Cambridge International Examinations

Cambridge International General Certificate of Secondary Education

Computer Science **0478/12**

Paper 1 Computer Systems **February/March 2024**

MARK SCHEME

Maximum Mark: 75

Cambridge Assessment International Education

PRE-STANDARDISATION

Cambridge Assessment International Education – 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.

Maths-Specific Marking Principles

1. Unless a particular method has been specified in the question, full marks may be awarded for any correct method. However, if a calculation is required then no marks will be awarded for a scale drawing.

2. Unless specified in the question, answers may be given as fractions, decimals or in standard form. Ignore superfluous zeros, provided that the degree of accuracy is not affected.

3. Allow alternative conventions for notation if used consistently throughout the paper, e.g. commas being used as decimal points.

4. Unless otherwise indicated, marks once gained cannot subsequently be lost, e.g. wrong working following a correct form of answer is ignored (isw).

5. Where a candidate has misread a number in the question and used that value consistently throughout, provided that number does not alter the difficulty or the method required, award all marks earned and deduct just 1 mark for the misread.

6. Recovery within working is allowed, e.g. a notation error in the working where the following line of working makes the candidate’s intent clear.

Mark scheme abbreviations

/ separates alternative words / phrases within a marking point
// separates alternative answers within a marking point
underline actual word given must be used by candidate (grammatical variants accepted)
max indicates the maximum number of marks that can be awarded
( ) the word / phrase in brackets is not required, but sets the context

Note: No marks are awarded for using brand names of software packages or hardware.

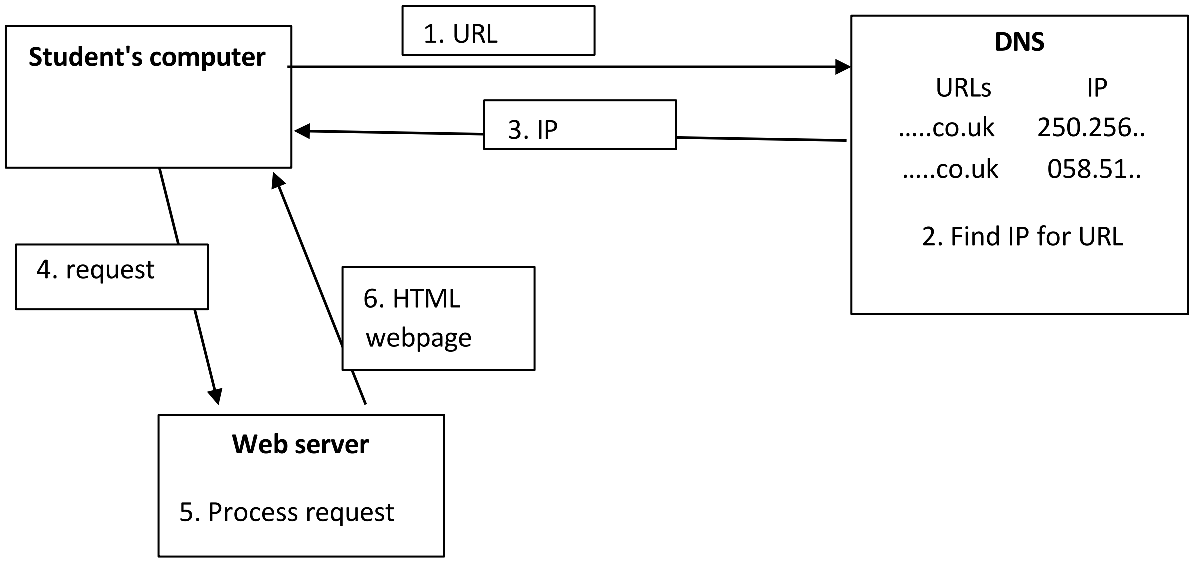
Question	Answer	Marks	Guidance
1(a)	B	**1**	
1(b)(i)	A	**1**	
1(b)(ii)	01001110	**1**	
1(b)(iii)	**Two** from: • **Unique** binary/denary number given/stored for each character // R E and D each have a **different** binary/denary number • The code for R is stored, then the code for E then D in sequence	**2**	
1(c)(i)	Any **two** from: • More bits allocated to each amplitude • Amplitudes can be more precise // Amplitudes are closer to the original • A wider range of amplitudes can be recorded	**2**	

1(c)(ii)	- Increase the sample rate	**1**	Do not award ways that the quality can be improved, it's how the recording is accurate instead of the original sound be higher quality.

2(a)	1 mark for letter and matching correction. • Statement B… • …MAR stores addresses and not instructions// MAR stores one address and not all address • Statement C… • …Data is from bus not PC // Data is from address in MAR not PC	**4**	Consider corrected statement without letter if obvious
2(b)(i)	• It can run 3.5 billion FE cycles **each second** // it can execute 3.5 billion instructions **each second**	**1**	
2(b)(ii)	Any **two** from: • 1 core can run 1 FE cycle/instruction **each second** • 2 (or other example) cores can run 2 (or other example) FE cycles/instructions **simultaneously** • … twice (or other example) as many instructions are executed each second	**2**	Accept reverse
2(b)(iii)	Any **two** from: • Cache stores frequently used instructions // cache stores instructions that may need to be reused • The more cache means the processor can access more data faster • …instead of having to access the data from the slower-access RAM // Cache is memory that is faster to access than RAM	**2**	Accept reverse
2(c)(i)	Any **two** from: • Volatile storage • Stores data for the processor to access directly/quickly // directly accessed by the CPU • Stores currently running data and/or instructions	**2**	

<table>
<tr><td>2(c)(ii)</td><td>Any <b>one</b> from:
e.g.
• Firmware
• Parts of OS
• Programs (e.g. in an embedded system)</td><td><b>1</b></td><td>Consider other words for start-up instructions e.g. bootstrap, BIOS</td></tr>
<tr><td>2(c)(iii)</td><td>Any <b>one</b> from:
e.g.
• To run programs there is insufficient RAM to run
• To allow RAM to store more data when required</td><td><b>1</b></td><td></td></tr>
<tr><td>3(a)</td><td><b>One</b> mark each
<table>
<tr><th>Function name</th><th>Description</th></tr>
<tr><td>managing memory</td><td>e.g.
• allocates memory to processes
• prevents two processes accessing the same memory</td></tr>
<tr><td>platform for running applications</td><td>allows application software to run on the computer</td></tr>
<tr><td>managing peripherals</td><td>e.g.
• allocates data to buffers
• transmits data to hardware
• receives data from hardware</td></tr>
</table></td><td><b>3</b></td><td></td></tr>
<tr><td>3(b)(i)</td><td>e.g.
• To indicate that something requires the attention of the <b>processor</b></td><td><b>1</b></td><td>Do not accept get user's attention</td></tr>
</table>

3(b)(ii)	**One** mark for device **and** matching interrupt e.g. • Keyboard Key pressed • Mouse Mouse moved//button clicked	**1**	
3(b)(iii)	Any **five** from • Processor finishes current FE cycle for program • Processor checks interrupt priority queue // processor checks for higher priority interrupt than program • Processor stores current process on stack • Processor calls ISR for interrupt • ISR resolves interrupt • Processor retrieves content of stack to continue with process from program	**5**	Discuss STM Allow Interrupt handler instead of ISR

4	Any **five** marks for each part of diagram • URL going from computer/browser to DNS • DNS storing table/database of URL and IPs // DNS finding IP for URL • DNS sending IP to browser • Browser sending request to IP of web server • Web server processing request • Web page data sent from server to student A's computer e.g. Consider deleting example at STM  Student's computer 1. URL DNS URLs IP .....co.uk 250.256.. .....co.uk 058.51.. 2. Find IP for URL 3. IP 4. request 6. HTML webpage Web server 5. Process request	**5**	

5	**One** mark for each term in correct place • physically • blockchains • time-stamp • traced A digital currency does not exist **physically**, it can only be accessed electronically. Some digital currencies have digital ledgers called a **blockchains**. These are decentralised databases where each transaction is stored as a new set of data with a **time-stamp** and is linked to the previous set of data. This means that transactions cannot be altered, only new transactions added, which allows the location of the data to be **traced**.	**4**	
6(a)	Any **one** from • It has electrical components • It is programmable	**1**	
6(b)(i)	Any **five** from • Sensor **continuously** sends the **digitised** value/reading/distance to the microprocessor • Microprocessor compares the data/signal to the stored reference of a person and distance of 3m • If the data/signal is less than (or equal to) a person and within 3m… • …a **signal** is sent to **actuator** to make the tractor **stop** / apply the brakes • If the data/signal is greater than 3m no action is taken • The whole process repeats continuously until turned off	**5**	

6(b)(ii)	1 mark for sensor and 1 for matching use e.g. • Accelerometer • …to adjust for uneven ground // to detect if the tractor crashes • Proximity • …to detect if near the end of the field // to detect other obstacles • Light • … to identify when to turn the headlights on	**2**	Mark together. If sensor given is unrealistic and no justification do not award. If suitable reason award both. Do not award reason with no sensor.
6(c)	**Three** from e.g. • Initial cost may be high • Maintenance cost may be high • Farmer may need reskilling in how to use it … • ... which could be costly • Farmer may need fewer employees … • … leading to unemployment • Can malfunction • … and not recognise a person and fails to stop	**3**	
6(d)	Any **three** from • Knowledge base • Rule base • Inference engine • Interface	**3**	

<table>
<tr><td>6(e)(i)</td><td>Any <b>three</b> from<ul><li>Data is transmitted from tractor to computer</li><li>The same data is transmitted back from computer to tractor</li><li>Tractor compares both sets of data to see if they are identical</li><li>Tractor sends confirmation of accuracy if the same or the data/message if error</li></ul></td><td><b>3</b></td><td>Consider 1 mark if not clear which is tractor/computer</td></tr>
<tr><td>6eii</td><td>1 mark for each shaded set/column
<table>
<tr><th></th><th>parity bit</th><th>bit 7</th><th>bit 6</th><th>bit 5</th><th>bit 4</th><th>bit 3</th><th>bit 2</th><th>bit 1</th></tr>
<tr><td><b>byte 1</b></td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td><b>byte 2</b></td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td></tr>
<tr><td><b>byte 3</b></td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td><b>byte 4</b></td><td>0</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td><b>byte 5</b></td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td><b>byte 6</b></td><td>0</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td><b>byte 7</b></td><td>1</td><td>1</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td><b>parity byte</b></td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td><td>0</td></tr>
</table></td><td><b>3</b></td><td>Consider marking 1 mark for 2 correct etc.</td></tr>
<tr><td>7(a)(i)</td><td><ul><li>If the data is intercepted it cannot be understood</li></ul></td><td><b>1</b></td><td></td></tr>
<tr><td>7(a)(ii)</td><td><b>Four</b> from<ul><li>Symmetric has a shared key</li><li>…the same key is used to encrypt and decrypt</li><li>Asymmetric has a public key to encrypt the data</li><li>…and a private key to decrypt the data</li><li>…anyone can know the public key to encrypt, but only those intended know the private key to decrypt</li></ul></td><td><b>4</b></td><td>At stm consider max 1 if generic symmetric has 1 key asymmetric has 2</td></tr>
</table>

7(b)(i)	Any **two** from e.g. • Destination address/IP • Sender address/IP • Packet number	**2**	
7(b)(ii)	Any **one** from • Control the route the packet takes • Send each packet towards its destination	**1**	
8(a)(i)	• EC	**1**	
8(a)(ii)	Any **one** from • Easier for humans to read/remember • Shorter for humans to enter • Less likely for humans to make mistakes • Easier for humans to spot errors • Takes up less space onscreen	**1**	
8(b)(i)	**One** mark for working, **one** mark for answer • e.g. 10110111 = 01001001 • -73	**2**	
8(b)(ii)	• 00101101	**1**	Must be 8 bits
8(c)	1 mark each • Divide • ...by 16	**2**	