



**Cambridge Assessment International Education**  
Cambridge Ordinary Level

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**COMPUTER SCIENCE**

**2210/12**

Paper 1

**October/November 2019**

MARK SCHEME

Maximum Mark: 75

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**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 October/November 2019 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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This document consists of **15** printed pages.

### 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.

| Question                        | Answer   | Marks        |             |              |                             |  |   |                             |  |   |                              |   |  |                                 |  |   |          |
|---------------------------------|--|--------------|-------------|--------------|-----------------------------|--|---|-----------------------------|--|---|------------------------------|---|--|---------------------------------|--|---|----------|
| 1                               | <p><b>One mark for each correct tick</b></p> <table border="1" data-bbox="300 319 967 678"> <thead> <tr> <th data-bbox="300 319 768 416">Statement</th> <th data-bbox="768 319 866 416">True<br/>(✓)</th> <th data-bbox="866 319 967 416">False<br/>(✓)</th> </tr> </thead> <tbody> <tr> <td data-bbox="300 416 768 483">25 kB is larger than 100 MB</td> <td data-bbox="768 416 866 483"></td> <td data-bbox="866 416 967 483">✓</td> </tr> <tr> <td data-bbox="300 483 768 550">999 MB is larger than 50 GB</td> <td data-bbox="768 483 866 550"></td> <td data-bbox="866 483 967 550">✓</td> </tr> <tr> <td data-bbox="300 550 768 617">3500 kB is smaller than 2 GB</td> <td data-bbox="768 550 866 617">✓</td> <td data-bbox="866 550 967 617"></td> </tr> <tr> <td data-bbox="300 617 768 678">2350 bytes is smaller than 2 kB</td> <td data-bbox="768 617 866 678"></td> <td data-bbox="866 617 967 678">✓</td> </tr> </tbody> </table> | Statement    | True<br>(✓) | False<br>(✓) | 25 kB is larger than 100 MB |  | ✓ | 999 MB is larger than 50 GB |  | ✓ | 3500 kB is smaller than 2 GB | ✓ |  | 2350 bytes is smaller than 2 kB |  | ✓ | <b>4</b> |
| Statement                       | True<br>(✓)  | False<br>(✓) |             |              |                             |  |   |                             |  |   |                              |   |  |                                 |  |   |          |
| 25 kB is larger than 100 MB     |  | ✓            |             |              |                             |  |   |                             |  |   |                              |   |  |                                 |  |   |          |
| 999 MB is larger than 50 GB     |  | ✓            |             |              |                             |  |   |                             |  |   |                              |   |  |                                 |  |   |          |
| 3500 kB is smaller than 2 GB    | ✓  |              |             |              |                             |  |   |                             |  |   |                              |   |  |                                 |  |   |          |
| 2350 bytes is smaller than 2 kB |  | ✓            |             |              |                             |  |   |                             |  |   |                              |   |  |                                 |  |   |          |

| Question | Answer   | Marks    |
|----------|--|----------|
| 2        | <b>Four</b> from: <ul style="list-style-type: none"> <li>• Arithmetic and logic unit (ALU)</li> <li>• Memory address register (MAR)</li> <li>• Memory data register (MDR) // Memory buffer register (MBR)</li> <li>• Accumulator (ACC)</li> <li>• Immediate Access Store (IAS)</li> <li>• Main memory // RAM</li> <li>• Program counter (PC)</li> <li>• Current instruction register (CIR)</li> <li>• Address bus</li> <li>• Data bus</li> <li>• Control bus</li> <li>• Input device</li> <li>• Output device</li> <li>• Secondary storage device</li> </ul> | <b>4</b> |

| Question | Answer  | Marks    |
|----------|---|----------|
| 3(a)     | <b>One</b> from: <ul style="list-style-type: none"> <li>• Continuous data // by description</li> <li>• Non-discrete data // by description</li> <li>• By example, e.g. data such as a sound wave</li> </ul> | <b>1</b> |
| 3(b)     | <b>One</b> from: <ul style="list-style-type: none"> <li>• <u>Discrete</u> data that has only two values</li> <li>• By example, e.g. binary data / 1's and 0's</li> </ul>                                    | <b>1</b> |

| Question | Answer  | Marks |   |   |   |   |   |   |   |   |
|----------|---|-------|---|---|---|---|---|---|---|---|
| 4(a)     | • 52  | 1     |   |   |   |   |   |   |   |   |
| 4(b)     | <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> <td style="text-align: center;">1</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> <td style="text-align: center;">0</td> </tr> </table> | 1     | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 1        | 1   | 0     | 1 | 0 | 0 | 0 | 0 |   |   |   |
| 4(c)     | • It is multiplied by 4   | 1     |   |   |   |   |   |   |   |   |

| Question | Answer  | Marks |
|----------|---|-------|
| 5(a)     | <b>Four</b> from: <ul style="list-style-type: none"> <li>• A compression algorithm is used</li> <li>• Discards any unnecessary sounds ...</li> <li>• ... using perceptual musical shaping</li> <li>• ... such as removing background noise / sounds humans can't hear // or other suitable example</li> <li>• Reduces sample size / resolution // by example</li> <li>• Reduces sample rate // by example</li> <li>• Sound is clipped</li> <li>• The data is permanently removed</li> </ul> | 4     |
| 5(b)(i)  | <b>One</b> from: <ul style="list-style-type: none"> <li>• The file size will be smaller than lossless</li> <li>• Requires less storage space</li> <li>• Requires less time to transmit</li> </ul>   | 1     |
| 5(b)(ii) | <b>One</b> from: <ul style="list-style-type: none"> <li>• The quality of the sound will be reduced</li> <li>• The original file cannot be restored</li> </ul>   | 1     |

| Question | Answer  | Marks    |
|----------|---|----------|
| 5(c)(i)  | <p><b>Four</b> from:</p> <ul style="list-style-type: none"> <li>• Musical Instrument Digital Interface file</li> <li>• Stores a set of commands / instructions for how the sound should be played</li> <li>• Does not store the actual sounds</li> <li>• Data in the file has been recorded using digital instruments</li> <li>• Specifies pitch of the note // specifies the note to be played</li> <li>• Specifies when each note plays and stops playing // Specifies key on/off</li> <li>• Specifies duration of the note</li> <li>• Specifies volume of the note</li> <li>• Specifies the tempo</li> <li>• Specifies the type of instrument</li> </ul> | <b>4</b> |
| 5(c)(ii) | <p><b>Four</b> from:</p> <ul style="list-style-type: none"> <li>• It uses a single wire ...</li> <li>• ... therefore, it is cheaper to manufacture / buy / install</li> <li>• ... therefore, less likely to have interference // no crosstalk</li> <li>• ... therefore, can be used over longer distances</li> <li>• Data is sent a bit at a time ...</li> <li>• ... therefore, less chance of data being skewed // data is received in order</li> <li>• Transmission can be synchronised ...</li> <li>• ... can reduce rate of errors</li> </ul>   | <b>4</b> |

| Question   | Answer   |                   |  | Marks     |                  |                   |  |  |   |  |  |   |  |   |  |  |  |   |  |   |  |   |  |   |          |
|--|--|-------------------|--|-----------|------------------|-------------------|--|--|---|--|--|---|--|---|--|--|--|---|--|---|--|---|--|---|----------|
| 6  | <p><b>One</b> mark for each correct tick</p> <table border="1" data-bbox="300 316 1424 877"> <thead> <tr> <th data-bbox="300 316 1066 416">Statement</th> <th data-bbox="1066 316 1245 416">Resistive<br/>(✓)</th> <th data-bbox="1245 316 1424 416">Capacitive<br/>(✓)</th> </tr> </thead> <tbody> <tr> <td data-bbox="300 416 1066 483">This touch screen has multi-touch capabilities</td> <td data-bbox="1066 416 1245 483"></td> <td data-bbox="1245 416 1424 483">✓</td> </tr> <tr> <td data-bbox="300 483 1066 550">This touch screen cannot be used whilst wearing gloves</td> <td data-bbox="1066 483 1245 550"></td> <td data-bbox="1245 483 1424 550">✓</td> </tr> <tr> <td data-bbox="300 550 1066 647">This touch screen is made up of two layers with a small space in between</td> <td data-bbox="1066 550 1245 647">✓</td> <td data-bbox="1245 550 1424 647"></td> </tr> <tr> <td data-bbox="300 647 1066 745">This touch screen uses the electrical properties of the human body</td> <td data-bbox="1066 647 1245 745"></td> <td data-bbox="1245 647 1424 745">✓</td> </tr> <tr> <td data-bbox="300 745 1066 812">This touch screen is normally cheaper to manufacture</td> <td data-bbox="1066 745 1245 812">✓</td> <td data-bbox="1245 745 1424 812"></td> </tr> <tr> <td data-bbox="300 812 1066 877">This touch screen has a quicker response time</td> <td data-bbox="1066 812 1245 877"></td> <td data-bbox="1245 812 1424 877">✓</td> </tr> </tbody> </table> |                   |  | Statement | Resistive<br>(✓) | Capacitive<br>(✓) | This touch screen has multi-touch capabilities |  | ✓ | This touch screen cannot be used whilst wearing gloves |  | ✓ | This touch screen is made up of two layers with a small space in between | ✓ |  | This touch screen uses the electrical properties of the human body |  | ✓ | This touch screen is normally cheaper to manufacture | ✓ |  | This touch screen has a quicker response time |  | ✓ | <b>6</b> |
| Statement  | Resistive<br>(✓)   | Capacitive<br>(✓) |  |           |                  |                   |  |  |   |  |  |   |  |   |  |  |  |   |  |   |  |   |  |   |          |
| This touch screen has multi-touch capabilities                           |  | ✓                 |  |           |                  |                   |  |  |   |  |  |   |  |   |  |  |  |   |  |   |  |   |  |   |          |
| This touch screen cannot be used whilst wearing gloves                   |  | ✓                 |  |           |                  |                   |  |  |   |  |  |   |  |   |  |  |  |   |  |   |  |   |  |   |          |
| This touch screen is made up of two layers with a small space in between | ✓  |                   |  |           |                  |                   |  |  |   |  |  |   |  |   |  |  |  |   |  |   |  |   |  |   |          |
| This touch screen uses the electrical properties of the human body       |  | ✓                 |  |           |                  |                   |  |  |   |  |  |   |  |   |  |  |  |   |  |   |  |   |  |   |          |
| This touch screen is normally cheaper to manufacture                     | ✓  |                   |  |           |                  |                   |  |  |   |  |  |   |  |   |  |  |  |   |  |   |  |   |  |   |          |
| This touch screen has a quicker response time                            |  | ✓                 |  |           |                  |                   |  |  |   |  |  |   |  |   |  |  |  |   |  |   |  |   |  |   |          |



| Question | Answer   | Marks    |
|----------|--|----------|
| 7(a)     | <p><b>Four</b> from:</p> <ul style="list-style-type: none"> <li>• Membrane / matrix / circuit board present at base of keys</li> <li>• A key is pressed that presses a switch</li> <li>• When a key is pressed it completes a circuit // changes the current in a circuit</li> <li>• The location of the keypress is calculated</li> <li>• An index of characters is searched to find the corresponding keypress</li> <li>• Each character has an ASCII / Unicode value</li> <li>• The ASCII / Unicode value has a binary value</li> <li>• Keypress generates an interrupt</li> <li>• Each character / keypress is added to a buffer to wait to be processed</li> <li>• The binary can then be processed by the CPU to action the key press</li> </ul> | <b>4</b> |
| 7(b)     | <p><b>Three</b> from:</p> <ul style="list-style-type: none"> <li>• Display a web page</li> <li>• Sends a request to the web server</li> <li>• Receives data from web server</li> <li>• Translates HTML files</li> <li>• Processes client-side script, e.g. JavaScript</li> <li>• Store favourites</li> <li>• Store history</li> <li>• Navigation forward and backward</li> <li>• Check security</li> <li>• Store / access cookies</li> <li>• Find specific text within a web page</li> <li>• Downloading file from the web</li> <li>• Allows a homepage</li> <li>• Allows multiple tabs / web pages to be opened</li> <li>• Stores data in its cache</li> </ul>  | <b>3</b> |

| Question | Answer   | Marks    |
|----------|--|----------|
| 7(c)     | <p><b>Three</b> from:</p> <ul style="list-style-type: none"> <li>• Hypertext Transfer Protocol Secure // It is a protocol ...</li> <li>• ... that is a set of rules/standards</li> <li>• Secure version of <u>HTTP</u></li> <li>• Secure website // secures data</li> <li>• Uses TLS / SSL</li> <li>• Uses encryption</li> </ul> | <b>3</b> |

| Question | Answer  | Marks    |
|----------|---|----------|
| 8(a)     | <ul style="list-style-type: none"> <li>• <math>X = 1</math> if (A is 1 XOR C is 1) OR (B is 1 NAND C is NOT 1)</li> <li>• <math>X = (A \text{ XOR } C) \text{ OR } (B \text{ NAND } \text{NOTC})</math></li> </ul> <p><b>One</b> mark for each bullet:</p> <ul style="list-style-type: none"> <li>• (A XOR C)</li> <li>• OR</li> <li>• (B NAND NOTC)</li> </ul> | <b>3</b> |

| Question | Answer  |   |   |               |   | Marks    |
|----------|---|---|---|---------------|---|----------|
| 8(b)     | <b>Four</b> marks for 8 correct outputs<br><b>Three</b> marks for 6 or 7 correct outputs<br><b>Two</b> marks for 4 or 5 correct outputs<br><b>One</b> mark for 2 or 3 correct outputs |   |   |               |   | <b>4</b> |
|          | A   | B | C | Working space | X |          |
|          | 0   | 0 | 0 |               | 1 |          |
|          | 0   | 0 | 1 |               | 1 |          |
|          | 0   | 1 | 0 |               | 0 |          |
|          | 0   | 1 | 1 |               | 1 |          |
|          | 1   | 0 | 0 |               | 1 |          |
|          | 1   | 0 | 1 |               | 1 |          |
|          | 1   | 1 | 0 |               | 1 |          |
|          | 1   | 1 | 1 |               | 1 |          |

| Question   | Answer   |              |  | Marks     |             |              |   |   |  |  |  |   |   |  |   |   |   |  |   |  |   |          |
|--|--|--------------|--|-----------|-------------|--------------|---|---|--|--|--|---|---|--|---|---|---|--|---|--|---|----------|
| 9(a)   | <p><b>One</b> mark per each correct tick</p> <table border="1" data-bbox="300 316 1368 735"> <thead> <tr> <th data-bbox="300 316 1032 384">Statement</th> <th data-bbox="1032 316 1200 384">True<br/>(✓)</th> <th data-bbox="1200 316 1368 384">False<br/>(✓)</th> </tr> </thead> <tbody> <tr> <td data-bbox="300 384 1032 453">Duplex data transmission can be either serial or parallel</td> <td data-bbox="1032 384 1200 453">✓</td> <td data-bbox="1200 384 1368 453"></td> </tr> <tr> <td data-bbox="300 453 1032 521">Duplex data transmission is when data is transmitted both ways, but only one way at a time</td> <td data-bbox="1032 453 1200 521"></td> <td data-bbox="1200 453 1368 521">✓</td> </tr> <tr> <td data-bbox="300 521 1032 590">Duplex data transmission is always used to connect a device to a computer</td> <td data-bbox="1032 521 1200 590"></td> <td data-bbox="1200 521 1368 590">✓</td> </tr> <tr> <td data-bbox="300 590 1032 659">Duplex data transmission is when data is transmitted both ways at the same time</td> <td data-bbox="1032 590 1200 659">✓</td> <td data-bbox="1200 590 1368 659"></td> </tr> <tr> <td data-bbox="300 659 1032 735">Duplex data transmission automatically detects any errors in data</td> <td data-bbox="1032 659 1200 735"></td> <td data-bbox="1200 659 1368 735">✓</td> </tr> </tbody> </table> |              |  | Statement | True<br>(✓) | False<br>(✓) | Duplex data transmission can be either serial or parallel | ✓ |  | Duplex data transmission is when data is transmitted both ways, but only one way at a time |  | ✓ | Duplex data transmission is always used to connect a device to a computer |  | ✓ | Duplex data transmission is when data is transmitted both ways at the same time | ✓ |  | Duplex data transmission automatically detects any errors in data |  | ✓ | <b>5</b> |
| Statement  | True<br>(✓)  | False<br>(✓) |  |           |             |              |   |   |  |  |  |   |   |  |   |   |   |  |   |  |   |          |
| Duplex data transmission can be either serial or parallel                                  | ✓  |              |  |           |             |              |   |   |  |  |  |   |   |  |   |   |   |  |   |  |   |          |
| Duplex data transmission is when data is transmitted both ways, but only one way at a time |  | ✓            |  |           |             |              |   |   |  |  |  |   |   |  |   |   |   |  |   |  |   |          |
| Duplex data transmission is always used to connect a device to a computer                  |  | ✓            |  |           |             |              |   |   |  |  |  |   |   |  |   |   |   |  |   |  |   |          |
| Duplex data transmission is when data is transmitted both ways at the same time            | ✓  |              |  |           |             |              |   |   |  |  |  |   |   |  |   |   |   |  |   |  |   |          |
| Duplex data transmission automatically detects any errors in data                          |  | ✓            |  |           |             |              |   |   |  |  |  |   |   |  |   |   |   |  |   |  |   |          |
| 9(b)   | <ul style="list-style-type: none"> <li>• Parallel data transmission</li> </ul>   |              |  | <b>1</b>  |             |              |   |   |  |  |  |   |   |  |   |   |   |  |   |  |   |          |

| Question | Answer   | Marks    |
|----------|--|----------|
| 9(c)     | <p><b>Four</b> from (maximum two marks per benefit):</p> <ul style="list-style-type: none"> <li>• It is a universal standard ...</li> <li>• ... so it is likely to be compatible with the computer</li> <br/> <li>• It can only be inserted one way ...</li> <li>• ... so there is less chance of connecting a device incorrectly</li> <br/> <li>• It is a high-speed connection ...</li> <li>• ... so data will be transmitted quicker</li> <br/> <li>• It uses serial transmission ...</li> <li>• ... so it is cheaper to manufacture/buy</li> <li>• ... less chance of skewing / errors</li> <br/> <li>• It doesn't require a (wireless) network ...</li> <li>• ... therefore, can be used if a network is down</li> <br/> <li>• It is backwards compatible ...</li> <li>• ... so no additional technology is needed</li> <br/> <li>• It can power the device ...</li> <li>• ... therefore no separate source of power is needed</li> <br/> <li>• Drivers are automatically downloaded // device is automatically identified ...</li> <li>• ... so no need to find them online / install them manually</li> </ul> | <b>4</b> |

| Question | Answer   | Marks    |
|----------|--|----------|
| 10(a)    | <p><b>Four</b> from:</p> <ul style="list-style-type: none"> <li>• Validation method</li> <li>• Used to check data entry</li> <li>• Digit is calculated from data // by example</li> <li>• Digit is appended / added to data</li> <li>• Digit is recalculated when data has been input</li> <li>• Digits are compared</li> <li>• If digits are different, error is detected // If digits match, no error is detected</li> </ul>   | <b>4</b> |
| 10(b)    | <p><b>Six</b> from (maximum three marks per security method):</p> <ul style="list-style-type: none"> <li>• Firewall ...</li> <li>• ... Monitors the traffic</li> <li>• ... <b>Blocks</b> any traffic that doesn't meet the <b>criteria / rules</b></li> <br/> <li>• (Strong) password // biometric ...</li> <li>• ... Data cannot be accessed without the use of the password / bio data</li> <li>• ... Prevent brute force attacks</li> <br/> <li>• Encryption ...</li> <li>• ... Data will be scrambled</li> <li>• ... <b>Key</b> is required to decrypt the data</li> <li>• ... If data is stolen it will be meaningless</li> <br/> <li>• Physical security methods ...</li> <li>• ... The physical security will need to be overcome</li> <li>• ... This can help deter theft of the data</li> <br/> <li>• Antispyware ...</li> <li>• ... will remove any spyware from system</li> <li>• ... will prevent data being relayed to a third party</li> </ul> | <b>6</b> |

| Question | Answer  | Marks    |
|----------|---|----------|
| 11(a)    | <p><b>RAM</b></p> <ul style="list-style-type: none"> <li>• To store the data / instructions / parts of OS that are currently in use</li> </ul> <p><b>ROM</b></p> <ul style="list-style-type: none"> <li>• To store the firmware / bootup instructions / BIOS</li> </ul> <p><b>SSD</b></p> <ul style="list-style-type: none"> <li>• To store files / software // by example</li> </ul>   | <b>3</b> |
| 11(b)    | <p><b>Two</b> from:</p> <ul style="list-style-type: none"> <li>• It is more durable // it has no moving parts</li> <li>• It has a faster read / write / access speed</li> <li>• It is more compact / light weight / smaller / portable</li> <li>• It uses less energy // battery will last longer</li> <li>• It is quieter</li> <li>• Not affected by magnetic forces</li> <li>• It runs at a cooler temperature</li> <li>• Less latency // takes less time to warm up</li> </ul> | <b>2</b> |