CAMBRIDGE
International Education

Cambridge IGCSE™

COMPUTER SCIENCE **0478/22**

Paper 2 Algorithms, Programming and Logic **February/March 2025**

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 February/March 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

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 descriptions 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.

Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
	Correct point
	Incorrect point
	Follow through
	Repetition
	Ignore
	Benefit of doubt given
	Content of response too vague
	Not answered question
	Omission
	Section not relevant

Annotation	Meaning
~~	Section incorrect
Highlighter	Highlights part of the answer or shows structure of complex answers
SEEN	Page or response seen by examiner
A2	AO2 mark
A3	AO3 mark
NE	Not enough
R1	Required item one
R2	Required item two
R3	Required item three
✓ 1	Correct awarding one mark
✓ 2	Correct awarding two marks
✓ 3	Correct awarding three marks
✓ 4	Correct awarding four marks
✓ 5	Correct awarding five marks
✓ 6	Correct awarding six marks
✓ 7	Correct awarding seven marks
✓ 8	Correct awarding eight marks
✓ 9	Correct awarding nine marks

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
1	C	**1**

Question	Answer	Marks
2	B	**1**

Question	Answer	Marks
3	**One** mark for each correct line **Stage** / **Description** testing → making sure the program code works as expected analysis → identifying of the problem and requirements coding → using a programming language to create the solution design → using structure diagrams, flowcharts and pseudocode to plan the solution reviewing the final solution to suggest further developments	**4**

Question	Answer	Marks
4(a)	To check that a value has been entered.	**1**
4(b)(i)	Type (check)	**1**

Question	Answer	Marks

4(b)(ii)	**One** mark per mark point:
	MP1 Condition controlled loop used
	MP2 Working input and re-input of value into declared variable
	MP3 Use of selection/loop entry/exit condition to test if input is an integer
	MP4 Appropriate use of error message
	MP5 Working complete termination of loop
	
	Example:
	`REPEAT`
	`  INPUT Number`
	`  IF MOD(Number, 1) <> 0`
	`  THEN`
	
	`  OUTPUT "Please try again"`
	`  ENDIF`
	`UNTIL MOD(Number, 1) = 0`
	
	Or
	
	`INPUT Number`
	`WHILE MOD(Number, 1) <> 0 (DO)`
	`  OUTPUT "Please try again"`
	`  INPUT Number`
	`ENDWHILE`
		5

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>5</td><td>One mark for each correct box

<table>
<tr><th>Test data</th><th>Type of test data</th><th>Purpose of test data</th></tr>
<tr><td>ABC</td><td>Abnormal</td><td>to make sure that the program rejects data that is too short</td></tr>
<tr><td>Password1 //
Password22</td><td>Boundary</td><td>to make sure that the program rejects data that is only just too short //

to make sure that the program accepts data that is only just at the correct length</td></tr>
<tr><td>CambridgeInternational</td><td>Normal</td><td>to make sure that the program accepts data that is an appropriate length</td></tr>
</table></td><td>6</td></tr>
</table>

Question	Answer	Marks
6(a)	**One** mark per mark point • Line 02 / `DECLARE Highest : STRING` should be `DECLARE Highest : INTEGER` • Line 05 / Highest ← `1500` should be Highest ← `0` • Line 09 / `Total ← Total + Count` should be `Total ← Total + Numbers[Count]` • Line 10 / `IF Numbers[Count] > Total` should be `IF Numbers[Count] > Highest` • Line 17 / `OUTPUT "The average is ", Average / 1000` should be `OUTPUT "The average is ", Total / 1000`	**5**

Question	Answer	Marks

6(a)	**Corrected algorithm**
	`01 DECLARE Numbers : ARRAY[1:1000] OF INTEGER`
	`02 DECLARE Highest : INTEGER`
	`03 DECLARE Count : INTEGER`
	`04 DECLARE Total : INTEGER`
	`05 Highest ← 0`
	`06 Total ← 0`
	`07 FOR Count ← 1 TO 1000`
	`08  INPUT Numbers[Count]`
	`09  Total ← Total + Numbers[Count]`
	`10  IF Numbers[Count] > Highest`
	`11  THEN`
	`12  Highest ← Numbers[Count]`
	`13  ENDIF`
	`14 NEXT Count`
	`15 OUTPUT "The highest number is ", Highest`
	`16 OUTPUT "The total is ", Total`
	`17 OUTPUT "The average is ", Total / 1000`	

6(b)	**One** mark per mark point MP1 Correct use of `ROUND` function to round the average MP2 … set to 2 decimal places with `OUTPUT` command. **Example**: `OUTPUT ROUND(Total / 1000, 2)`	**2**
6(c)	**One** mark per mark point, **max four** MP1 Declaration of new variable for smallest value at start of algorithm/before it is used MP2 Initialisation of smallest variable to a high number / the first input MP3 New selection statement after input to compare input with current smallest number MP4 If input is smaller than current smallest variable, it should replace it MP5 Outside the loop, output the current value of the smallest variable.	**4**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>7(a)</td><td>One mark per correct column

<table>
<tr><th>Answer</th><th>Value1</th><th>Operator</th><th>Value2</th><th>OUTPUT</th></tr>
<tr><td></td><td></td><td></td><td></td><td>Continue?</td></tr>
<tr><td>Y</td><td>7</td><td>S</td><td>9</td><td>−2</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Continue?</td></tr>
<tr><td>Y</td><td>5</td><td>M</td><td>12</td><td>60</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Continue?</td></tr>
<tr><td>Y</td><td>25</td><td>D</td><td>5</td><td>5</td></tr>
<tr><td></td><td></td><td></td><td></td><td>Continue?</td></tr>
<tr><td>N</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
</table></td><td>5</td></tr>
<tr><td>7(b)</td><td>It is a calculator.</td><td>1</td></tr>
</table>

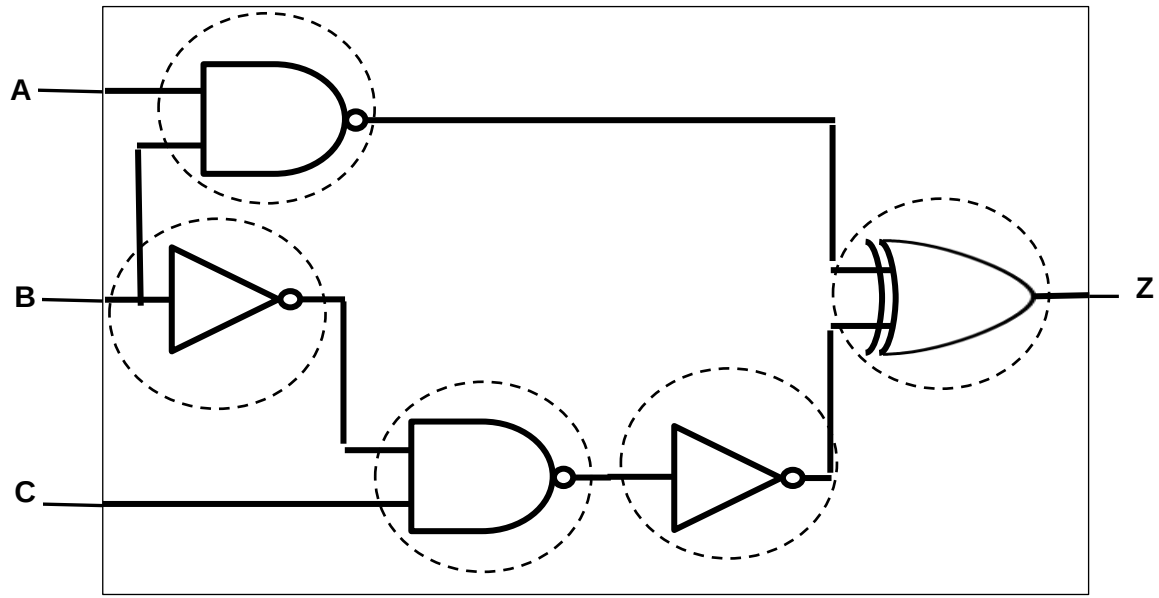
Question	Answer	Marks
7(c)(i)	**One** mark per mark point MP1 Include two process boxes MP2 … after the `Answer` and `Operator` input boxes MP3 Use of `UCASE` in both boxes to change the input given to upper case. **OR** **One** mark per mark point MP4 Change the condition in all the (4) decision boxes MP5 … for the variables `Answer` and `Operator` MP6 Using OR e.g. `OR Answer = 'y'` and `OR Operator = 'a'`	**3**
7(c)(ii)	**One** mark, for example: Only tests for A, S, and M; any other input is assumed to be D (for division) Divide by 0 error (if D and 0 are entered) Wrong data type e.g. character instead of number No data entered (enter without a preceding value) If Yes/yes entered the algorithm stops No input prompts.	**1**

Question	Answer	Marks
8(a)	**One** mark per correct answer **Fields:** 6 **Records:** 23	**2**
8(b)	**One** mark per correct answer **Primary key field:** Code **Reason:** It is the only field with unique contents. // It is a unique identifier	**2**

Question	Answer	Marks

8(c)	**One** mark per mark point
	MP1 Correct data present – spelt correctly
	MP2 Correct layout – three columns, with no additional punctuation
	MP3 Correct order and no integrity errors
	
	Correct output
	`Valencia Venezuela 1,983,445`
	`Lima Peru 11,206,000`
	`Buenos Aires Argentina 15,490,415`
		3

8(d)	**One** mark per mark point
	MP1 At least two correct fields in `SELECT`
	MP2 Remaining two correct fields in `SELECT`
	MP3 `FROM MajorCity`
	MP4 `WHERE Capital = TRUE;`
	
	Correct code:
	`SELECT Code, City, Country, Continent`
	`FROM MajorCity`
	`WHERE Capital = TRUE;`
		4

Question	Answer	Marks
9(a)	**One** mark for each correct gate, with the correct input(s) as shown. 	**5**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>9(b)</td><td>Four marks for all eight correct outputs
Three marks for six or seven correct outputs
Two marks for four or five correct outputs
One mark for two or three correct outputs

<table>
<tr><th>A</th><th>B</th><th>C</th><th>Z</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>1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>0</td></tr>
<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>0</td></tr>
</table>
</td><td>4</td></tr>
</table>

Question	Answer	Marks
10	Marks are available for: • AO2 (maximum 9 marks) • AO3 (maximum 6 marks) **Data structures required** with names as given in the scenario: Arrays or lists `MemberID[]`, `Name[]` Variables `NewID` **Requirements (techniques)** **R1** displays menu and allows choice, then proceeds based on valid choice, (nested iteration, input, output, selection, validation). **R2** checks length of string, checks contents of array for matches, stores approved data (validation, string handling (length), selection, input, storage). **R3** outputs contents of arrays. Program continues until user chooses stop. (output, iteration).	**15**

Question	Answer	Marks

10	**Example 15-mark answer in pseudocode**
	// Array and variable declaration – not required in candidates' responses
	REPEAT
	  // Display of menu choices
	  OUTPUT "Enter 1 to input a new member, 2 to output member codes and
	  first and last names, or 3 to stop "
	  // Input menu choice with validation of input
	  REPEAT
	  INPUT Answer
	  IF Answer < 1 OR Answer > 3
	  THEN
	  OUTPUT "You must input 1, 2 or 3. Please try again "
	  ENDIF
	  UNTIL Answer >= 1 AND Answer <= 3
	  // User chooses to input new member details
	  IF Answer = 1
	  THEN
	  REPEAT
	  // Initialisation of flag for previous use of code
	  Used ← FALSE
	  // User enters new code, with prompt
	  OUTPUT "Enter a new six-character membership code "
	  INPUT Code
	  // Checking code is 6 characters long
	  IF LENGTH(Code) <> 6
	  THEN
	  // If code is wrong length, re-entry required
	  OUTPUT "The code must contain six characters, please try again."
	  ELSE
	  // If code is correct length, it is checked with
	  // with previous codes for uniqueness
	  IndexCheck ← 1
	  WHILE MemberID[IndexCheck] <> "" AND NOT Used DO
	  IF Code = MemberID[IndexCheck]	

Question	Answer	Marks

10	THEN
	// If code already used, flag changed and re-entry required
	Used ← TRUE
	OUTPUT "This code has already been used,
	please try again "
	ELSE
	IndexCheck ← IndexCheck + 1
	ENDIF
	ENDWHILE
	// If code correct length and not previously used
	// it is stored, along with first and last name
	IF NOT Used
	THEN
	MemberID[IndexCheck] ← Code
	OUTPUT "Enter your first name "
	INPUT Name[IndexCheck, 1]
	OUTPUT "Enter your last name "
	INPUT Name[IndexCheck, 2]
	ENDIF
	ENDIF
	UNTIL LENGTH(Code) = 6 AND NOT Used
	ENDIF
	// User chooses to output all member details
	IF Answer = 2
	THEN
	IndexOut ← 1
	// All array contents output using iteration
	WHILE MemberID[IndexOut] <> ""
	OUTPUT "Membership code: ", MemberID[IndexOut]
	OUTPUT "First name: ", Name[IndexOut, 1]
	OUTPUT "Last name: ", Name[IndexOut, 2]
	IndexOut ← IndexOut + 1
	ENDWHILE
	ENDIF
	UNTIL Answer = 3	

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. *Any use of selection, iteration, counting, totalling, input and output.*	Some programming techniques used are appropriate to the problem. *More than one technique seen applied to the scenario, check the list of techniques needed.*	The range of programming techniques used is appropriate to the problem. *All criteria stated for the scenario have been covered by the use of appropriate programming techniques, check the list of techniques needed.*
	Some data has been stored but not appropriately. *Any **use** of variables or arrays or other language dependent data structures e.g. Python lists.*	Some of the data structures chosen are appropriate and store some of the data required. *More than one data structure **used** to store data required by the scenario.*	The data structures chosen are appropriate and store all the data required. *The data structures **used** store all the data required by the scenario.*

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. *Some of the data structures used have meaningful names.*	The majority of identifiers used are appropriately named. *Most of the data structures used have meaningful names.*	Suitable identifiers with names meaningful to their purpose have been used throughout. *All of the data structures used have meaningful names.*
	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. *Solution contains few lines of code with errors that attempt to perform a task given in the scenario.*	The solution contains parts that are inaccurate. *Solution contains lines of code with some errors that logically perform tasks given in the scenario. Ignore minor syntax errors.*	The solution is accurate. *Solution logically performs all the tasks given in the scenario. Ignore minor syntax errors.*
	The solution attempts at least one of the requirements. *Solution contains lines of code that attempt at least one task given in the scenario.*	The solution attempts to meet most of the requirements. *Solution contains lines of code that attempt most tasks given in the scenario.*	The solution meets all the requirements given in the question. *Solution performs all the tasks given in the scenario.*