GCE

Computer Science

H046/02: Algorithms and problem solving

AS Level

Mark Scheme for June 2022

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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.

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MARKING INSTRUCTIONS

PREPARATION FOR MARKING
SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris 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 scoris 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) 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 scoris 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 scoris **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 scoris 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: Not applicable in F501
      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

12.   Subject Specific Marking Instructions

INTRODUCTION
Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:
- the specification, especially the assessment objectives
- the question paper and its rubrics
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

USING THE MARK SCHEME
Please study this Mark Scheme carefully. The Mark Scheme is an integral part of the process that begins with the setting of the question paper and ends with the awarding of grades. Question papers and Mark Schemes are developed in association with each other so that issues of differentiation and positive achievement can be addressed from the very start.

This Mark Scheme is a working document; it is not exhaustive; it does not provide 'correct' answers. The Mark Scheme can only provide 'best guesses' about how the question will work out, and it is subject to revision after we have looked at a wide range of scripts.

The Examiners' Standardisation Meeting will ensure that the Mark Scheme covers the range of candidates' responses to the questions, and that all Examiners understand and apply the Mark Scheme in the same way. The Mark Scheme will be discussed and amended at the meeting, and administrative procedures will be confirmed. Co-ordination scripts will be issued at the meeting to exemplify aspects of candidates' responses and achievements; the co-ordination scripts then become part of this Mark Scheme.

Before the Standardisation Meeting, you should read and mark in pencil a number of scripts, in order to gain an impression of the range of responses and achievement that may be expected.

In your marking, you will encounter valid responses which are not covered by the Mark Scheme: these responses must be credited. You will encounter answers which fall outside the 'target range' of Bands for the paper which you are marking. Please mark these answers according to the marking criteria.

Please read carefully all the scripts in your allocation and make every effort to look positively for achievement throughout the ability range. Always be prepared to use the full range of marks.

LEVELS OF RESPONSE QUESTIONS:
The indicative content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.
Using 'best-fit', decide first which set of BAND DESCRIPTORS best describes the overall quality of the answer. Once the band is located, adjust the mark concentrating on features of the answer which make it stronger or weaker following the guidelines for refinement.

- **Highest mark:** If clear evidence of all the qualities in the band descriptors is shown, the HIGHEST Mark should be awarded.

- **Lowest mark:** If the answer shows the candidate to be borderline (i.e. they have achieved all the qualities of the bands below and show limited evidence of meeting the criteria of the band in question) the LOWEST mark should be awarded.

- **Middle mark:** This mark should be used for candidates who are secure in the band. They are not 'borderline' but they have only achieved some of the qualities in the band descriptors.

Be prepared to use the full range of marks. Do not reserve (e.g.) high Band 3 marks 'in case' something turns up of a quality you have not yet seen. If an answer gives clear evidence of the qualities described in the band descriptors, reward appropriately.

	AO1	AO2	AO3
High (thorough)	Precision in the use of question terminology. Knowledge shown is consistent and well-developed. Clear appreciation of the question from a range of different perspectives making extensive use of acquired knowledge and understanding.	Knowledge and understanding shown is consistently applied to context enabling a logical and sustained argument to develop. Examples used enhance rather than detract from response.	Concerted effort is made to consider all aspects of a system / problem or weigh up both sides to an argument before forming an overall conclusion. Judgements made are based on appropriate and concise arguments that have been developed in response resulting in them being both supported and realistic.
Middle (reasonable)	Awareness of the meaning of the terms in the question. Knowledge is sound and effectively demonstrated. Demands of question understood although at times opportunities to make use of acquired knowledge and understanding not always taken.	Knowledge and understanding applied to context. Whilst clear evidence that an argument builds and develops through response there are times when opportunities are missed to use an example or relate an aspect of knowledge or understanding to the context provided.	There is a reasonable attempt to reach a conclusion considering aspects of a system / problem or weighing up both sides of an argument. However the impact of the conclusion is often lessened by a lack of supported judgements which accompany it. This inability to build on and develop lines of argument as developed in the response can detract from the overall quality of the response.
Low (basic)	Confusion and inability to deconstruct terminology as used in the question. Knowledge partial and superficial. Focus on question narrow and often one-dimensional.	Inability to apply knowledge and understanding in any sustained way to context resulting in tenuous and unsupported statements being made. Examples if used are for the most part irrelevant and unsubstantiated.	Little or no attempt to prioritise or weigh up factors during course of answer. Conclusion is often dislocated from response and any judgements lack substance due in part to the basic level of argument that has been demonstrated throughout response.

Question			Answer	Mark	Guidance
1	**(a)**		1 mark per box up to a maximum of 4 marks: 	4 AO2.2 (4)	
1	**(b)**		1 mark for any of the following bullet points: • To write programming code. • To debug programming code. • To compile/interpret code.	1 A01.1 (1)	
1	**(c)**		1 mark per bullet up to a maximum of 2 marks for each construct (4 marks in total), e.g.: • Sequence… • …e.g. display payment details once a room has been selected • …e.g. send confirmation email after successfully entering payment details • Selection… …e.g. if payment details are successful then send confirmation email • ...e.g. if a valid date has been entered then display a list of available rooms • Iteration…. • ….e.g. repeat code until a date has been entered • ….e.g. repeat code until a room has been selected	4 A01.2 (2) A02.1 (2)	Award 1 mark for stating a construct and then 1 mark for a suitable example that is relevant to the context. Award a maximum of two marks for each programming construct.

1	(d)		1 mark per bullet up to a maximum of 2 marks, e.g.: • Blackbox testing • Whitebox testing • Alpha testing • Beta testing	2 A01.1 (2)	
1	(e)		1 mark per bullet up to a maximum of 2 marks: • Waterfall lifecycle • Agile methodologies • Extreme programming • Spiral model • Rapid Application Development	2 A01.1 (2)	Allow RAD as acronym this time
1	(f)		1 mark per bullet up to a maximum of 2 marks for each advantage (4 marks in total), e.g.: • Saves times (1) as code does not need to be rewritten (1) • Code may already be tested (1) which will therefore save development//debugging time (1) • More efficient code (1) which will use less memory//be easier to maintain (1) • May require less technical knowledge (1) as code can used rather than written (1)	4 A01.1 (2) A01.2 (2)	Award a maximum of two marks for each advantage. Allow other suitable examples.

2	(a)	i	1 mark per bullet up to a maximum of 4 marks, e.g.: • makes use of a (while) loop… • ….which will continually check the telephone number…. • …and repeatedly ask for a telephone number to be re-entered…. • ….until the rules have been met	4 A02.2 (2) A03.3 (2)	
2	(a)	ii	1 mark for stating a suitable procedure name and 1 mark for a suitable purpose (4 marks in total), e.g.: • **Procedure Name:** registerAccount • **Purpose:** To load up the registration page when the user wants to create a new account • **Procedure Name:** validateDetails • **Purpose:** To check the suitability of a new username and password entered • **Procedure Name:** checkLogin • **Purpose:** Checks a username and password matches those stored when a customer logs in • **Procedure Name:** checkStock • **Purpose:** Checks an item is in stock before the item can be added to a shopping basket	4 A02.1 (4)	The procedure name must be relevant to the context in the question. Both a procedure name and purpose must be stated for 2 marks. Allow other suitable examples that are relevant to the context.
2	(a)	iii	1 mark per bullet up to a maximum of 4 marks, e.g.: • by reference will receive the memory location of where the data/variable is stored • by value will receive a copy of the data/variable	2 A01.2 (2)	Must cover by reference and by value to be given full marks.

| 2b | **Mark Band 3 – High level (7-9 marks)**
The candidate demonstrates a thorough knowledge and understanding of modularity; the material is generally accurate and detailed. 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 is able to weigh up the use of modularity within a team of programmers which results in a supported and realistic judgment as to whether it is suitable to use within the context.*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 modularity; 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.
The candidate makes a reasonable attempt to come to a conclusion showing some recognition of influencing factors that would determine whether it is possible to use modularity in this context.
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 modularity with limited understanding shown; the material is basic and contains some inaccuracies. The candidates 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 comunicated 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. | 9

AO1.1
(2)

AO1.2
(2)

A02.1
(2)

A03.3
(3) | **Knowledge and Understanding**
• A module is a set/block of instructions which is given a name which can then be called upon by the main body of code to complete a task(s).
• The different modules within the program are then executed when the program is run in order to provide a solution to the problem.
• A module can be created using a function which is a block of code that will return a value, or a procedure which is a block of code that will not return a value.
• Alternatively, a module may contain a collection of different sub-programs (procedures/functions) that are combined together to complete a task.

Application
• The program is a large program and therefore the use of modules will allow the program to be split into different subtasks.
• Different programmers can agree the procedure names and parameters needed for each module.
• Each subtask can then be written and tested by different programmers simultaneously which will therefore reduce development time.
• Each subtask can be self-contained which means that the work carried out by one programmer should not affect another.
• Each subtask can be programmed by specific programmers who have the skills and expertise in that area/language being used.

Evaluation
• Modularity will reduce development time as the team of programmers can work together at the exact same time on the same program.
• Programmers can specialise in their area of expertise/language which therefore means blocks can be reused by other programmers who may not have expertise in some areas.
• Programmers may feel restricted if they have to follow the agreed house style. This could have a knock-on effect with other programmers if not followed. |

3	a		1 mark for each correct row up to a maximum of 4 marks.	4 A02.1 (4)	Marks should be awarded for correct swapping of adjacent items that are out of order. Therefore if the previous step is incorrect but the candidate has followed through with the correct answer then marks should be awarded.
			<table><tr><td>89</td><td>25</td><td>75</td><td>37</td><td>45</td><td></td></tr><tr><td>25</td><td>89</td><td>75</td><td>37</td><td>45</td><td>1 mark</td></tr><tr><td>25</td><td>75</td><td>89</td><td>37</td><td>45</td><td>1 mark</td></tr><tr><td>25</td><td>75</td><td>37</td><td>89</td><td>45</td><td>1 mark</td></tr><tr><td>25</td><td>75</td><td>37</td><td>45</td><td>89</td><td>1 mark</td></tr></table>		
3	b	i	• Line 5	1 A02.1 (1)	Allow line 4 and 12
3	b	ii	numbers	1 A02.1 (1)	
3	b	iii	1 mark per bullet up to a maximum of 2 marks, e.g.: • To temporarily hold data… • …To allow the contents of two variables to be swapped • …to ensure that data is not overwritten	2 A01.2 (2)	
3	b	iv	1 mark per bullet up to a maximum of 2 marks, e.g.: • signifies whether or not any swaps have been made in a pass • if still set to true at the end of a pass, then the list is sorted	2 A01.2 (2)	

4	a		1 mark per bullet up to a maximum of 2 marks, e.g.: • = is used as the `number` variable is being assigned a value… • …== is not used as the program is not checking if the variable is equal to a value	2 A01.2 (2)	Accept: • = is an assignment operator • == is a comparison operator.
4	b		• 2,4,6,8	1 A03.3 (1)	
4	c		• 1,3,5,7	1 A03.3 (1)	
4	d		1 mark per bullet up to a maximum of 2 marks, e.g.: • Modulo division • Finds the remainder after a division • Used to determine if `a` is an odd or even number	2 A03.3 (2)	

5	a		1 mark per bullet up to a maximum of 3 marks, e.g.: • To start from the beginning // first booking slot • Search each slot in order // sequentially • Search until the first empty slot is found	3 A02.2 (3)	

5	b		1 mark per bullet up to a maximum of 7 marks, e.g.:
			• Defining the `findFirst` function correctly
			• Suitable logic for checking the first time slot
			• Suitable logic for checking the next time slot…
			• Suitable loop to check all time slots
			• Suitable logic for returning the available time slot
			• Suitable logic for returning -1 if no time slots available
			• Suitable use of variable names and indentation
				7
				
				A03.1
				(7)
					Example solution:
					<pre>function findFirst()
					    count = 0
					    do
					        found = false
					        if customerID[2, count] == "" then
					            found = true
					        else
					            count = count + 1
					        endif
					    until count == 10 or found == true
					    if found == True
					        return customerID[0,count]
					    else
					        return -1
					    endif
					endfunction</pre>There are many different ways that this function could have been achieved. Therefore other alternative methods should be given credit.

5	c	iii	A procedure does not return a value / a function will return a value.	1 A02.2 (1)	

6	a		1 mark per bullet up to a maximum of 2 marks, e.g.: • Line 04 is calling the procedure • Line 06 is defining the procedure	2 A03.3 (2)	
6	b		1 mark per bullet up to a maximum of 2 marks, e.g.: • the variable `change` is global (set on line 03) • the value is printed after it has been changed to 0 by the procedure	2 A03.3 (2)	
6	c		1 mark per bullet up to a maximum of 3 marks, e.g.: • to convert/cast the values • …from an integer to a string • to allow the values/labels to be joined/concatenated // to allow them to be printed together	3 A02.2 (3)	Allow "To typecast the variables"

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