Cambridge Assessment International Education

Cambridge International AS & A Level

COMPUTER SCIENCE **9618/13**

Paper 1 Theory Fundamentals **May/June 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 May/June 2023 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 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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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>1(a)</td><td>NOT B</td><td>1</td></tr>
<tr><td>1(b)</td><td>1 mark for first 4 rows correct; 1 mark for second 4 rows correct

<table>
<tr><th>A</th><th>B</th><th>C</th><th>X</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>0</td></tr>
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<tr><td>1</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td></tr>
</table></td><td>2</td></tr>
</table>

Question	Answer	Marks
2(a)	**1 mark** each to **max 2** • WAN covers a large **geographica**l area and LAN covers a small **geographical** area • LAN connections between devices are usually physical, whereas the WAN connections are often virtual • A LAN has a high data transfer rate, whereas a WAN has a low data transfer rate • The **ownership** of a LAN is private; the **ownership** of a WAN can be private or public • LAN is **usually** more secure than a WAN because protection is easier to implement	**2**
2(b)(i)	**1 mark** each to **max 2** • All computers are connected to at least one other device • There are multiple routes between devices • The computers can act as relays, passing packets on towards the final destination	**2**

Question	Answer	Marks
2(b)(ii)	**1 mark** each to **max 2** • If one line goes down there are more routes available • Improved security as not using one main line • No/fewer collisions • New nodes can be added without interruption or interfering with other nodes • More secure because data is sent over a dedicated connection	**2**
2(c)	**1 mark** each to **max 2** • Server performs **all** processes required by the task and/or data storage • Clients **only** sends requests to the server and displays the returned results	**2**
2(d)	**1 mark** each to **max 4** Examples: • Some students might only have one sort of connection on their device • Wired provides better performance for the student's device • ... for example, enabling faster access to university databases • There will be less interference if students connect via a cable • Students can transmit private/confidential data/work securely • ... for example, their final dissertation • Wireless connection means that the students can use their devices in different rooms/sites/outside/anywhere more freely // student devices can be portable • Wireless connection enables the students to bring multiple devices // bring their own devices // change devices	**4**
2(e)	**1 mark** for identification • IP address is made up of a network ID and a host ID **1 mark** each to **max 2** for description • Each device in a subnetwork has the same network ID // Each subnetwork has a different network ID • Every device **in each subnetwork** has a different host ID but the same network ID // the host ID uniquely identifies the device **within the subnetwork**	**3**

Question	Answer	Marks
3(a)	**1 mark** for each term • Resistive • Circuit • Capacitive • Change • Coordinates A **resistive** touchscreen has two layers. When the user touches the screen, the layers touch and a **circuit** is completed. A **capacitive** touchscreen has several layers. When the top layer is touched there is a **change/increase/decrease** in the electric current. A microprocessor identifies the **coordinates** of the touch.	**5**
3(b)	**1 mark** each to **max 3** Examples: • Scans the scene in real time • Identifies if there are faces in the image • Uses facial recognition • ... uses image recognition • ... takes each frame individually • ... analyses the pixels • ... stores pattern for a face • ... looks for patterns that match/come close to the pattern for a face • Camera focuses on the **pattern** identified	**3**
3(c)(i)	**1 mark** each • The amplitude is recorded a set number of times a second • Each (instance of an) amplitude is given a **corresponding** binary number • The binary number (of each amplitude) is saved in sequence	**3**
3(c)(ii)	**1 mark** each; **max 2** for rate and **max 2** for resolution Sampling rate • There are smaller 'gaps' in the sound wave // sound is recorded **more** often • Digital **waveform** is closer to the analogue **waveform** • The quantisation errors are smaller Sampling resolution • There are **more** bits per sample // a wider range of amplitudes can be stored • Each binary **amplitude**/note (in the digital recording) is closer to the analogue **amplitude**/note • Digital **waveform** is closer to the analogue **waveform** • The quantisation errors are smaller	**4**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>4(a)</td><td>1 mark for each bullet point. Mark in pairs. Max 2 for each description.

• Reduces data redundancy
• ... because linked tables mean that each data item is stored only once
• Reduces program-data dependency
• ... because the data is separate from the software so changes to the data do not require programs to be re-written
• Reduces data inconsistency // improves data integrity
• ... because by only storing data once it only needs to be updated once // changes in one table will automatically update in another // linked data cannot be entered differently in two tables
• Complex queries are easier to run
• Can provide different views
• ….so users can only see specific aspects of the database</td><td>4</td></tr>
<tr><td>4(b)</td><td>1 mark each

<table><tr><th>Term</th><th>Description</th></tr><tr><td>Entity</td><td>An object that data is stored about.</td></tr><tr><td>Tuple</td><td>A row of data in a table about one instance of an object.</td></tr><tr><td>Secondary key</td><td>An additional/alternative key used as well as the primary key to locate specific data // a candidate key that has not been chosen as a primary key.</td></tr><tr><td>Foreign key</td><td>A field in one table that is linked to a primary key in another table.</td></tr></table></td><td>4</td></tr>
<tr><td>4(c)</td><td>1 mark each

• Only 3 tables with appropriate identifiers (i.e. one table for customer, one for booking and one for car)
• Appropriate Primary key in each table underlined
• Booking table includes Primary key from car and Primary key from customer as Foreign keys
• All original fields are in correct tables

Example answer:
BOOKING(BookingID, CarRegistration, CustomerID, StartDate, EndDate)
CAR(CarRegistration, CarModel, CarColour)
CUSTOMER(CustomerID, CustomerFirstName, CustomerLastName, EmailAddress, TelephoneNumber)</td><td>4</td></tr>
</table>

Question	Answer	Marks
4(d)(i)	**1 mark** each to **max 2** • Length check: the registration number must be **6 characters** long • Format check: the registration number must be in the format **letter-digit-digit-digit-letter-letter** • Type check: the registration number must be **alphanumeric**	**2**
4(d)(ii)	**1 mark** each • Visual check: **Manually** compare the registration number entered with the source document • Double entry: Enter the registration number twice and **the computer compares** to check they are the same	**2**
4(d)(iii)	The registration number on the original document might be in the correct format but may be the incorrect registration number for that car.	**1**

Question	Answer	Marks
5(a)(i)	**1 mark** each to **max 2** • Programmer can test sections of the code without every part working / being written • Programmer can debug in real time • … so that errors can be fixed and the program continued from that point • The effect of any changes made by the programmer can be seen immediately • To avoid dependent errors	**2**
5(a)(ii)	**1 mark** each to **max 3** • The compiler produces an executable file • ... so the user cannot access / edit / sell the code • ... and users do not need the translator to run the game • The game can be compiled for different hardware specifications • ... and then used to generate more income for the programmer • The program can be **tested** multiple times without having to retranslate each time	**3**

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Question	Answer	Marks
5(b)	**1 mark** for appropriate licence; **1 mark** for each point to **max 3** • Commercial software licence • User has to pay for the product so the programmer can gain an income • Enables the program to be **copyrighted** • ... so the user cannot **legally** edit the program // the programmer retains control over product • … and can take legal action against people who attempt to **illegally** copy it /sell it on • Shareware licence • Enables the program to be **copyrighted** • The user cannot **legally** edit the program so the developer retains control over product • User can try the program for free and then pay for the full game which allows the programmer to gain an income • so more people can experience it and therefore be more likely to buy it	**4**

Question	Answer	Marks
6(a)	**1 mark** each to **max 5** • The sender hashes **the document** • ... to produce a digest • The sender encrypts the digest to create the digital signature • The message and the signature are sent to the receiver • The receiver decrypts the signature to reproduce the digest • The receiver uses the same hashing algorithm on the document received to produce a second digest • The receiver compares this digest with the one from the digital signature • If both of the receiver's digests are the same the document is authentic	**5**

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>6(b)</td><td>1 mark each for identification and appropriate description of 2 pieces of software, max 2
<table>
<tr><th>Type of software</th><th>Description</th></tr>
<tr><td>Antivirus</td><td>• scans the computer for viruses and checks against a stored database of viruses, that needs to be updated regularly and then deletes / quarantines them
• compares downloaded files to a database of known viruses and prevents the download continuing</td></tr>
<tr><td>Antispyware</td><td>• scans the computer for spyware and checks against a stored database of viruses, that needs to be updated regularly and then deletes / quarantines them
• compares downloaded files to a database of known spyware and prevents the download continuing.</td></tr>
<tr><td>Firewall</td><td>• monitors incoming and outgoing traffic and compares it to criteria that are set by the user such as through a whitelist/blacklist/identifying allowed / blocked IP addresses
• compares incoming and outgoing traffic to criteria blocks those that do not match criteria</td></tr>
<tr><td>Antimalware</td><td>• scans the computer for viruses and checks against a stored database of viruses, that needs to be updated regularly and then deletes / quarantines them
• compares downloaded files to a database of known viruses and prevents the download continuing</td></tr>
</table></td><td>2</td></tr>
</table>

Question	Answer	Marks
7(a)	**1 mark** for each correct line **Description** / **Denary value** The smallest integer that can be represented in 8-bit two's complement. → −128 The largest integer that can be represented in 8-bit two's complement. → 127 The largest unsigned integer that can be represented in 8 bits. → 255 −127 127 −255 −128 −256 256 128 255	**3**
7(b)	**1 mark** each to **max 4** • The **system clock** gives out **timing** signals • … which are sent on the **control bus** • …to **synchronise** the other system components • The **Control Unit** initiates data transfer • …by generating signals that are sent on the **control bus** to other components	**4**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>7(c)</td><td>1 mark for each Register transfer notation

<table>
<tr><th>Stage description</th><th>Register transfer notation</th></tr>
<tr><td>The Program Counter (PC) is incremented</td><td>PC ← [PC] + 1</td></tr>
<tr><td>The data in the address stored in the Memory Address Register (MAR) is copied to the Memory Data Register (MDR)</td><td>MDR ← [[MAR]]</td></tr>
</table>
</td><td>2</td></tr>
</table>