</td><td>1</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr></table></div>                                                                                 | 1     | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 4 |
| 1        | 0                                                                                                                                                                                                                                                                                                                                                                                 | 0     | 1 | 0 | 1 | 1 | 1 |   |   |   |   |   |   |   |   |   |   |   |
| 0        | 1                                                                                                                                                                                                                                                                                                                                                                                 | 0     | 1 | 1 | 1 | 0 | 0 |   |   |   |   |   |   |   |   |   |   |   |
| 1(b)     | <p>Any <b>four</b> from:</p> <ul style="list-style-type: none"><li>used to identify a device</li><li>it is a <u>unique</u> (address)</li><li>it is a static address // it does not change</li><li>it is set by the manufacturer</li><li>the first part is the manufacturer ID / number / identifies the manufacturer</li><li>the second part is the serial number / ID.</li></ul> | 4     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1(c)     | <p>Any <b>two</b> from:</p> <ul style="list-style-type: none"><li>colour <u>codes</u> // colour in <u>HTML/CSS</u></li><li>error messages</li><li>locations in memory</li><li>memory dump // debugging</li><li>IP(v6) address</li><li>ASCII // Unicode</li><li>assembly language</li><li>URL.</li></ul>                                                                           | 2     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1(d)(i)  | <table><tr><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td></tr></table>                                                                                                                                                                                                                                                                          | 0     | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 |   |   |   |   |   |   |   |   |
| 0        | 1                                                                                                                                                                                                                                                                                                                                                                                 | 0     | 0 | 1 | 0 | 0 | 0 |   |   |   |   |   |   |   |   |   |   |   |
| 1(d)(ii) | The value becomes incorrect because the left most bits are lost.                                                                                                                                                                                                                                                                                                                  | 1     |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1(e)     | <p>One mark for method, e.g. conversion to binary then flipping and adding 1.<br/>One mark for correct answer.</p> <table><tr><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td></tr></table>                                                                                                                                                       | 1     | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 2 |   |   |   |   |   |   |   |   |
| 1        | 1                                                                                                                                                                                                                                                                                                                                                                                 | 0     | 0 | 1 | 0 | 1 | 0 |   |   |   |   |   |   |   |   |   |   |   |

| Question  | Answer                                                                                                                                                                                                                                                                                                                                                                                                                          | Marks    |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 2(a)      | Any <b>four</b> from:<br><ul style="list-style-type: none"> <li>• it has a header</li> <li>• ... that contains the destination address</li> <li>• ... that contains the packet number</li> <li>• ... that contains the originator's address</li> <li>• it has a payload</li> <li>• it has a trailer.</li> </ul>                                                                                                                 | <b>4</b> |
| 2(b)(i)   | <b>C</b>                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>1</b> |
| 2(b)(ii)  | <ul style="list-style-type: none"> <li>• lossy</li> <li>• lossless</li> </ul>                                                                                                                                                                                                                                                                                                                                                   | <b>2</b> |
| 2(b)(iii) | Any <b>four</b> from:<br><ul style="list-style-type: none"> <li>• parallel would allow fastest transmission</li> <li>• ... of the large amount of data</li> <li>• data can be uploaded and downloaded ...</li> <li>• ... but this does not have to be at the same time</li> <li>• data is not required to travel a long distance</li> <li>• ... therefore skewing is not a problem.</li> </ul>                                  | <b>4</b> |
| 2(c)(i)   | Any <b>four</b> from:<br><ul style="list-style-type: none"> <li>• multiple computers are used as bots</li> <li>• designed to deny people access to a website</li> <li>• a large number / numerous requests are sent (to a server) ...</li> <li>• ... all at the same time</li> <li>• the server is unable to respond / struggles to respond to all the requests</li> <li>• the server fails / times out as a result.</li> </ul> | <b>4</b> |
| 2(c)(ii)  | firewall <b>OR</b> proxy server                                                                                                                                                                                                                                                                                                                                                                                                 | <b>1</b> |

| Question                   | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                  | Marks       |      |       |          |                            |             |             |                    |   |
|----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------|-------|----------|----------------------------|-------------|-------------|--------------------|---|
| 3(a)(i)                    | Any <b>three</b> from: <ul style="list-style-type: none"><li>• consists of values between 0–255 / 0–FFF</li><li>• values are separated by full stops / colons</li><li>• it is a unique address</li><li>• can be static or dynamic</li><li>• can be public or private</li><li>• can be IPv4 / have four groups of digits</li><li>• can be IPv6 / have eight groups of digits</li><li>• in IPv6 :: can replace groups of zeros.</li></ul> | 3           |      |       |          |                            |             |             |                    |   |
| 3(a)(ii)                   | router                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1           |      |       |          |                            |             |             |                    |   |
| 3(b)                       | <b>One</b> mark for each correct row. <table><tr><th>URL section</th><th>Name</th></tr><tr><td>https</td><td>protocol</td></tr><tr><td>cambridgeassessment.org.uk</td><td>domain name</td></tr><tr><td>/index.html</td><td>web page/file name</td></tr></table>                                                                                                                                                                         | URL section | Name | https | protocol | cambridgeassessment.org.uk | domain name | /index.html | web page/file name | 3 |
| URL section                | Name                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |      |       |          |                            |             |             |                    |   |
| https                      | protocol                                                                                                                                                                                                                                                                                                                                                                                                                                |             |      |       |          |                            |             |             |                    |   |
| cambridgeassessment.org.uk | domain name                                                                                                                                                                                                                                                                                                                                                                                                                             |             |      |       |          |                            |             |             |                    |   |
| /index.html                | web page/file name                                                                                                                                                                                                                                                                                                                                                                                                                      |             |      |       |          |                            |             |             |                    |   |

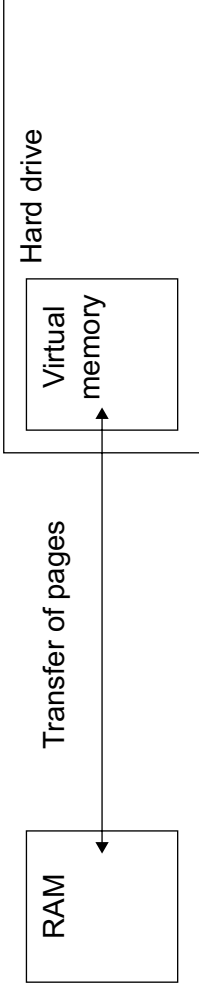
| Question | Answer                                                                                                                                                                                                                                                                | Marks |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 4(a)     | <p><b>One</b> mark for each correctly circled component:</p> <ul style="list-style-type: none"> <li>• accumulator (ACC)</li> <li>• program counter (PC)</li> <li>• memory address register (MAR)</li> </ul>                                                           | 3     |
| 4(b)     | <p>Any <b>two</b> from:</p> <ul style="list-style-type: none"> <li>• It sends control signals</li> <li>• ... that manage the transfer of data and instructions within the CPU</li> <li>• It decodes an instruction</li> <li>• ... using an instruction set</li> </ul> | 2     |
| 4(c)(i)  | <p>Any <b>one</b> from:</p> <ul style="list-style-type: none"> <li>• to process an instruction</li> <li>• to carry out a fetch-execute cycle.</li> </ul>                                                                                                              | 1     |

| Question | Answer                                                                                                                                                         | Marks |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 4(c)(ii) | <ul style="list-style-type: none"> <li>It can now process two instructions simultaneously (where suitable)</li> <li>... increasing the performance.</li> </ul> | 2     |
| 4(d)     | <b>B</b>                                                                                                                                                       | 1     |

| Question | Answer                                                                                                                                                                                                               | Marks |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 5(a)(i)  | Any <b>two</b> from: <ul style="list-style-type: none"> <li>it is easier / quicker to read/write/understand</li> <li>it is easier / quicker to debug</li> <li>code is portable.</li> </ul>                           | 2     |
| 5(a)(ii) | Any <b>one</b> from: <ul style="list-style-type: none"> <li>not able to directly manipulate the hardware</li> <li>may need to wait for translation before running</li> <li>program may be less efficient.</li> </ul> | 1     |
| 5(b)     | Software that provides useful functions for a programmer writing a computer program.                                                                                                                                 | 1     |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                       | Marks |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 6(a)     | <ul style="list-style-type: none"> <li>It has electrical components.</li> <li>It is programmable.</li> </ul>                                                                                                                                                                                                                                                                                                                                 | 2     |
| 6(b)     | Any <b>two</b> from: <ul style="list-style-type: none"> <li>more efficient than a human</li> <li>more accurate than a human</li> <li>can lift larger and heavier equipment than a human</li> <li>can replace humans working in a dangerous environment</li> <li>reduces running costs, such as wages and overheads</li> <li>can produce consistent results/output</li> <li>can work 24 hours a day // do not need to take breaks.</li> </ul> | 2     |

| Question | Answer                                                                                                                                                                                        | Marks |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 7(a)     | <ul style="list-style-type: none"> <li>All the characters and symbols that can be represented by a computer system.</li> <li>Each character and symbol is assigned a unique value.</li> </ul> | 2     |
| 7(b)     | Each character is encoded using more bits.                                                                                                                                                    | 1     |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Marks    |
|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 8(a)     | <p><b>One mark for each part of the diagram:</b></p> <p>The diagram shows:</p> <ul style="list-style-type: none"> <li>• a hard drive</li> <li>• the hard drive portioned in some way to create virtual memory</li> <li>• RAM</li> <li>• an indication of pages transferred between the RAM and the virtual memory.</li> </ul> <p>For example:</p>  <p>The diagram consists of a large rectangle labeled 'Hard drive' at the top. Inside this rectangle, there is a smaller rectangle labeled 'Virtual memory' on the right. To the left of the 'Virtual memory' rectangle is another rectangle labeled 'RAM'. A horizontal arrow points from the 'RAM' rectangle to the 'Virtual memory' rectangle, with the text 'Transfer of pages' written above the arrow.</p> | <b>4</b> |
| 8(b)     | <ul style="list-style-type: none"> <li>• to extend the RAM capacity</li> <li>• ... to stop the 3D modelling software from freezing/crashing when the physical RAM is full</li> <li>• to allow the computer to process the large amount of data required for 3D modelling.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>3</b> |

| Question | Answer                                                                                                                                        | Marks    |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 9        | <p><b>One mark for each correct term in the correct place.</b></p> <p>plain<br/>algorithm/key<br/>key/algorithm<br/>cipher<br/>understood</p> | <b>5</b> |

| Question | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Marks    |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 10       | <p><b>Six from:</b></p> <ul style="list-style-type: none"> <li>• SSL is a (security) protocol.</li> <li>• It encrypts any data that is sent.</li> <li>• It uses/sends digital certificates ...</li> <li>• ... which are sent to the (buyer's/user's) browser // requested by the (buyer's/user's) browser</li> <li>• ... that contains the gallery's public key</li> <li>• ... that can be used to authenticate the gallery.</li> <li>• Once the certificate is authenticated, the transaction will begin.</li> </ul> | <b>6</b> |

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