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CAMBRIDGE
International Education

Cambridge International AS & A Level

COMPUTER SCIENCE **9618/12**

Paper 1 Theory Fundamentals **May/June 2024**

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 2024 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U 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 descriptions 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:

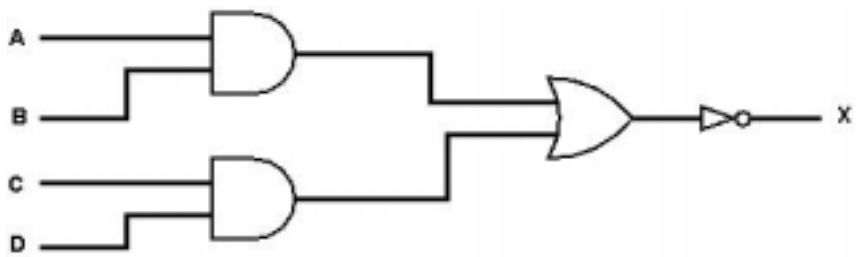
Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

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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Question	Answer	Marks
1(a)	**1 mark** for each correct answer: *NAND* • The output is 0 when both inputs are 1, otherwise the output is 1 *NOR* • The output is 1 when both inputs are 0, otherwise the output is 0 *XOR* • The output is 1 when one of the inputs is 1 and the other input is 0, otherwise the output is 0 *OR* • The output is 0 when both inputs are 0, otherwise the output is 1	**4**
1(b)	**1 mark** for both AND gates with correct inputs **1 mark** for correct OR and NOT gates with correct inputs and no superfluous gates: 	**2**

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Question	Answer	Marks
2(a)	**1 mark** for each correctly completed statement: • **(**LCD) displays/screens/lenses • gyroscope/accelerometer • direction/speed • digital cameras A headset can have one or two **(LCD) displays/screens/lenses** that output the image to the user. The headset has speakers that output surround sound to give a realistic experience. The user's head movements are detected using a sensor. This sensor is a **gyroscope/accelerometer**. The data is transmitted to a microprocessor that analyses the data to identify the **direction/speed** of movement. Some headsets use **digital cameras** that record the user's eye movements for analysis.	**4**
2(b)	**1 mark** each to **max 3**: • The buffer is used as a **temporary** store for data going to the headset • Data is **transferred** into the buffer by the computer • Data is **retrieved** from the buffer by the headset • When the buffer is empty/full an interrupt is sent to the computer requesting more data/stopping further data being sent • When the headset has enough data/needs more data, an interrupt is sent by the headset to the computer to stop sending data from buffer	**3**
2(c)	**1 mark** each to **max 3**: • EEPROM allows **frequent/multiple** read/write/erase operations • … so the headset can take advantage of new features • … without fully erasing the contents of the firmware in the headset first // can erase a particular byte or the whole EEPROM • … without removing the chip(s)/firmware from the headset • ... the contents of the firmware in the headset can be changed by the user without technical expertise • Cheaper to manufacture so headset will be cheaper to purchase	**3**
2(d)(i)	**1 mark** each: • Image is made of pixels and each pixel has one colour • Each colour has a **unique** binary code • **Code for the colour** of each pixel is stored in **sequence**	**3**
2(d)(ii)	**1 mark** each to **max 2**: • List of objects in the drawing • A list that stores the command/description/equation required to draw each object • Properties of each object e.g. the fill colour, line weight/colour	**2**

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Question	Answer	Marks
2(d)(iii)	**1 mark** each to **max 2**: • Dedicated connection to the headset // not sharing bandwidth • Already fast connection that can transmit the data without slowing • Video may already be a small file size and does not need further reduction • Video is not saved so storage is not an issue in the headset	**2**

Question	Answer	Marks
3(a)(i)	**1 mark** for security measure **1 mark** each to **max 2** for how the chosen measure works: • Firewall • Checks **incoming** connections • ... against criteria • Blocks data from entering specific ports • Blocks data that does not meet whitelist that meets blacklist • Proxy server • Prevents devices accessing the web server directly • Intercepts any requests • Forwards the request using its own IP address • Screens returning data before sending it to the user	**3**
3(a)(ii)	**1 mark** for security measure **1 mark** each to **max 2** for description of the chosen measure: • Encryption • Encodes/scrambles data • ... so if it is intercepted it cannot be **understood** • Algorithm/key is required to decode the data	**3**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>3(b)</td><td>1 mark for characteristic
1 mark for description of application to examination software:

<table>
<tr><th>Thin-client characteristic</th><th>Description of use in this software</th></tr>
<tr><td>Data is not stored on the client computer</td><td>Exam papers are stored on the server and not on the examiner’s computer // exam papers are not permanently stored on the examiners’ computers</td></tr>
<tr><td>Client computer is reliant on access to server</td><td>Examiners cannot mark if their device cannot access the server / the server ‘goes down’</td></tr>
<tr><td>Client computer heavily reliant on network/internet connection</td><td>The marking software will not operate without network/internet access</td></tr>
<tr><td>Client computer requires few local resources/memory</td><td>Examiners can use devices with low resources and the marking software will still function</td></tr>
<tr><td>Client computer performs minimal functions/processes</td><td>The marking software transmits requests, the server responds and sends the response to the user</td></tr>
</table></td><td>4</td></tr>
<tr><td>3(c)(i)</td><td>1 mark each to max 2:

• Receives packets from internet
• Analyses the destination IP address of each packet
• Forwards the packet towards its destination
• ... using the routing table
• Maintains/updates the routing table
• Finds the most efficient route to the destination</td><td>2</td></tr>
<tr><td>3(c)(ii)</td><td>1 mark each to max 2:

• The PSTN consists of many different types of communication lines
• … therefore the digital data may need to be converted into a different form/analogue signal
• Data is transmitted in both directions at the same time // duplex data transmission
• Using a PSTN the communication passes through different switching centres/ISPs</td><td>2</td></tr>
</table>

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Question	Answer	Marks
4(a)	**1 mark** for: 1-to-many	**1**

4(b)	**1 mark** each:
	
	• Creating table EXAM with opening and closing brackets
	• All fields with appropriate data types and commas at end of lines
	• ExamID as primary key
	
	Example:
	`CREATE TABLE EXAM(`
	`ExamID varchar NOT NULL,`
	`Subject varchar,`
	`Level int,`
	`TotalMarks int,`
	`PRIMARY KEY(ExamID)`
	`);`
		3

4(c)	**1 mark** each:
	
	• Altering table EXAM_QUESTION
	• Linking ExamID to ExamID in EXAM
	
	Example.
	`ALTER TABLE EXAM_QUESTION`
	`ADD FOREIGN KEY (ExamID) REFERENCES EXAM(ExamID);`
		2

4(d)	**1 mark** each to **max 5**: • STUDENT table identified with suitable Primary Key • A linking table between STUDENT and EXAM with suitable Primary Key **and** appropriate name • … that includes the Primary Key of the STUDENT table as a Foreign Key to join with STUDENT • ... and includes the Primary Key of the EXAM table as a Foreign Key to join with EXAM • A linking table between STUDENT and EXAM_QUESTION with suitable Primary Key **and** appropriate name • … that includes the Primary Key of Table 2 as a Foreign Key to join with Table 2 • … that stores the ExamQuestionID and the mark for that question	**5**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5(a)</td><td>1 mark for each correct answer:

<table>
<tr><th>Program Number</th><th>Code</th><th>ACC Content</th></tr>
<tr><td>1</td><td>LDI 15
SUB #1</td><td>11</td></tr>
<tr><td>2</td><td>LDD 14
ADD 11</td><td>13</td></tr>
<tr><td>3</td><td>LDM #11
ADD #3
SUB 16</td><td>2</td></tr>
<tr><td>4</td><td>LDR #2
LDX 14
ADD #2</td><td>14</td></tr>
</table></td><td>4</td></tr>
<tr><td>5(b)</td><td>1 mark for each correct answer:

<table>
<tr><th>Program Number</th><th>Code</th><th>ACC Content</th></tr>
<tr><td>1</td><td>XOR 29</td><td>0100 1001</td></tr>
<tr><td>2</td><td>AND #29</td><td>0000 0100</td></tr>
<tr><td>3</td><td>OR B11111111</td><td>1111 1111</td></tr>
</table></td><td>3</td></tr>
</table>

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Question	Answer	Marks
6	**1 mark** each to **max 4** **Max 3** marks for each management task: *Memory management:* **Max 3 marks** • Stores data from all currently running programs concurrently in RAM • Stops the data from overwriting each other in RAM/primary storage • Decides which processes should be in main memory • Makes efficient use of memory *Process management:* **Max 3 marks** • Allows one process to be paused whilst another process can be actioned • Decides which process is to be run next • Switches between processes to allow them to share the use of the processor • Identification/description of scheduling	**4**

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Question	Answer	Marks
7(a)	**1 mark** for: 3300 kibibytes	**1**
7(b)	**1 mark** each: • Converting 100 to binary **0110 0100 and** 10 to binary **0000 1010** • Subtraction method - converting 10 to – 10 and adding // direct subtraction … • … correct answer **0101 1010** Method 1: Converting to -10 and adding: Binary for +10 is 0000 1010 Binary for –10 is 1111 0110 Binary for 100 is 0110 0100 100 + (-10): 0 1 1 0 0 1 0 0 +1 1 1 1 0 1 1 0 (1) 0 1 0 1 1 0 1 0 Carries: 1 1 0 0 1 0 0 0 Method 2: Direct Subtraction Borrows: 0 0 0 1 1 0 1 0 0 1 1 0 0 1 0 0 – 0 0 0 0 1 0 1 0 0 1 0 1 1 0 1 0	**3**
7(c)	**1 mark** for working: 1100 0000 1111 // 2048 + 1024 + 8 + 4 + 2 + 1 // (12 * 16^2) + 15 // (12 * 16 * 16) + 15 // 3072 + 15 **1 mark** for correct answer: 3087	**2**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>8(a)</td><td>1 mark each to max 2:

• Creates an executable file
• … so the code can be tested multiple times without having to recompile
• … so repeated testing takes less time</td><td>2</td></tr>
<tr><td>8(b)</td><td>1 mark for identification of each feature and 1 mark for matching description:

e.g.
For coding:
<table><tr><th>IDE feature</th><th>Description</th></tr><tr><td>Context-sensitive prompts</td><td>Gives suggestions for code as the user types instead of having to write/remember the code</td></tr><tr><td>Auto-correct</td><td>Corrects spelling mistakes so that user has fewer errors to correct</td></tr></table>
For presentation:
<table><tr><th>IDE feature</th><th>Description</th></tr><tr><td>Pretty-printing</td><td>Colour code keywords so the user can identify any errors</td></tr><tr><td>Expand/collapse (code) blocks</td><td>The user can hide code that they are not currently working on</td></tr></table>
For debugging:
<table><tr><th>IDE feature</th><th>Description</th></tr><tr><td>Single stepping</td><td>Run the code one line at a time // shows the effect of each line of code</td></tr><tr><td>Breakpoints</td><td>Stop the code running at a set point to check the flow/variable contents</td></tr></table></td><td>6</td></tr>
<tr><td>8(c)</td><td>1 mark each to max 2:

• Saves programming/testing time as code does not have to be written/re-written from scratch // code does not have to be tested
• Code is already tested so it is more robust/likely to work
• The programmer does not need to maintain the library // library routines are updated automatically
• Can perform complex calculations that the programmer may be unable to do
• Makes code more easily readable</td><td>2</td></tr>
</table>

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