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Cambridge Assessment International Education

Cambridge International AS & A Level

COMPUTER SCIENCE **9618/12**

Paper 1 Theory Fundamentals **October/November 2023**

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 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level 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 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.

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Question	Answer	Marks
1(a)	**1 mark** for: • infra-red / proximity (sensor)	**1**
1(b)	**1 mark** for each bullet point (**max 2**) • Actuator generates a signal / causes an action / converts electrical energy into a mechanical force • ... to push an arm // to open a trap door // to pick up the chocolate bar with the incorrect weight	**2**
1(c)(i)	**1 mark** for each feature (**max 2**) • Dedicated to a single task // limited number of functions • Built into a larger system // integrated into a larger system • An embedded system must contain a processor, memory and an I/O capability // Dedicated hardware	**2**
1(c)(ii)	**1 mark** for each bullet point (**max 1**) • Difficult to change / update the firmware by the user // Difficult to upgrade devices to take advantage of new technology • Cannot be easily **adapted** for **another** task • Troubleshooting faults/upgrading is a specialist task • Devices are often thrown away rather than repaired as difficult to upgrade or repair	**1**

Question	Answer	Marks
2(a)	**1 mark** for each term (**max 3**) Entity: • An object about which data can be stored Primary key: • The **unique** attribute / combination of attributes used to identify the **record / tuple** Referential integrity: • Makes sure that if data is changed in one place the change is reflected in all related records - cascading update/delete • Makes sure that data that does not exist cannot be referenced • Ensures that every foreign key has a **corresponding** primary key // A logical dependency of a foreign key on a primary key • Ensures that the data in the database is consistent / up to date • Prevents records from being added/deleted/modified incorrectly • Makes sure any queries return accurate and complete results	**3**

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Question	Answer	Marks
2(b)	**1 mark** for each bullet point (**max 4**) **Max 2** if no descriptions • Backup / recovery procedures • … automatically takes copies of the database and store off site on a regular basis / weekly, etc. • ... so that the data can be recovered if lost • Use of access rights • … some users are given different access permissions to different tables • ... read/write, read only, full access, etc. • Views • … different users are able to see different parts of the database • ... only see what users need to see // by example • Record and table locking • … prevents simultaneous access to data • ... so updates are not lost // data is not overwritten • Encryption • ... the data is turned into ciphertext • ... so it cannot be understood **without a decryption key**	**4**
2(c)	**1 mark** for each bullet point (**max 4**) • Identify **repeating** groups of attributes ... • ... Subject **and** SubjectCode • Ensure each field is atomic • ... StudentName should be split into e.g. FirstName and LastName • Identify the primary key for the table	**4**

Question	Answer	Marks
3(a)	**1 mark** for: Either • kibibyte = 1,024 bytes // 2^{10} bytes **and** megabyte = 1000 kilobytes //1 000 000 bytes // 10^3 kilobytes // 10^6 bytes Or • kibi is binary prefix **and** mega is denary prefix	**1**
3(b)(i)	1111 0011 1100	**1**
3(b)(ii)	865	**1**
3(b)(iii)	470	**1**

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Question	Answer	Marks
3(c)	**1 mark** for a correct application **1 mark** for a corresponding justification • An application that performs financial / banking calculations • ... because it is difficult to represent decimal values exactly in normal binary and financial transactions use only two decimal places and must be accurate, no accumulating errors Or • Electronic displays, e.g. calculators, digital clocks • ... because visual displays only need to show individual digits • ... because conversion between denary and BCD is easier Or • The storage of the date and time in the BIOS of a PC • ... because conversion with denary is easier	**2**

Question	Answer	Marks
4(a)	**1 mark** for each bullet point • A NAND B • NOT(B XOR C) • Final NAND X = A NAND B NAND (NOT(B XOR C))	**3**
4(b)	**1 mark** for each set of rows (shaded)	**2**
5(a)	**1 mark** for: Either • Ensuring data can only be accessed by / disclosed to authorised persons Or • Ensuring data cannot be accessed by / disclosed to unauthorised persons	**1**

A	B	C	X
0	0	0	**0**
0	0	1	**0**
0	1	0	**1**
0	1	1	**0**
1	0	0	**1**
1	0	1	**1**
1	1	0	**1**
1	1	1	**1**

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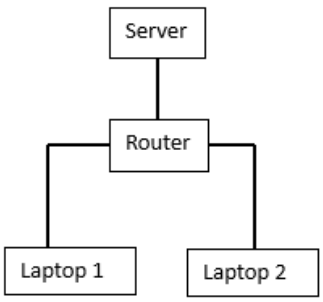
Question	Answer	Marks
5(b)	**1 mark** for each bullet point (**max 1**) • Ensuring the accuracy / completeness / consistency of data (during / after processing) • Ensuring the data is up to date	**1**
5(c)	**1 mark** for each bullet point. Phishing email (**max 2**) • The email pretends to be from an official body • ... persuading individuals to disclose private information // by example such as bank details • ... or requesting authentication by redirecting to an unofficial/unauthorised website // inviting a user to click a link Spyware (**max 2**) • Malware downloaded **without the user's knowledge** • ... which secretly records the user's actions / keystrokes on the computer • ... and sends logs of the actions to a third party	**4**

Question	Answer	Marks
6(a)	**1 mark** for each bullet point (**max 3**) Lossy compression (ticked) • Loss of quality will not be noticed • Needs to be viewed in real time so less bandwidth needed if file size smaller • Smaller file sizes will reduce buffering so the video will play more smoothly • Viewers may watch on different devices, so may not need high quality resolution Lossless compression (ticked) • Original recording may not have been made in high resolution • Could be streaming to high bandwidth devices • The reduction in the file size is sufficient for the receiving device • Viewers do not want any loss of quality	**3**

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Question	Answer	Marks
6(b)	**1 mark** for each bullet point (**max 3**) Increase sampling resolution • … the number of bits used for each sample is increased • … there will be more values available to represent each sample // more amplitudes can be represented • ... each binary amplitude/note in the digital recording is closer to the analogue amplitude/note • … quantisation errors are reduced • … the digital soundwave is closer to the original analogue soundwave Decrease sampling resolution • … the number of bits used for each sample is decreased • … there will be fewer values available to represent each sample // fewer amplitudes can be stored • ... each binary amplitude/note in the digital recording is further from the analogue amplitude/note • … quantisation errors are increased • … the digital soundwave is less like the original analogue soundwave	**3**
6(c)	**1 mark** for answer, **1 mark** for working Answer: 2.5 mebibytes Working: (2048 × 1024 × 10) / (8 × 1024 × 1024)	**2**

Question	Answer	Marks
7(a)	**1 mark** for each bullet point **(max 2**) • Only has four groups of digits // IPv6 has eight groups • Uses dotted notation instead of colons • Because it is a 32 bit / 4 byte address // IPv6 is 128 bits / 16 bytes	**2**
7(b)(i)	**1 mark** for server only connected to router **1 mark** for two laptop computers connected only to router  	**2**

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Question	Answer	Marks
7(b)(ii)	**1 mark** for each bullet point (**max 2**) • The data from the sending laptop is transmitted to the router • The data has address of recipient • The router determines recipient's destination address • ... by using a routing table • The router transmits data directly / only to recipient	**2**
7(b)(iii)	**1 mark** for each use (**max 2**) and **1 mark** for corresponding expansion (**max 2**) • To improve the security of the LAN • … so that devices do not receive unintended data • … so that a compromised device does not expose the whole network • ... so not all devices can access all segments • To make the network management easier • … because faults can be isolated more efficiently • ... by appropriate example • To make the network easier to expand // For better control of network growth • … by allowing for greater range of IP addresses to be available • To improve network performance • To reduce network congestion • … by localising network communications // by dividing data between segments • … so that devices are not flooded with data • … because data sent between devices on the same subnet stays within the subnet	**4**
7(c)	**1 mark** for each bullet point (**max 3**) • To monitor the communications channel • To send data only when there is no data being transmitted / the line is quiet / idle • **To detect a collision** and then stop transmissions of further data // transmit a **jamming** signal • To calculate a **random** wait time / back-off time • ... then retransmit the data after that random wait time • Increase **random** time if multiple collisions	**3**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>7(d)</td><td>1 mark for each highlighted area

<table>
<tr><th>Type of IP address</th><th>Description</th></tr>
<tr><td>public IP address</td><td>an IP address that is assigned to a device to allow direct access on the internet</td></tr>
<tr><td>static IP address</td><td>an IP address that is fixed / doesn’t change each time a device re-joins a LAN / network</td></tr>
<tr><td>private IP address</td><td>an IP address used for internal LAN communication only</td></tr>
<tr><td>dynamic IP address</td><td>an IP address that may be refreshed / changed each time a device re-joins a LAN / network</td></tr>
</table></td><td>4</td></tr>
</table>

Question	Answer	Marks
8(a)	**1 mark** for each bullet point (**max 1**) • To hide the complexities of the hardware from the user • To provide a platform for software to run • To provide a user interface	**1**
8(b)	**1 mark** for the name of the utility software **2 marks** for the explanation • Defragmentation software • … because over time saving and deleting of small files fragments the disk • ... the software makes (individual) files contiguous • … so access time to the files is improved • … because head movement is reduced • Disk contents analysis/disk repair software • … to identify and mark bad sectors • ... to restore corrupted files • ... to recover lost data (due to hardware failure) • File compression • … to reduce the size of files • ... which saves storage and memory space // by example • ... and reduces transmission time // by example • Disk formatter • … to prepare a disk for use // set up the file system • ... to partition the disc • ... to delete all the data from the disc	**3**

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Question	Answer	Marks
8(c)(i)	**1 mark** for each bullet point (**max 1**) • USB / Universal Serial Bus • HDMI	**1**
8(c)(ii)	**1 mark** for each component (**max 3**) Buffers • A buffer temporarily holds data until it is ready to be transmitted **to the device** Address Bus • The address of the **data to be written to the device** (in RAM) is carried on the address bus Data Bus • All data to be **written to the device / buffer** is carried on the data bus	**3**

Question	Answer	Marks
9(a)	**1 mark** for each bullet point • `IN` - Input **and** output of data • `ADD` - Arithmetic operations • `JPE` - Unconditional and conditional instructions • `CMI` - Compare instructions	**4**

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Question	Answer	Marks
9(b)	**1 mark** for each set of shaded rows	**4**

Instruction address	ACC	IX	Memory address				Output
			100	101	110	111	
			0	0	51	65	
10		0					
11	49						
12				49			
13	51						
14							
15							
16	49						
17	65						
18		1					
19			65				
20							
13	65						
14							
15							
21							A
22							

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