Cambridge Assessment International Education

Cambridge International AS & A Level

COMPUTER SCIENCE **9618/13**

Paper 13 Theory Fundamentals **May/June 2022**

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 May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

This document consists of **10** 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(a)(i)</td><td>1 mark per point to max 2

• All of the characters/symbols that the computer can use/represent
• Each character has a unique number/binary number/hexadecimal number</td><td>2</td></tr>
<tr><td>1(a)(ii)</td><td>1 mark for each character set to max 2, 1 mark for difference

• ASCII
• Extended ASCII
• UNICODE

• ASCII has 7 bits whereas UNICODE has 16 bits
• Extended ASCII has 8 bits whereas UNICODE has 16 bits
• ASCII has 7 bits whereas extended ASCII has 8 bits
• Unicode can represent more characters than ASCII/Extended// by example
• Extended ASCII can represent more characters than ASCII</td><td>3</td></tr>
<tr><td>1(a)(iii)</td><td>1 mark per point to max 2

• Can use run-length encoding
• Identifies groups of repeated characters ...
• ... replaces them with a one copy of the character and the number of times it occurs</td><td>2</td></tr>
<tr><td>1(a)(iv)</td><td>1 mark per point to max 2

• None of the original data can be lost / deleted
• The (text) file would be corrupted // the (text) file cannot be opened</td><td>2</td></tr>
<tr><td>1(b)</td><td>1 mark for each correct value

<table>
<tr><th>Statement</th><th>Answer</th></tr>
<tr><td>The hexadecimal value 11 represented in denary</td><td>17</td></tr>
<tr><td>The smallest denary number that be represented by an unsigned 8-bit binary integer</td><td>0</td></tr>
<tr><td>The denary number 87 represented in Binary Coded Decimal (BCD)</td><td>1000 0111</td></tr>
<tr><td>The denary number 240 represented in hexadecimal</td><td>F0</td></tr>
<tr><td>The denary number –20 represented in 8-bit two’s complement binary</td><td>1110 1100</td></tr>
</table>
</td><td>5</td></tr>
</table>

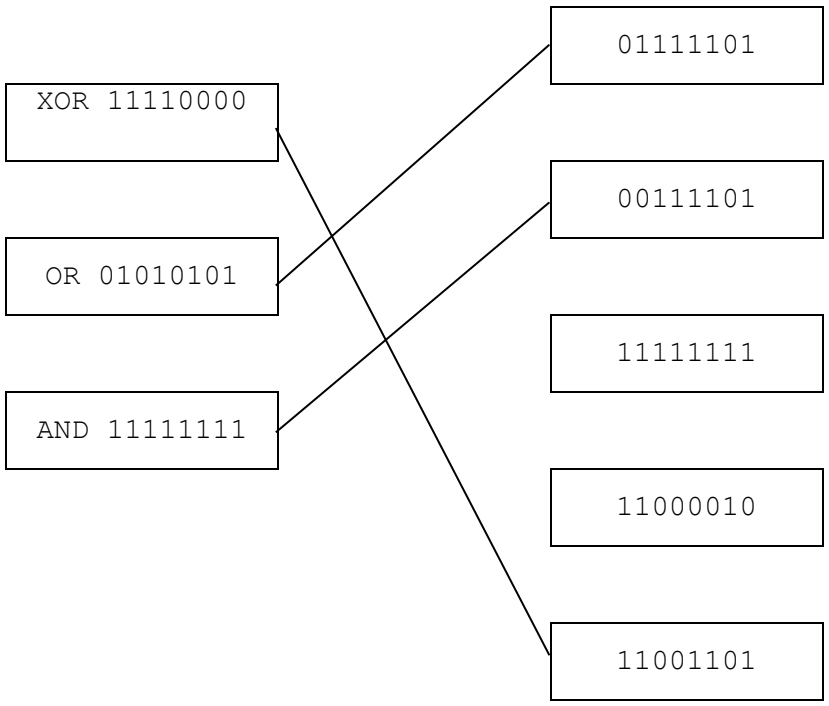
<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>1 mark for each correct description

<table>
<tr><th>Step</th><th>Description</th></tr>
<tr><td>PC ← [PC] + 1</td><td>Address in PC is incremented</td></tr>
<tr><td>MDR ← [[MAR]]</td><td>The data in the address held in the MAR is copied to the MDR</td></tr>
<tr><td>MAR ← [PC]</td><td>The contents of the PC are copied to the MAR</td></tr>
</table></td><td>3</td></tr>
<tr><td>2(b)</td><td>1 mark per point to max 5

• Check for interrupt at start/end of an F-E cycle
• Priority is checked
• If lower priority than current process continue with F-E cycle
• If higher priority than current process …
• … state of current process is / registers are stored on stack
• Location/type of interrupt identified
• Appropriate ISR is called to handle the interrupt
• When ISR finished, check for further interrupts (of higher priority) / return to step 1
• Otherwise load data from stack and continue with next F-E cycle (of process)</td><td>5</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(a)</td><td>1 mark for each correct value

<table>
<tr><th>Instruction</th><th>Accumulator</th></tr>
<tr><td>LDM #103</td><td>103</td></tr>
<tr><td>LDD 102</td><td>104</td></tr>
<tr><td>LDI 103</td><td>101</td></tr>
</table></td><td>3</td></tr>
</table>

Question	Answer	Marks
3(b)	**1 mark** for group name, **1 mark** for appropriate description e.g. • Input and output of data • Takes an input from the user // outputs the character of the binary number • Arithmetic operations • Perform addition and subtraction • Unconditional and conditional instructions • Move to another instruction (identified by a label) • Compare instructions • Compare the result to another value	**4**
3(c)	**1 mark** for each correct line **Instruction** **Result**  	**3**

Question	Answer	Marks
4(a)	**1 mark** for identifying task, **max 2** for each description **Max 2** for only identifying tasks without descriptions e.g. • Memory management • Controls the movement of data between RAM, processor, VM etc • allocates memory to processes • File management • Creates files/folders • Renames file/folders • Security management • Creates accounts/passwords • Provide /upgrade firewall / anti-malware • Hardware management • Receives data from input devices ///sends data to output device • Use of device drivers • Process management • Decides which process to run next • supports multitasking	**4**
4(b)(i)	**1 mark** per point to **max 2** for each Back-up • To make a copy of data **at regular intervals** • So that if it is lost/corrupted it **can be retrieved** Defragmentation • Make individual **files** occupy contiguous blocks // move free space together • Improve disk access times // Data/files can be loaded faster	**4**
4(b)(ii)	**1 mark** from e.g. • Compression software • (Hard) disk formatter • Virus checker • Disk analysis software • Disk repair software	**1**

Question	Answer	Marks
5(a)(i)	**1 mark** from • To stop the data being lost / corrupted / amended • To make sure it can be recovered • To prevent unauthorised access	**1**
5(a)(ii)	**1 mark** each e.g. • Install / run a firewall • **Up to date** Anti-virus / anti-malware • (Username and**) (**strong) password • Encryption • Access rights	**2**
5(b)(i)	**1 mark** each • Visual check • **Manually** compare the data entered with the original (document) • Double entry • Enter the data twice and **the system** compares them to see if they are the same	**2**
5(b)(ii)	**1 mark** each e.g. Range check: • Make sure it is after and before a specific date // e.g. between 1900 and today's date // check month is between 1 and 12 // check day is between 1 and month end Presence check: • Make sure the date of birth has been entered Length check: • Make sure there are at least 1 for day, 1 for month, 2/4 for year // must be 8 characters	**3**
5(b(iii)	1 mark per bullet point to **max 2** • Validation checks data is reasonable/within bounds it does not check that accurate data has been entered • Verification checks if the data matches the data given it does not check if the **original** data is accurate	**2**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6(a)</td><td>1 mark per point

• Primary key StaffID in STAFF…
• …links to foreign key StaffID in DEVICE
• One staff member can have many devices
• Each device can only be with one member of staff</td><td>4</td></tr>
<tr><td>6(b)(i)</td><td>1 mark for each correctly completed statement

<pre>SELECT COUNT(STAFF.StaffID)
FROM STAFF
INNER JOIN DEVICE
ON STAFF.StaffId = DEVICE.StaffID
WHERE STAFF.FirstName = "Ali"
AND STAFF.LastName = "Khan";</pre></td><td>4</td></tr>
<tr><td>6(b)(ii)</td><td>1 mark per bullet point

• ALTER TABLE DEVICE
• ADD appropriate field name, appropriate data type

e.g.
<pre>ALTER TABLE DEVICE
ADD Returned Boolean;</pre></td><td>2</td></tr>
<tr><td>6(c)</td><td><table><tr><th>Normal Form</th><th>Description</th></tr><tr><td>First Normal Form (1NF)</td><td>No repeating groups or repeating attributes</td></tr><tr><td>Second Normal Form (2NF)</td><td>All attributes must be fully dependant on the (composite) primary key // No partial dependencies</td></tr><tr><td>Third Normal Form (3NF)</td><td>All attributes must be fully dependent on the primary key and no other attributes // no non-key dependencies // no transitive dependencies</td></tr></table>
1 mark for each correct description</td><td>3</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>7(a)</td><td>1 mark for each section
• A AND B
• NOT C AND B // B AND NOT C
• XOR (with remainder correct and bracketed and nothing extra)

X = (A AND B) XOR (NOT C AND B)</td><td>3</td></tr>
<tr><td>7(b)</td><td>1 mark for first 4 rows, 1 mark for second 4 rows (shaded)

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

Question	Answer	Marks
8(a)	Accessing a service/files/software on a remote **server**	**1**
8(b)	**1 mark** each from: Public e.g. • Computing services offered by 3rd party provider over the public Internet • Public is open/available to anyone with the appropriate equipment/software/credentials Private e.g. • Computing services offered either over the Internet or a private internal network • Only available to select users not the general public • Private is a dedicated/bespoke system only accessible for/from the organisation	**2**

Question	Answer	Marks
8(c)	**1 mark** for each benefit to **max 2** e.g. • Can be accessed anywhere **with Internet access** • Do not need to install security // security might be better • Do not need to perform backups • Do not need to buy specific software/hardware • Can easily share documents • Can have multiple people working on the same document **1 mark** for drawback e.g. • You cannot access it if no internet access • Reliant on someone else to backup • Reliant on someone else for security // **can have** poorer security • Cannot access if server goes down	**3**