



Cambridge International AS & A Level

COMPUTER SCIENCE

9618/12

Paper 12 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 **9** 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.

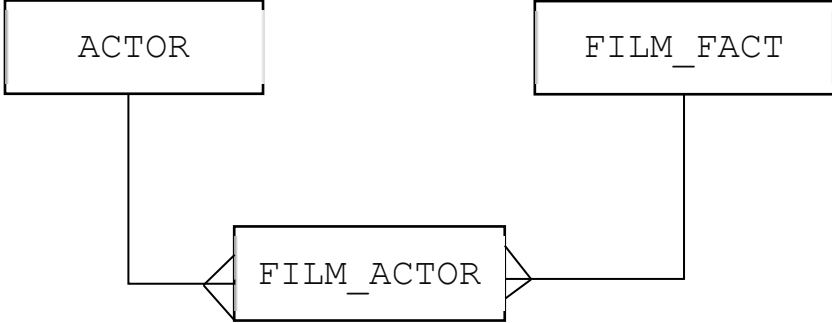
Question	Answer	Marks												
1(a)	<p>1 mark for 1 correct line 2 marks for 2 or 3 correct lines 3 marks for all 4 correct lines</p> <table border="0" style="width: 100%; text-align: center;"> <thead> <tr> <th data-bbox="320 383 595 443">Term</th> <th data-bbox="595 383 935 443"></th> <th data-bbox="935 383 1299 443">Definition</th> </tr> </thead> <tbody> <tr> <td data-bbox="320 450 595 562">Pixel</td> <td data-bbox="595 450 935 562" rowspan="4"> </td> <td data-bbox="935 450 1299 562">The number of pixels wide by the number of pixels high</td> </tr> <tr> <td data-bbox="320 629 595 741">Bit depth</td> <td data-bbox="935 629 1299 741">The smallest identifiable component of an image</td> </tr> <tr> <td data-bbox="320 808 595 920">Image resolution</td> <td data-bbox="935 808 1299 920">Stores data about the image file, e.g. file format, number of bits per pixel, file size</td> </tr> <tr> <td data-bbox="320 1010 595 1122">File header</td> <td data-bbox="935 1010 1299 1122">The number of bits used to represent each colour</td> </tr> </tbody> </table>	Term		Definition	Pixel		The number of pixels wide by the number of pixels high	Bit depth	The smallest identifiable component of an image	Image resolution	Stores data about the image file, e.g. file format, number of bits per pixel, file size	File header	The number of bits used to represent each colour	3
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File header		The number of bits used to represent each colour												
1(b)(i)	8	1												
1(b)(ii)	<p>1 mark for working</p> <ul style="list-style-type: none"> • $10 * 5 * 8 \text{ (bits)} / 8 // = 50 \text{ (pixels)} * 8 \text{ (bits)} / 8$ <p>1 mark for answer</p> <ul style="list-style-type: none"> • 50 (bytes) 	2												
1(c)	<p>1 mark per point</p> <ul style="list-style-type: none"> • Increasing the colour depth results in increased <u>file</u> size // Decreasing the colour depth results in smaller <u>file</u> size • Increasing the colour depth means more bits per pixel and hence more data stored // Decreasing the colour depth means fewer bits per pixel and hence less data stored 	2												
1(d)	<p>1 mark per point</p> <ul style="list-style-type: none"> • Use run-length encoding // RLE • Record the colour <u>Blue</u>, and the number of times it occurs <u>10</u> 	2												

Question	Answer	Marks												
2(a)	<p>1 mark per point to max 2</p> <ul style="list-style-type: none"> The lane detection system is built into / integrated into the car The lane detection system only performs one task The lane detection system is not easily changed/updated by the car owner 	2												
2(b)	<p>1 mark for primary</p> <ul style="list-style-type: none"> e.g. Miles travelled in the current journey, before the engine is turned off <p>1 mark for secondary</p> <ul style="list-style-type: none"> e.g. Total miles travelled since the car was built // miles for most recent journey after engine switched off 	2												
2(c)	<p>1 mark for all correct ticks</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 60%;">Statement</th> <th style="width: 20%;">True</th> <th style="width: 20%;">False</th> </tr> </thead> <tbody> <tr> <td>The screen always has five different layers</td> <td></td> <td style="text-align: center;">✓</td> </tr> <tr> <td>A processor determines the horizontal and vertical coordinates of the point of contact</td> <td style="text-align: center;">✓</td> <td></td> </tr> <tr> <td>The touchscreen will work if any object touches the screen</td> <td style="text-align: center;">✓</td> <td></td> </tr> </tbody> </table>	Statement	True	False	The screen always has five different layers		✓	A processor determines the horizontal and vertical coordinates of the point of contact	✓		The touchscreen will work if any object touches the screen	✓		1
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Question	Answer	Marks
3(a)	<p>1 mark for correct opcode and 1 mark for corresponding operand</p> <p>OR #255 // OR #154 // XOR #154</p> <p>e.g.</p> <ul style="list-style-type: none"> OR... ... #255 	2
3(b)	<p>1 mark for correct opcode and 1 mark for corresponding operand</p> <p>XOR #255</p> <p>e.g.</p> <ul style="list-style-type: none"> XOR... ... #255 	2
3(c)	7E	1
3(d)	11110000	1

Question	Answer	Marks
3(e)	<p>1 mark per point</p> <ul style="list-style-type: none"> • Correct conversion to binary 01111111 (127) and 00001100 (12) • Working e.g. turning 01111111 into two's complement 10000001 • Answer: 1000 1101 	3

Question	Answer	Marks									
4(a)	<p>1 mark per point, max 1 for data and max 1 for computer system</p> <p>Data</p> <ul style="list-style-type: none"> • Data needs protecting from someone amending / deleting or taking it <p>Computer System</p> <ul style="list-style-type: none"> • Computer system need protecting to stop people for example, installing malware or damaging the system 	2									
4(b)	<p>1 mark for each correct threat, matching description and prevention e.g.</p> <table border="1"> <thead> <tr> <th>Threat</th> <th>Description</th> <th>Prevention method</th> </tr> </thead> <tbody> <tr> <td>Virus</td> <td>Malicious software that replicates itself and can corrupt data</td> <td>Anti-virus / Firewall / Anti-malware</td> </tr> <tr> <td>Hacker</td> <td>Unauthorised access to the computer with malicious intent</td> <td>Firewall / strong or biometric passwords / user permissions</td> </tr> </tbody> </table>	Threat	Description	Prevention method	Virus	Malicious software that replicates itself and can corrupt data	Anti-virus / Firewall / Anti-malware	Hacker	Unauthorised access to the computer with malicious intent	Firewall / strong or biometric passwords / user permissions	6
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4(c)	<p>1 mark per point to max 2</p> <ul style="list-style-type: none"> • Data is turned into <u>cipher text</u> // Data is encoded • Used so that it cannot be understood if intercepted without the decryption key 	2									

Question	Answer	Marks
5(a)	<p>1 mark for each correct relationship</p> 	2
5(b)	<p>1 mark per point</p> <ul style="list-style-type: none"> • Neither key uniquely identifies each tuple by itself • One actor cannot appear in the same film twice so together they are unique 	2
5(c)	<p>1 mark per correct entry</p> <pre>SELECT FILM_ACTOR.ActorID / ActorID FROM FILM_ACTOR INNER JOIN FILM_FACT ON FILM_FACT.FilmID = FILM_ACTOR.FilmID WHERE FILM_FACT.FilmTitle = "Cinderella" ;</pre>	4
5(d)	<p>1 mark per point</p> <ul style="list-style-type: none"> • COUNT and correct fieldname • SELECT and FROM statements, including the table name in FROM • WHERE statement <p>e.g.</p> <pre>SELECT COUNT(FilmID) FROM FILM_FACT WHERE ReleaseDate >= #01/01/2022# AND ReleaseDate <= #31/01/2022#; // WHERE ReleaseDate BETWEEN #01/01/2022# AND #31/01/2022#; // WHERE ReleaseDate = "January 2022";</pre>	3

Question	Answer	Marks
5(e)	<p>1 mark for each correctly completed term</p> <ul style="list-style-type: none"> • data dictionary • field names // primary keys • primary keys //field names • logical schema • query • interface <p>A DBMS provides data management. This includes the development of a data dictionary that stores information about the data stored, such as field names and primary keys. The logical schema uses methods such as an E-R diagram to show the structure of the database and its relationships. The query processor allows a user to perform searches to find specific data. The DBMS also provides a developer interface that allows the user to create tables, forms and reports.</p>	6

Question	Answer	Marks
6(a)	<p>1 mark per point to max 2</p> <p>e.g.</p> <ul style="list-style-type: none"> • Attempts to translate the whole source code • Creates a separate error report at the end of the translation process • If translation successful / no errors creates an executable file 	2
6(b)	<p>1 mark per point to max 2</p> <p>e.g.</p> <ul style="list-style-type: none"> • Reads each line then translates it and executes it • Stops when an error is encountered // displays errors where it finds them 	2
6(c)	<p>1 mark per point, max 2 for writing, max 2 for testing</p> <p>Writing e.g.</p> <ul style="list-style-type: none"> • Enter code into an editor • Pretty printing to identify key terms • Context-sensitive prompts to help complete statements • Expand and collapse code blocks • Auto-complete to suggest what to type next • Auto-formatting to indent code blocks • Dynamic syntax checking <p>Testing e.g.</p> <ul style="list-style-type: none"> • Single stepping to run the code line by line • Breakpoints to stop the code at set points to check values • Report window to see how variables change 	4

Question	Answer	Marks																																													
7	<p>1 mark for first 4 rows, 1 mark for second 4 rows (shaded)</p> <table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> <th>Working space</th> <th>X</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> <td></td> <td>0</td> </tr> <tr> <td>0</td> <td>0</td> <td>1</td> <td></td> <td>0</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> <td></td> <td>1</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> <td></td> <td>0</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> <td></td> <td>1</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> <td></td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> <td></td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> <td></td> <td>0</td> </tr> </tbody> </table>	A	B	C	Working space	X	0	0	0		0	0	0	1		0	0	1	0		1	0	1	1		0	1	0	0		1	1	0	1		0	1	1	0		0	1	1	1		0	2
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8	<p>1 mark for identification of an application Max 2 marks for relevant description e.g.</p> <ul style="list-style-type: none"> • Police identifying wanted people • Uses image recognition • ... to identify features/characteristics/items in an image <ul style="list-style-type: none"> • Natural language interfaces • Use speech recognition to identify words that are spoken • ... and adapts to learn regional accents <ul style="list-style-type: none"> • Self-driving cars • Detects its position on the road and within the traffic • Follows a route // Collision avoidance // Self-parking etc. <ul style="list-style-type: none"> • Spoken Interfaces • Use natural language processing • ... to take a sentence and work out its meaning <ul style="list-style-type: none"> • Game playing • Models characters in a computer game • ... to allow computer characters to react according to the player's movements 	3

Question	Answer	Marks										
9(a)	<p>1 mark for each completed name or description</p> <table border="1" data-bbox="320 315 1310 875"> <thead> <tr> <th data-bbox="320 315 550 383">Device</th> <th data-bbox="550 315 1310 383">Description</th> </tr> </thead> <tbody> <tr> <td data-bbox="320 383 550 479">Router</td> <td data-bbox="550 383 1310 479">Receives and sends data between two networks operating on the same protocol</td> </tr> <tr> <td data-bbox="320 479 550 645">Wireless Network Interface Card (WNIC)</td> <td data-bbox="550 479 1310 645">Hardware component that allows a device to connect to a <u>wireless</u> network // Provides a MAC address to the device to identify it on the <u>wireless</u> network</td> </tr> <tr> <td data-bbox="320 645 550 741">Repeater</td> <td data-bbox="550 645 1310 741">Restores the digital signal so it can be transmitted over greater distances</td> </tr> <tr> <td data-bbox="320 741 550 875">Wireless Access Point (WAP)</td> <td data-bbox="550 741 1310 875">Hardware component that provides radio communication from the central device to nodes on the network (and vice versa)</td> </tr> </tbody> </table>	Device	Description	Router	Receives and sends data between two networks operating on the same protocol	Wireless Network Interface Card (WNIC)	Hardware component that allows a device to connect to a <u>wireless</u> network // Provides a MAC address to the device to identify it on the <u>wireless</u> network	Repeater	Restores the digital signal so it can be transmitted over greater distances	Wireless Access Point (WAP)	Hardware component that provides radio communication from the central device to nodes on the network (and vice versa)	4
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9(b)	<p>1 mark for each difference e.g.</p> <ul style="list-style-type: none"> • Fibre optic data is transmitted using light, copper cable through electrical signals • Fibre optic has higher bandwidth than copper cable // Fibre optic has higher transmission rates than copper cable • Fibre optic has smaller risk of (noise) interference than copper cable • Fibre optic can be used over longer distances than copper cable before repeaters are needed • Fibre optic is much more difficult to hack into than copper cable • Fibre optic is more prone to damage than copper cable 	3										
9(c)	<p>1 mark per point to max 4</p> <ul style="list-style-type: none"> • A workstation / node (wishing to transmit) listens to the communication channel • ...data is only sent when the channel is free // ... if channel is free data is sent • Because there is more than one computer connected to the same transmission medium • ... two workstations can start to transmit at the same time, causing a collision • If a collision happens, the workstations send a (jamming) signal / abort transmission • ...and each waits a random amount of time before attempting to resend 	4										