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CAMBRIDGE
International Education

Cambridge International AS & A Level

COMPUTER SCIENCE **9618/13**

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.

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

• binary
• 3072
• denary/decimal
• 2000

A kibibyte has a binary prefix. Three kibibytes is the same as 3072 bytes.
A megabyte has a decimal/denary prefix. Two terabytes is the same as 2000 gigabytes.</td><td>4</td></tr>
<tr><td>1(b)</td><td>1 mark for correct answer:
F1</td><td>1</td></tr>
<tr><td>1(c)</td><td>1 mark for a correct answer:

The answer is too long to be represented in the same number of bits as the binary numbers being added</td><td>1</td></tr>
<tr><td>1(d)(i)</td><td>1 mark for all 3 answers correct:
<table><tr><th>Character set</th><th>Number of bits</th></tr><tr><td>ASCII</td><td>7</td></tr><tr><td>extended ASCII</td><td>8</td></tr><tr><td>Unicode</td><td>16/32</td></tr></table></td><td>1</td></tr>
<tr><td>1(d)(ii)</td><td>1 mark each:

• Each character has a unique binary code
• The binary code for each character is stored in sequence</td><td>2</td></tr>
</table>

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>1 mark for working:
• 4000 * 3000 * 4

1 mark for correct answer:
• 48MB</td><td>2</td></tr>
<tr><td>2(b)(i)</td><td>1 mark each to max 3:

• The file takes less storage space on the web server than if lossless compression was used
• The file is faster to upload/download to/from the server than if lossless compression was used
• The file uses less bandwidth to transmit than if lossless compression was used
• The file consumes less data allowance than if lossless compression was used</td><td>3</td></tr>
</table>

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Question	Answer	Marks
2(b)(ii)	**1 mark** each: • Identifies **consecutive** repeating **pixels** of the same colour • Stores the colour /pattern and the number of times it repeats	**2**
2(c)	**1 mark** each to **max 2**: • Colour/bit depth • Image resolution	**2**

Question	Answer	Marks

3(a)	**1 mark** for each correct answer:
	
	Program Number / **Code** / **ACC Content**
	1 / `LDM #50`
	`INC ACC`
	`SUB #1` / **50**
	2 / `LDI 51`
	`ADD 52` / **97**
	3 / `LDR #2`
	`LDX 50`
	`DEC ACC` / **48**
	4 / `LDD 52`
	`SUB 54`
	`INC ACC` / **44**
		4

3(b)	**1 mark** for each correct answer: **Instruction Number** / **Instruction** / **ACC Content** 1 / `LSL #2` / **1111 1100** 2 / `XOR 100` / **1111 0010** 3 / `AND 103` / **0011 0111**	**3**

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Question	Answer	Marks
4(a)	**1 mark** for: many to 1 // there are many performances of each show	**1**

4(b)	**1 mark** each for:
	
	• Creating table `PERFORMANCE` with opening and closing brackets
	• Setting all four attributes with appropriate data types
	• Setting `PerformanceID` as primary key
	• Setting `ShowID` as foreign key referencing `SHOW` table
	
	Example:
	`CREATE TABLE PERFORMANCE(`
	`PerformanceID varchar NOT NULL,`
	`ShowID varchar,`
	`ShowDate Date,`
	`StartTime Time,`
	`PRIMARY KEY(PerformanceID),`
	`FOREIGN KEY(ShowID) REFERENCES SHOW(ShowID)`
	`);`
		4

4(c)	**1 mark** each for:
	
	• Selecting `COUNT` of an attribute in `PERFORMANCE` table with suitable name
	• `FROM` clause
	• Joining tables
	• Grouping by the title and selecting the title
	
	Example 1:
	`SELECT SHOW.Title, Count(PERFORMANCE.PerformanceID)`
	`AS NumberOfShowings`
	`FROM PERFORMANCE, SHOW`
	`WHERE PERFORMANCE.ShowID = SHOW.ShowID`
	`GROUP BY SHOW.Title;`
	
	Example 2:
	`SELECT SHOW.Title, Count(PERFORMANCE.PerformanceID)`
	`AS NumberOfShowings`
	`FROM PERFORMANCE INNER JOIN SHOW`
	`ON PERFORMANCE.ShowID = SHOW.ShowID`
	`GROUP BY SHOW.Title;`
		4

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Question	Answer	Marks
4(d)	**1 mark** each to **max 5**: e.g. • CUSTOMER table identified with suitable Primary Key and appropriate name • … and other suitable fields including name and email • BOOKING TABLE identified with suitable Primary Key and appropriate name • … that stores the Primary Key of the CUSTOMER table as a Foreign Key to join with CUSTOMER table • … and stores the Primary Key of the PERFORMANCE table as a Foreign Key to join with PERFORMANCE table • A linking table between Table 2 and SEAT 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 SeatID.	**5**

Question	Answer	Marks
5(a)(i)	**1 mark** for: Dedicated/bespoke services/storage on a remote server only available to company	**1**
5(a)(ii)	**1 mark** each to **max 3**: e.g. • Not reliant on a third party • … gives greater **control** over security/privacy • … gives greater **control** over backup • Storage can be tailored/scalable to company requirements// an example e.g. the amount of storage accessible/ facilitating the sharing of files	**3**
5(b)	**1 mark** each: • Sending computer transmits packets directly to switch/router/central device • Switch/router/central device **checks destination address** of packet and forwards directly to that device	**2**
5(c)(i)	**1 mark** each to **max 2**: • Jamming signal is transmitted by the **sending device** • Transmission is aborted • The **sending device** waits a **random** time before trying to send data again ... • ... if further collisions occur the wait time is increased	**2**

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Question	Answer	Marks
5(c)(ii)	**1 mark** each to **max 2**: • Random time increased each time so can be infinite waiting • May be constant jamming signal so nothing ever sends • Certain nodes cannot be prioritised • High power consumption • Only suitable for short distance network // limited distance • Not scalable // more nodes means exponentially longer waiting times	**2**
5(d)	**1 mark** for: Static means the IP for that device does not change **and** Private means it can only be accessed/seen/used within the LAN	**1**

Question	Answer	Marks
6	**1 mark** for each correct line: Truth table A B C X 0 0 0 0 0 0 1 1 0 1 0 0 0 1 1 0 1 0 0 1 1 0 1 1 1 1 0 0 1 1 1 0 A B C X 0 0 0 0 0 0 1 1 0 1 0 0 0 1 1 0 1 0 0 0 1 0 1 0 1 1 0 0 1 1 1 1 A B C X 0 0 0 1 0 0 1 1 0 1 0 1 0 1 1 1 1 0 0 1 1 0 1 1 1 1 0 0 1 1 1 1 Logic expression NOT (A XOR B) AND C (A OR C) AND NOT B A NAND B NAND C (A NAND B) OR C NOT (A AND B AND C)	**3**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>7(a)</td><td>1 mark for sensor and matching purpose to max 2:

<table><tr><th>Sensor</th><th>Purpose of sensor in navigation system</th></tr><tr><td>Pressure</td><td>To detect if a table or other obstacle has been hit // to detect when food is put on/taken off the tray so it can move on</td></tr><tr><td>Infra-red</td><td>To detect if there is an obstacle in the way // to indicate that it has reached the desired table</td></tr><tr><td>Sound</td><td>To detect if someone is speaking so that it can use AI to decipher the speech and whether the robot is required to stop</td></tr></table></td><td>2</td></tr>
<tr><td>7(b)</td><td>1 mark each to max 3:

e.g.
• Voice/speech recognition is used
• ... to identify if someone speaking
• The sound is recorded and analysed
• The audio recordings are compared to a database of words/sound waves
• ... to identify the word that has the highest probability of being said
• Natural language recognition is used
• Words are combined and compared to known sentences
• … programmed action(s) for matching sentence(s) are performed</td><td>3</td></tr>
<tr><td>7(c)</td><td>1 mark each to max 2:

• Feedback ensures that a system operates within set criteria / constraints
• ... by enabling system output to affect subsequent system input
• ... thus allowing conditions to be automatically adjusted</td><td>2</td></tr>
<tr><td>7(d)</td><td>1 mark each to max 4:

• Resistive: The space between the conductive layers is removed/the layers touch and a circuit is completed

• Capacitive: The electrical charge changes where the user pressed

• The point of contact is identified
• ... from the change in electrical field
• The software/microprocessor calculates the coordinates</td><td>4</td></tr>
<tr><td>7(e)(i)</td><td>1 mark for:

Pre-written code/functions/routines that can be imported/called in another program</td><td>1</td></tr>
</table>

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>7(e)(ii)</td><td>1 mark each to max 4:

• Maintenance not needed to be done by the programmer
• ... because the DLL is separate from program
• The calling program does not need recompilation by the programmer when a DLL file changes
• ... because the DLL file can be updated independently of the calling program
• … updates will apply to all programs that use the DLL file</td><td>4</td></tr>
<tr><td>7(f)(i)</td><td>1 mark for each correct method and
1 mark for corresponding description to max 4:

<table>
<tr><th>Method</th><th>Description</th></tr>
<tr><td>Parity byte</td><td>An additional bit is added to make the number of 1s in the byte odd or even to match the parity. If a byte with an odd number of 1 bits is received when even parity is used, there is an error.</td></tr>
<tr><td>Parity block</td><td>Parity is calculated horizontally and vertically. A parity byte is created from the bits produced by the vertical parity check. This is sent with the data. The parity is re-checked when received and the position of an incorrect bit can be determined.</td></tr>
<tr><td>Checksum</td><td>A calculation is made from the data and the result transmitted with the data. The receiver repeats the calculation and compares the result with the value received. If the two are different, there is an error.</td></tr>
</table>
</td><td>4</td></tr>
<tr><td>7(f)(ii)</td><td>1 mark each to max 2:

• Encodes/scrambles data
• ... so if it is intercepted it cannot be understood
• Algorithm/key is required to decode the data</td><td>2</td></tr>
</table>

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