



Cambridge IGCSE™

COMPUTER SCIENCE

0478/23

Paper 2 Algorithms, Programming and Logic

October/November 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 October/November 2023 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

This document consists of **16** printed pages.

PUBLISHED**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	1

Question	Answer	Marks
2	B	1

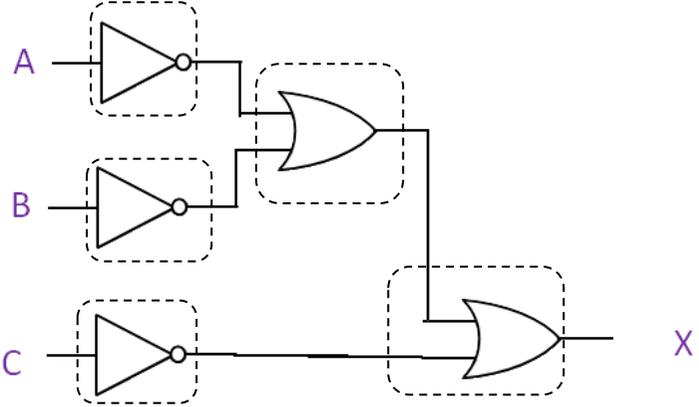
Question	Answer	Marks
3(a)	<p>One mark for each correct line from description to pseudocode keyword</p> <div style="display: flex; justify-content: space-around;"> <div style="text-align: left;"> <p>Pseudocode description</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">stores data in a file</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">retrieves data from a file</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">displays data on a screen</div> <div style="border: 1px solid black; padding: 5px;">enters data from a keyboard</div> </div> <div style="text-align: left;"> <p>Pseudocode keyword</p> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">OUTPUT</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">WRITE</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">READ</div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;">OPEN</div> <div style="border: 1px solid black; padding: 5px;">INPUT</div> </div> </div>	4
3(b)	<p>One mark for each point (max two)</p> <ul style="list-style-type: none"> • data is stored permanently • data can be moved to another computer • another copy of data can be made and stored//accessed elsewhere // backup copy 	2

Question	Answer	Marks
4(a)	<p>One mark for each point</p> <ul style="list-style-type: none"> • type check • range check 	2
4(b)	<p>One mark for each point (max five)</p> <ul style="list-style-type: none"> • use of loop for check • checking for whole number • checking for number greater than or equal to one • ... and less than or equal to six • Appropriate error/reinput message • ability to reinput value <p>Example:</p> <pre>WHILE Seats < 1 OR Seats > 6 OR Seats <> ROUND(Seats, 0) DO OUTPUT "Please enter a valid number of seats " INPUT Seats ENDWHILE</pre>	5
4(c)	<p>One mark for correct test data, one mark for corresponding reason</p> <p>Example:</p> <p>7, abnormal data to show that this value would be rejected</p>	2

Question	Answer	Marks
5(a)	<p>One mark for each error identified and correction given</p> <ul style="list-style-type: none"> • Line 06 Password should be NewPassword • Line 11 AND should be OR • Line 16 INPUT should be OUTPUT 	3

Question	Answer	Marks
5(b)	<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <pre> graph TD Start([START]) --> Output1[/OUTPUT "Enter your new password"/] Output1 --> Input[/INPUT NewPassword/] Input --> Init[Posn ← 1 Found ← FALSE] Init --> Dec1{IS NewPassword = OldList[Posn]?} Dec1 -- Yes --> FoundTrue[Found ← TRUE] Dec1 -- No --> PosnInc[Posn ← Posn + 1] FoundTrue --> Dec2{IS Found OR OldList[Posn] = "XXXX"?} PosnInc --> Dec2 Dec2 -- No --> Dec1 Dec2 -- Yes --> Dec3{IS Found?} Dec3 -- Yes --> Output2[/OUTPUT "Password has been used before"/] Dec3 -- No --> Output3[/OUTPUT "New password accepted"/] Output2 --> Stop([STOP]) Output3 --> Assign[OldList[Posn] ← NewPassword] Assign --> Stop </pre> </div> <div style="width: 50%;"> <p>Max six marks from:</p> <p>Max four from:</p> <ul style="list-style-type: none"> one mark for data entry with message one mark for initialisation one mark for checking list // decision box comparing input with array one mark for updating // updating the two variables position and found one mark for loop control // second decision box one mark for setting new password to position in list one mark for outputs // two outputs <p>Two marks:</p> <ul style="list-style-type: none"> one mark for correct use of flow chart symbols one mark for correct use arrows and labels </div> </div>	6

Question	Answer	Marks															
6(a)	<p>One mark for correct gate and one mark for correct truth table</p> <p>AND</p> <table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>X</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> <td>1</td> </tr> </tbody> </table>	A	B	X	0	0	0	0	1	0	1	0	0	1	1	1	2
A	B	X															
0	0	0															
0	1	0															
1	0	0															
1	1	1															
6(b)	<p>One mark for correct gate and one mark for correct truth table</p> <p>XOR // EOR</p> <table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>X</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>0</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> </tr> </tbody> </table>	A	B	X	0	0	0	0	1	1	1	0	1	1	1	0	2
A	B	X															
0	0	0															
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Question	Answer	Marks															
6(c)	<p>One mark for correct gate and one mark for correct truth table</p> <p>NOR</p> <table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>X</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>1</td> <td>0</td> </tr> <tr> <td>1</td> <td>0</td> <td>0</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> </tr> </tbody> </table>	A	B	X	0	0	1	0	1	0	1	0	0	1	1	0	2
A	B	X															
0	0	1															
0	1	0															
1	0	0															
1	1	0															
6(d)	<p>One mark for each correct gate, with the correct input(s) as shown.</p> 	5															

Question	Answer	Marks
7	one mark for first description one mark for matching difference max four <ul style="list-style-type: none">• local variables - scope is a defined block of code/subroutine/procedure/function• global variables – scope is the whole program• local variables - value cannot be changed elsewhere in the program• global variables – value can be changed anywhere in the program	4

Question	Answer					Marks
8(a)	Accept	Reject	PartOK	Error	OUTPUT	5
	0	0				
	1		Y			
	2		Y			
	3		Y			
		1	N			
	4		Y			
	5		Y			
	6		Y			
	7		Y			
		2	N			
	8		Y			
	9		Y			
	10		Y	20		
					Too many rejected 20% error	
One mark for each column						

Question	Answer	Marks
8(b)	<p>One mark for each point max three</p> <ul style="list-style-type: none"> • after the Input box // before the first decision box • insert a process box • to convert the input to upper case <p>OR</p> <ul style="list-style-type: none"> • change the first decision / add another decision box • to accept 'y' as well • by adding OR PartOK = 'y' 	3

Question	Answer	Marks
9(a)	Records: 14 Fields: 5	2
9(b)(i)	Species/Description	1
9(b)(ii)	Long names that could be easily misspelt // species or description could be duplicated	1
9(b)(iii)	Easy to validate // always unique	1
9(c)	<p>One mark for each correct row or column</p> <p>True silver white laced top half and black lower half</p> <p>Brown eared brown with ear tufts</p>	2
9(d)	<p>One mark for each correct addition</p> <pre>SELECT Species FROM PheasantList WHERE Breeding or WHERE Young = 0 AND Young = 0; AND Breeding;</pre>	4

Question	Answer	Marks
10	<ul style="list-style-type: none"> • AO2 (maximum 9 marks) • AO3 (maximum 6 marks) <p>Data Structures required names shown underlined must be used as given in the scenario 2D Array or list <u>Temperatures</u> Variables <u>MaxDay</u>, <u>MinDay</u>, <u>AvDay</u>, <u>MaxWeek</u>, <u>MinWeek</u>, <u>AvWeek</u></p> <p>Requirements (techniques)</p> <p>R1 Find maximum and minimum temperatures for each day and calculates the average daily temperature (searching, totalling) R2 Find maximum and minimum temperatures for week and calculates the average weekly temperature (nested searching, totalling) R3 outputs for each day name, the rounded values for maximum temperature, minimum temperatures and average temperature. Outputs for the week the rounded values for maximum temperature, minimum temperatures and average temperature (output with appropriate messages and rounded values)</p> <p>Example 15-mark answer in pseudocode:</p> <pre>// meaningful identifier names and appropriate data structures to store the data required DECLARE DayCounter, HourCounter : INTEGER DECLARE AvDay, AvWeek, MaxDay, MinDay, MaxWeek, MinWeek : REAL DECLARE DayTotal, WeekTotal : REAL DECLARE Day : STRING CONSTANT Hours ← 24 CONSTANT Days ← 7</pre>	15

Question	Answer	Marks
10	<pre> MaxWeek ← -1000// initialise max and min temperatures and total for the week MinWeek ← 1000 WeekTotal ← 0 FOR DayCounter ← 0 TO Days - 1 MaxDay ← -1000// initialise max and min temperatures and total for each day MinDay ← 1000 DayTotal ← 0 FOR HourCounter ← 0 TO Hours - 1 DayTotal ← DayTotal + Temperatures(HourCounter, DayCounter) // update total maximum and minimum IF Temperatures(HourCounter, DayCounter) > MaxDay THEN MaxDay ← Temperatures(HourCounter, DayCounter) ENDIF IF Temperatures(HourCounter, DayCounter) < MinDay THEN MinDay ← Temperatures(HourCounter, DayCounter) ENDIF NEXT HourCounter CASE OF DayCounter // select message for day 0 : Day ← "Monday" 1 : Day ← "Tuesday" 2 : Day ← "Wednesday" 3 : Day ← "Thursday" 4 : Day ← "Friday" 5 : Day ← "Saturday" 6 : Day ← "Sunday" ENDCASE DayAverage ← DayTotal / Hours // output results for day OUTPUT Day // Results from a day OUTPUT "Maximum temperature ", MaxDay OUTPUT "Minimum temperature ", MinDay OUTPUT "Average temperature ", ROUND(DayAverage,2) </pre>	

Question	Answer	Marks
10	<pre>IF MaxDay > MaxWeek // update total maximum and minimum THEN MaxWeek ← MaxDay ENDIF IF MinDay > MinWeek THEN MinWeek ← MinDay ENDIF WeekTotal ← WeekTotal + DayTotal // update total for week NEXT DayCounter WeekAverage ← WeekTotal / Days OUTPUT "Maximum temperature for week ", MaxWeek// output results for week OUTPUT "Minimum temperature for week ", MinWeek OUTPUT "Average temperature for Week ", ROUND(WeekAverage,2)</pre>	

Marking Instructions in italics			
AO2: Apply knowledge and understanding of the principles and concepts of computer science to a given context, including the analysis and design of computational or programming problems			
0	1-3	4-6	7-9
No creditable response.	At least one programming technique has been used. <i>Any use of selection, iteration, counting, totalling, input and output.</i>	Some programming techniques used are appropriate to the problem. <i>More than one technique seen applied to the scenario, check the list of techniques needed.</i>	The range of programming techniques used is appropriate to the problem. <i>All criteria stated for the scenario have been covered by the use of appropriate programming techniques, check list of techniques needed.</i>
	Some data has been stored but not appropriately. <i>Any use of variables or arrays or other language dependent data structures e.g. Python lists.</i>	Some of the data structures chosen are appropriate and store some of the data required. <i>More than one data structure used to store data required by the scenario.</i>	The data structures chosen are appropriate and store all the data required. <i>The data structures used store all the data required by the scenario.</i>

Marking Instructions in italics			
AO3: Provide solutions to problems by:			
	evaluating computer systems	making reasoned judgements	presenting conclusions
0	1-2	3-4	5-6
No creditable response.	Program seen without relevant comments.	Program seen with some relevant comment(s).	The program has been fully commented.
	Some identifier names used are appropriate. <i>Some of the data structures used have meaningful names.</i>	The majority of identifiers used are appropriately named. <i>Most of the data structures used have meaningful names.</i>	Suitable identifiers with names meaningful to their purpose have been used throughout. <i>All of the data structures used have meaningful names.</i>
	The solution is illogical.	The solution contains parts that may be illogical.	The program is in a logical order.
	The solution is inaccurate in many places. <i>Solution contains few lines of code with errors that attempt to perform a task given in the scenario.</i>	The solution contains parts that are inaccurate. <i>Solution contains lines of code with some errors that logically perform tasks given in the scenario. Ignore minor syntax errors.</i>	The solution is accurate. <i>Solution logically performs all the tasks given in the scenario. Ignore minor syntax errors.</i>
	The solution attempts at least one of the requirements. <i>Solution contains lines of code that attempt at least one task given in the scenario.</i>	The solution attempts to meet most of the requirements. <i>Solution contains lines of code that perform most tasks given in the scenario.</i>	The solution meets all the requirements given in the question. <i>Solution performs all the tasks given in the scenario.</i>