Cambridge Assessment International Education

Cambridge International AS & A Level

COMPUTER SCIENCE **9618/13**

Paper 1 Theory Fundamentals **May/June 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 May/June 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **10** printed pages.

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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)(i)	**1 mark** for each description Pixel: • A single square of one colour • The smallest addressable element in an image File header: • Data about the bitmap image (e.g. number of colours)	**2**
1(a)(ii)	**1 mark** per bullet point for working, **1 mark** for answer Working: • 1024 × 512 = 524 288 pixels/bytes • 524288 / 1024 / 1024 Answer: 0.50 mebibytes	**3**
1(b)	**1 mark** for naming method, **1 mark** per description to **max 2** • Run-length encoding • Replace **sequences** of the **same colour** pixel • … with colour code and number of identical pixels	**3**
1(c)(i)	252	**1**

1(c)(ii)	**1 mark** per bullet point
	
	• Converting 15 to binary `0000 1111`
	• Method for addition
	• Final answer
	`0010 0011`
	`+ 0000 1111`
	`0011 0010`
	`1 111`
		3

1(c)(iii)	**1 mark** per bullet point
	
	• Converting −10 to two's complement binary `1111 0110`
	• Adding values
	• Final answer `0001 1001`
	10 = `0000 1010`
	–10 = `1111 0110`
	
	`0010 0011`
	`+ 1111 0110`
	`0001 1001`
	`11 11`
		3

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Question	Answer	Marks
1(d)	**1 mark** per bullet point to **max 2** • The **formal and legal rights** to ownership // intellectual property rights • Protects against **unauthorised** reproduction of work • Provides for legal right of redress	**2**

Question	Answer	Marks
2(a)	**1 mark** for each correct line **Utility software** / **Description** Disk formatter → Sets up a disk so it is ready to store files Defragmentation → Moves parts of files so that each file is contiguous in memory Back-up → Creates a copy of data that is no longer required Disk repair → Scans for errors in a disk and corrects them Scans software for errors and repairs the problems Creates a copy of data in case the original is lost	**4**
2(b)	**1 mark** per bullet point to **max 4** • memory management • file management • security management • hardware / device / peripheral / resources management • input/output management • process management • error checking and recovery • provision of a platform for software • provision of a user interface	**4**

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

The Program Counter holds the address of the next instruction to be loaded.
This address is sent to the Memory Address Register.
The Memory Data Register holds the data fetched from this address. This data is sent to the Current Instruction Register and the Control Unit decodes the instruction’s opcode.
The Program Counter is incremented.</td><td>5</td></tr>
<tr><td>3(b)</td><td>1 mark for each shaded set of values
<table>
<tr><th rowspan="2">Instruction address</th><th rowspan="2">ACC</th><th colspan="4">Memory address</th><th rowspan="2">IX</th><th rowspan="2">Output</th></tr>
<tr><th>365</th><th>366</th><th>367</th><th>368</th></tr>
<tr><td></td><td></td><td>1</td><td>3</td><td>65</td><td>66</td><td>0</td><td></td></tr>
<tr><td>200</td><td>1</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>201</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td>203</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>204</td><td></td><td>2</td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td>206</td><td>65</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>207</td><td></td><td></td><td></td><td></td><td></td><td></td><td>A</td></tr>
<tr><td>208</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>200</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td>204</td><td></td><td>3</td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td>206</td><td>66</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>207</td><td></td><td></td><td></td><td></td><td></td><td></td><td>B</td></tr>
<tr><td>208</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>200</td><td>3</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>201</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>202</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>209</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table></td><td>6</td></tr>
</table>

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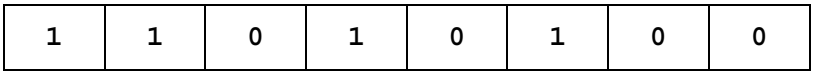
Question	Answer	Marks
3(c)(i)		1
3(c)(ii)	**1 mark** for correct answer The number is divided by 8 (and only whole number retained)	1

Question	Answer	Marks
4(a)	**1 mark** per bullet point to **max 2** • All computers are of equal status • Each computer provides access to resources and data // data is distributed • Computers can communicate and share resources • Each computer is responsible for its own security	2
4(b)	**1 mark** per bullet point to **max 2** per drawback • Reduced security // no central management of security • … only as secure as the weakest computer on the network • … each computer is at risk from viruses from other computers • No central management of backup • ... if the data from one computer is not backed up it is lost to all of them • No central management of files/software • … consistency may be difficult to maintain • … each computer may have different software from the others • Individual computers may respond slower • … because they are being accessed by other computers • In order to share files etc. all the computers involved need to be switched on • ... so the files etc. may not be always available	4

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(c)(i)</td><td>1 mark for first 2 ticks, 1 mark for last 2 (shaded)

<table>
<tr><th>Task</th><th>Performed by router</th><th>Not performed by router</th></tr>
<tr><td>Receives packets from devices</td><td>✓</td><td></td></tr>
<tr><td>Finds the IP address of a Uniform Resource Locator (URL)</td><td></td><td>✓</td></tr>
<tr><td>Directs each packet to all devices attached to it</td><td></td><td>✓</td></tr>
<tr><td>Stores the IP and/or MAC address of all devices attached to it</td><td>✓</td><td></td></tr>
</table></td><td>2</td></tr>
<tr><td>4(c)(ii)</td><td>1 mark per bullet point for justification up to max 3

No mark for identification of wired/wireless

Wired
• Faster connection // higher bandwidth
• …. needed as she is downloading/streaming large files
• … less time waiting / less latency / fewer delays
• More reliable / stable connection
• … is less susceptible to issues with distance/walls/interference
• More secure

Wireless
• Freedom of movement
• … can move between different rooms with a mobile device and still receive/transmit data
• … no need of a physical connection
• Easily expanded if friends want to access the same network
• Less cabling / expertise is needed
• ... making the initial setup less expensive</td><td>3</td></tr>
<tr><td>4(d)</td><td>1 mark for identifying that she is using both.
1 mark per bullet point for justification

• using internet because sending data on the infrastructure
• using WWW because accessing a website (that is stored on a web server operated by the webmail) that is part of the WWW</td><td>3</td></tr>
</table>

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Question	Answer	Marks
5(a)	**1 mark** per bullet point to **max 2** • Definition: Microprocessor/microcontroller within a **larger system** // microprocessor/microcontroller that performs **one specific task** • Example: e.g. Embedded system in washing machine only controls the programs for the washing cycle // it is part of the washing machine but does not perform any other function within it	**2**
5(b)	**1 mark** for RAM, **1 mark** for ROM RAM: • **Store** the choices/wash program the user has entered // **stores** the data read from the sensors // **stores** the time left in the program // by example ROM: • **Store** the start-up instructions (for the washing cycles)	**2**
5(c)	**1 mark** per bullet point • The system uses feedback • The system causes the temperature to change // produces an action	**2**

Question	Answer	Marks
6(a)	Range (check)	**1**
6(b)	Presence (check)	**1**
6(c)	Existence (check)	**1**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>7(a)</td><td>1 mark per bullet point to max 3

• Flat-file has more data redundancy
• … because the same data is stored many times // data is stored in different tables which are linked

• There is program-data dependence with flat-files
• ... because any changes to the structure of the data means the programs that access that data have to be re-written

• Flat-file has more data inconsistency // worse data integrity
• ... because duplicated data might be stored differently //…because when data is updated in one place, it is not updated everywhere

• It is not easy to perform complex searches /queries
• … because a new program has to be written each time

• Flat files could have a lack of privacy
• … as user views cannot easily be implemented</td><td>3</td></tr>
<tr><td>7(b)(i)</td><td>1 mark for each correct example

one-to-one
• e.g. customer to payment details // customer to login details
one-to-many
• e.g. customer to order
many-to-many
• e.g. order to product // customer to product</td><td>3</td></tr>
<tr><td>7(b)(ii)</td><td>1 mark

<table><tr><th>Relationship</th><th>Tick (✓)</th></tr><tr><td>one-to-one</td><td></td></tr><tr><td>one-to-many</td><td></td></tr><tr><td>many-to-many</td><td>✓</td></tr></table></td><td>1</td></tr>
<tr><td>7(b)(iii)</td><td>1 mark

<code>CREATE DATABASE SHOPORDERS;</code></td><td>1</td></tr>
<tr><td>7(c)</td><td>1 mark per item to max 3

• table name
• field name // attribute
• data type
• type of validation
• Primary Key
• Foreign Key
• relationships</td><td>3</td></tr>
</table>

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>8</td><td>1 mark per correct row

<table>
<tr><th>Statement</th><th>AND</th><th>NAND</th><th>NOR</th><th>XOR</th><th>OR</th></tr>
<tr><td>The output is 1 only when both inputs are 1</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>The output is 1 only when both inputs are different</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>The output is 1 only when both inputs are 0</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
</table></td><td>3</td></tr>
</table>

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