GCE

Computer Science

H046/01: Computing principles

AS Level

Mark Scheme for June 2024

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING
SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **number of required** standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the 50% and 100% deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone or the RM messaging system, or by email.

5. **Crossed Out Responses**
   Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

   Rubric Error Responses – Optional Questions
   Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

   Multiple Choice Question Responses

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).
When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses
When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only **one mark per response**)
Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth **two or more marks**)
If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)
Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7.   Award No Response (NR) if:
   - there is nothing written in the answer space

   Award Zero '0' if:

   - anything is written in the answer space and is not worthy of credit (this includes text and symbols).

   Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

8. The RM **comments box** is used by your team leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
    If you have any questions or comments for your team leader, use the phone, the RM messaging system, or e-mail.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:
    a. **To determine the level** – start at the highest level and work down until you reach the level that matches the answer
    b. **To determine the mark within the level**, consider the following:

Descriptor	Award mark
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

11. **Annotations**

Annotation	Meaning
∧	Omission mark
BOD	Benefit of the doubt
C	Subordinate clause / consequential error
✗	Incorrect point
E	Expansion of a point
FT	Follow through
NAQ	Not answered question
NBOD	No benefit of doubt given
P	Point being made
REP	Repeat
/	Slash / half-mark
✔	Correct point
TV	Too vague
0	Zero (big)
BP	Blank Page – this annotation must be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
L1	Level 1
L2	Level 2
L3	Level 3

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12. Subject Specific Marking Instructions

Question			Answer	Mark	Guidance
1			1 Mark for each labelled component.	AO1.1 (5)	Accept MBR // Memory Buffer Register for D
			A — Data Bus		
			B — MAR // Memory Address Register		
			C — PC // Program Counter		
			D — MDR // Memory Data Register		
			E — ACC // Accumulator		

Question			Answer	Mark	Guidance
2			**Mark Band 3- High Level** **(7-9 marks)** The candidate demonstrates a thorough knowledge and understanding of both Von Neumann and Harvard architectures. All detail is generally accurate and relevant. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate will come to a clear conclusion that must be justified by their comments. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Mark Band 2- Mid Level** **(4-6 marks)** The candidate demonstrates reasonable knowledge and understanding of Von Neumann and Harvard architectures; the material is generally accurate but at times underdeveloped. The candidate may not have applied both to this scenario. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. The candidate will attempt to come to a conclusion, although it may not be fully justified by their answer. *There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.* **Mark Band 1- Low Level** **(1-3 marks)**	AO1.1 (2) AO1.2 (2) AO2.1 (2) AO3.3 (3)	AO1 Harvard Architecture: • Uses separate memory for data and instructions. • Uses separate data and address buses for each piece of memory • Can read/write data and instructions simultaneously Von Neumann Architecture: • Uses one physical piece of memory for both data and instructions • Uses one data and one address bus. • Can only read/write data or instructions, not both at the same time AO2 • Von Neumann design is less complex. Development of one is cheaper. Harvard design is more complex as it requires two buses. Development is more expensive. More CPU pins are required; a complex motherboard is required with doubling of memory. • Harvard Architecture free data memory cannot be used for instructions and vice-versa AO3 • Harvard architecture allows for faster processing as instructions and data are simultaneously fetched/executed. • Harvard splits memory between instruction and data in a static way, meaning you could run out of one memory with unused memory in the other area. • Von Neumann architecture allows for dynamic allocation between instruction and data

			The candidate demonstrates a basic knowledge of Von Neumann and Harvard architectures. The material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided. The candidate provides nothing more than an unsupported assertion. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No attempt to answer the question or response is not worthy of credit.		• Large programs with small data (Computer games) or small programs with large data (video editing) can be equally catered for

Question			Answer	Mark	Guidance
3	(a)	(i)	- Allows for more efficient use of computing resources … Less likely to have workstations run idle … can allocate more resources to power users dynamically Or - Thin clients are cheaper than desktops… …which could save the school money. Or - Thin clients are often physically smaller than desktops… …allowing more desk space/workspace for staff/students.	AO2.1 (2)	Accept other valid reasons with a suitable justification
3	(a)	(ii)	- Can cause network overload… …if the network does not have sufficiently good bandwidth - Could create process lag… …If lots of large processes run at the same time - If a virtual machine hangs/crashes the user is unable to reset it… …whereas they can physically reboot on a local machine. - Thin-clients may not be compatible with some peripherals… …meaning some of the school's peripherals become unusable.	AO2.1 (2)	Mark in pairs

Mark Scheme

| 3 | b | | • **Multi Tasking** …
 • … is optimised to deal with multiple processes simultaneously/concurrently
 …Can run multiple programs/tasks at the same time
 Example, e.g.
 • Home/personal computer

 • **Distributed** …
 • … Designed to run the **same** task over multiple machines
 Example, e.g.
 SETI or other cloud-based processes// Clusters of desktops used for rendering/calculations.

 • **Embedded** …
 • … Will have a restricted set of operations (to conserve resources)
 • … is read only
 Example, e.g.
 Domestic appliance such as a washing machine

 • **Real-Time** …
 • …optimised to handle and respond to inputs with no wait/within a guaranteed response time/immediate.
 Example, e.g.
 • Used in "mission critical" systems such as aircraft control. | AO1.1 (3)
 AO1.2 (3) | 1 mark for type of OS
 1 mark for description
 1 mark for suitable example

 Allow other suitable types of operating system. |
| 3 | c | (i) | • Application software allows the **user** to solve a problem / complete a task.
 • Utility software is designed to monitor / manage / maintain a computer system | AO1.2 (2) | |

3	c	(ii)	• Word Processor …
			E.g
			   • Allows students to write essays / reports
			
			• Spreadsheets …
			E.g.
			   • Allow students to track/aggregate/calculate data
			   • Create charts
			   • Model situations / experiments
			
			• Presentation …
			E.g.
			   • Allows students to create presentations on a particular topic
				AO1.1 (2)
				AO2.1 (2)
					Allow any sensible application that could be used in a school environment as part of a student's workflow (e.g. photo editor, email client, web-browser).
					
					Example must be specific to a school environment
					
					Do not allow brand names for type of application
					
					If a brand name is used, allow follow through mark for a valid example

3	c	(iii)	• Open Source Software allows access/modification to/of the **source code**… …can tailor the software to their specific needs …may be more widely bug fixed …there may be a wider pool of support available in the community Or • There will likely be no cost to purchasing a **license** to use the software… …saving the school money	AO2.1 (2)	
3	d		e.g. • Disk defragmentation • File management • Device driver • System cleanup • Anti-virus/Anti-malware • Firewall • Backup • Compression	AO2.1 (3)	Allow other examples if valid (no duplicates)

Question			Answer	Mark	Guidance

4	a		<table><tr><td></td><td>Compiler</td><td>Interpreter</td><td>Assembler</td></tr><tr><td>Creates an executable file</td><td>X</td><td></td><td>(X)</td></tr><tr><td>Creates one line of object code for each line of source code</td><td></td><td></td><td>X</td></tr><tr><td>Translates all the high-level code at once</td><td>X</td><td></td><td></td></tr><tr><td>A program needs to be translated each time it is run</td><td></td><td>X</td><td></td></tr></table>	AO1.2 (4)	For "creates an executable file", accept any of the following combinations:
					  - Compiler
					  - Assembler
					  - Compiler and assembler

4	b		• Compiler … • … Would protect their source code // keep their IP secret • … meaning competitors cannot steal their ideas • … Protect their money making ideas • …would mean the game would run quicker (than if it were interpreted).	AO2.1 (2)	

| 4 | c | | • INP and STA two numbers correctly
• Appropriate use of branching to exit the loop.
• SUB ONE and STA NUM
• LDA ANSWER and ADD NUMA
• Output (correct) answer.
• Set DAT for NUMA, NUMB, ONE, ANSWER after HLT | AO3.2
(6) | First and second number can be interchanged
Accept suitable labels for DAT and Loop points
For point 6 the 0s for ANSWER, NUMA, NUMB are optional but ONE must be initialised to 1.

Allow FT for BP5 if logic is correct.

Accept alternative mnemonics identified in the specification. |
| | | | **POSSIBLE SOLUTION:** | | |

```
          INP
          STA NUMA
          INP
          STA NUMB
LOOPSTART LDA NUMB
          BRZ LOOPEND
          SUB ONE
          STA NUMB
          LDA ANSWER
          ADD NUMA
          STA ANSWER
          BRA LOOPSTART
LOOPEND   LDA ANSWER
          OUT
          HLT
ANSWER    DAT 0
ONE       DAT 1
NUMA      DAT 0
NUMB      DAT 0
```

Question	Answer	Mark	Guidance

5	- Correctly declared **function errorCheck ()** (CAO) - Use **getElementById** and assign to a variable - Use `if` statement to check if password length < 8 // password length > 12 … … `if` statement checks both password length < 8 and password length > 12 - Inside if statement set `innerHTML` of `errorText` to "Password Length Error" (CAO)
	POSSIBLE SOLUTION:
	<pre>function errorCheck() {
	
	var pass = document.getElementById("Password").value;
	
	if (pass.length > 12 || pass.length < 8)
	{
	
	    document.getElementById("errorText").innerHTML =
	    "Password Length Error";
	
	}
	}</pre>
		AO3.2 (5)	Award 0 marks if it is clear JavaScript has not been used
			
			Allow nested if statements

Question			Answer	Mark	Guidance
6	(a)	(i)	157	AO2.2 (1)	CAO
6	(a)	(ii)	-99	AO2.2 (1)	CAO
6	(a)	(iii)	9D	AO2.2 (1)	CAO
6	(b)		**Mark Band 3 - High Level** **(7-9 marks)** The candidate demonstrates a thorough knowledge and understanding of why data is stored in binary with points covering a range of examples of data types. All detail is generally accurate and relevant. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate will come to a clear conclusion that must be justified by their comments. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Mark Band 2- Mid Level** **(4-6 marks)** The candidate demonstrates reasonable knowledge and understanding of why data is stored in binary with points covering a range of examples of data types stored in binary. The material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation.	AO1.1 (2) AO1.2 (2) AO2.1 (2) AO3.3 (3)	AO1 Types of data stored in binary: E.g. • Numeric • Alphanumeric/text/characters/symbols • Sound • Images • Video AO2: Examples: • Text – Use of character sets such as ASCII and Extended ASCII. Each character is given a separate binary code. Increasing the number of bits for each character increase the number of possible characters that can be stored • Numbers – Numbers can be stored using binary. Sign and Magnitude and Two's Compliment can be used to store negative binary numbers. Floating Point binary can be used to store data with a decimal point. Other answers outside of the specification should still be accepted. E.g. • Images are split into pixels. Each pixel is given a binary value which represents a colour.

The candidate will attempt to come to a conclusion, although it may not be fully justified by their answer.

There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.

Mark Band 1- Low Level
(1-3 marks)
The candidate demonstrates a basic knowledge of why data is stored in binary with points covering some examples of data types stored in binary. The material is basic and contains some inaccuracies.
The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided.
The candidate provides nothing more than an unsupported assertion.

The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.

0 marks
No attempt to answer the question or response is not worthy of credit.

- Analogue sound is sampled. A sample is a reading that is taken at certain points and is stored as a binary number.

AO3
Reasons computers use binary:
- Computers made up of switches/logic gates
- They will have on/off/two states
- This easily translates to binary values

Question			Answer	Mark	Guidance
7	(a)	(i)	 | A	B	Q
---	---	---
0	0	0
0	1	1
1	0	1
1	1	0	 • 1 Mark for the first 2 rows • 1 mark for the last 2 rows	AO2.2 (2)	
7	(a)	(ii)	XOR	AO1.2 (1)	Accept "Exclusive OR"
7	(b)		 • A going into an OR game • B going into a NOT gate with the output going into the OR gate • Output of the OR gate going into an AND gate with C	AO3.1 (3)	

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