Cambridge Assessment International Education

# Cambridge International AS & A Level

| | |
|---|---|
| **COMPUTER SCIENCE** | **9608/12** |
| Paper 1 Theory Fundamentals | **October/November 2021** |
| 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 October/November 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **9** 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.

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1</td><td><b>1 mark</b> for each shaded set of rows
<table>
<tr><th>Statement</th><th>RAM</th><th>ROM</th></tr>
<tr><td>Stores data permanently</td><td></td><td>✓</td></tr>
<tr><td>It is volatile</td><td>✓</td><td></td></tr>
<tr><td>Stores the start-up instructions for the computer</td><td></td><td>✓</td></tr>
<tr><td>Directly accessed by the CPU</td><td>✓</td><td>✓</td></tr>
<tr><td>Type of main memory</td><td>✓</td><td>✓</td></tr>
<tr><td>Stores currently running applications</td><td>✓</td><td></td></tr>
<tr><td>Can be static or dynamic</td><td>✓</td><td></td></tr>
</table>
</td><td>3</td></tr>
</table>

| Question | Answer | Marks |
|---|---|---|
| 2(a)(i) | 2 bits | 1 |
| 2(a)(ii) | **2 marks** for correct working, **1 mark** for correct answer<br>Working:<br>• Pixels is 8 * 8<br>• Bytes = (2 * 8 * 8) / 8 // (2 * 64) / 8<br>Answer: 16 (bytes) | 3 |
| 2(b) | **1 mark** per bullet point to **max 2**<br>• A metafile / wrapper<br>• …that contains audio **and** video // …that contains various different types of data<br>• Describes how the (encoded) data is stored<br>• Is not confined to any one codec / compression method<br>• Synchronises the different types of data (on playback) | 2 |
| 2(c) | **1 mark** for each correct term<br>• **Spatial redundancy** is when a sequence of consecutive pixels in the same frame have the same value.<br>• **Temporal redundancy** is when a pixel in the same location in two consecutive frames has the same value. | 2 |

| Question | Answer | Marks |
|---|---|---|
| 3(a) | **1 mark** per bullet point to **max 2**<br>• Cell phone **network**<br>• Satellite system<br>• Public Switched Telephone Network | 2 |
| 3(b) | **1 mark** per bullet point to **max 2**<br>Many correct answers, for example:<br>• Server<br>• Router<br>• Gateway<br>• Radio transmitter/receiver //WAP<br>• Hub<br>• Switch<br>• Repeater | 2 |
| 3(c) | **1 mark** for name and **max 2** marks for matching description<br>Parity check<br>• **Counts** if the number of 1s or 0s in each byte is odd or even<br>• Adds a bit to make the number odd or even<br>• Parity is re-calculated at receiving end and a change in parity indicates corruption<br>Echo check<br>• Receiver sends data back to sender<br>• Sender compares data received with original<br>• Sender either confirms or resends data<br>Automatic repeat request (ARQ)<br>• Uses error detection method to detect errors in individual packets<br>• Sends a negative acknowledgement if an error<br>• Uses timeouts to detect missing packets<br>• Automatically asks for a repeat of the data from the sender | 3 |

| Question | Answer | Marks |
|---|---|---|
| 3(d) | **1 mark** per bullet point to **max 2** per security measure, **max 4** in total<br>e.g.<br>• Firewall<br>• …denies access to data that does not conform to set rules<br>• ... maintains a blacklist/whitelist of IP addresses<br>• Proxy<br>• …denies access to data that does not conform to set rules<br>• … prevents some requests ever reaching the server<br>• Authentication<br>• ... makes use of usernames and strong passwords...<br>• ... without a correct unique combination of characters data on the server cannot be accessed<br>• ... makes use of biometrics ...<br>• ... unique features of individuals that cannot be guessed<br>• ... makes use of two step verification ...<br>• ... a verification code is sent to a mobile phone or other device | **4** |

| Question | Answer | Marks |
|---|---|---|
| 4(a)(i) | **1 mark** per bullet point to **max 2**<br>• Compare instructions<br>• Arithmetic operations<br>• Data movement | **3** |
| 4(a)(ii) | **1 mark** only from<br>• Unconditional and conditional jump instructions<br>• Input and output of data | **1** |
| 4(b) | **1 mark** per bullet point to **max 2** per register, **max 6** in total<br>Program Counter<br>• Points to the address ...<br>• ... of the next instruction to be fetched<br>• So the address can be transferred to/from the MAR<br>Memory Address Register<br>• Points to the address where data to be fetched/stored is located<br>• So data can be transferred to/from the MDR<br>Memory Data Register<br>• Holds the data received from/ transmitted to memory<br>• So data can be received from/transmitted to the CIR<br>Current Instruction Register<br>• Holds the data received from the MDR<br>• CIR stores the current instruction being processed | **6** |

| Question | Answer | Marks |
|---|---|---|
| 5(a) | **1 mark** per correct word<br>The **executable** file does not contain the library routines.<br>A DLL file can be **edited** without having to **recompile** the calling program.<br>One drawback of a DLL file is that the main program could stop working if the DLL file is **corrupted**. | **4** |
| 5(b) | **1 mark** for name, **1 mark** per bullet point to **max 3** for description<br>Interpreter<br>• Converts high level language code into low level code<br>• Translates and runs one line at a time<br>• Stops when an error occurs<br>• Allows errors to be corrected in real time // errors can be corrected and translation continued from that point<br>Compiler<br>• Converts high level language code into low level code<br>• Translates the whole program before attempting to run it<br>• Creates an executable file/object code...<br>• ... if there are no errors<br>• Generates a report of all the errors | **4** |
| 5(c) | **1 mark** per bullet point to **max 2**<br>• Formal / legal recognition of ownership // To protect her intellectual property rights<br>• Formal / legal restrictions on the use of the program | **2** |

| Question | Answer | Marks |
|---|---|---|
| 6 | **1 mark** per bullet point to **max 2** per utility program, **max 4** in total<br>File compression<br>• Reduces the file size<br>• ... by using algorithms to change the data<br>• ... which can be either lossy or lossless<br>Defragmenter<br>• Finds files that are split across the disk<br>• …and moves the blocks that make up each file to be contiguous<br>• Collates free space | **4** |

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>7</td><td>

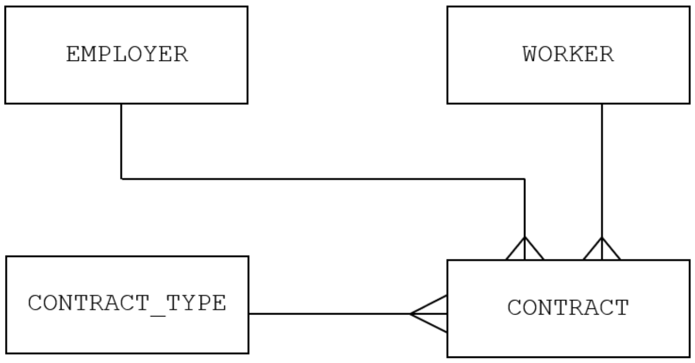
**1 mark** per pair of rows (shaded and unshaded)

<table>
<tr><th>A</th><th>B</th><th>C</th><th>Working space</th><th>X</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td></td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td></td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td></td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td></td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td></td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td></td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td></td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td></td><td>0</td></tr>
</table>

</td><td>4</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>8(a)</td><td>

**1 mark** per correct relationship



</td><td>3</td></tr>
<tr><td>8(b)</td><td>

**1 mark** per bullet point

- `ALTER TABLE` and correct table name `(CONTRACT)`
- `DROP` and the correct attribute name `(RefConNumber)`

```
ALTER TABLE CONTRACT
DROP RefConNumber;
```

</td><td>2</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>8(c)</td><td><b>1 mark</b> for the shaded rows and <b>1 mark</b> for the unshaded rows<br>
<table>
<tr><th>Statement</th><th>DML</th><th>DDL</th></tr>
<tr><td><code>ADD PRIMARY KEY</code></td><td></td><td>✓</td></tr>
<tr><td><code>ALTER TABLE</code></td><td></td><td>✓</td></tr>
<tr><td><code>SELECT FROM</code></td><td>✓</td><td></td></tr>
<tr><td><code>INNER JOIN</code></td><td>✓</td><td></td></tr>
<tr><td><code>CREATE DATABASE</code></td><td></td><td>✓</td></tr>
</table></td><td>2</td></tr>
<tr><td>8(d)</td><td><b>1 mark</b> per bullet point to <b>max 2</b> per validation method, <b>max 4</b> in total<br><br>• Presence check<br>• …to make sure the phone number is entered // to make sure the field is not left empty<br><br>• Length check<br>• …to make sure there are a maximum of 14 characters</td><td>4</td></tr>
<tr><td>8(e)</td><td><b>1 mark</b> for a correct answer<br><br>An attribute (or set of attributes) that <b>could be</b> a primary key</td><td>1</td></tr>
<tr><td>8(f)</td><td><b>1 mark</b> per bullet point to <b>max 2</b><br><br>• An attribute that can be indexed...<br>• …for faster searching<br><br>• An attribute that is a candidate key...<br>• …but is not the primary key</td><td>2</td></tr>
</table>

| Question | Answer | Marks |
|---|---|---|
| 8(g) | **1 mark** per bullet point to **max 5**<br>• The disk has one or more platters …<br>• … made of aluminium/glass<br>• The platters are coated with ferrous oxide which is capable of being magnetised<br>• The platters/disks are mounted on a central spindle.<br>• The disks are rotated at high-speed<br>• Each surface of the disk has a read-write head mounted on an arm positioned just above the surface<br>• Electronic circuits control the movement of the arm and hence the heads<br>• The surface of the platter/disk is divided into concentric tracks and sectors<br>• The data is encoded as a magnetic pattern for each block<br>• When writing to disk, a variation in the current in the head produces a variation in magnetic field on the disk<br>• When reading from disk, a variation in magnetic field produces a variation in current through the head | **5** |

| Question | Answer | Marks |
|---|---|---|
| 9 | **1 mark** per correct description | **3** |

| Register transfer notation | Description |
|---|---|
| `MAR ←[PC]` | The data stored in the Program Counter is passed to the Memory Address Register |
| `PC ←[PC] + 1` | The Program Counter is incremented |
| `MDR ←[[MAR]]` | The data in the address pointed to by the Memory Address Register is passed to the Memory Data Register |

| Question | Answer | Marks |
|---|---|---|
| 10(a) | **1 mark** for the correct answer<br>256 | **1** |
| 10(b) | **1 mark** for each correct answer<br>Smallest: –128<br>Largest: +127 | **2** |