CAMBRIDGE
International Education

Cambridge IGCSE™

COMPUTER SCIENCE **0478/21**

Paper 2 Algorithms, Programming and Logic **May/June 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 May/June 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

© Cambridge University Press & Assessment 2025

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.

© Cambridge University Press & Assessment 2025

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.

© Cambridge University Press & Assessment 2025

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

© Cambridge University Press & Assessment 2025

Annotation	Meaning
	Section incorrect
Highlighter	Highlights part of the answer or shows structure of complex answers
	Page or response seen by examiner
	AO2 mark
	AO3 mark
	Not enough
	Required item one
	Required item two
	Required item three
	Correct awarding one mark
	Correct awarding two marks
	Correct awarding three marks
	Correct awarding four marks
	Correct awarding five marks
	Correct awarding six marks
	Correct awarding seven marks
	Correct awarding eight marks
	Correct awarding nine marks

© Cambridge University Press & Assessment 2025

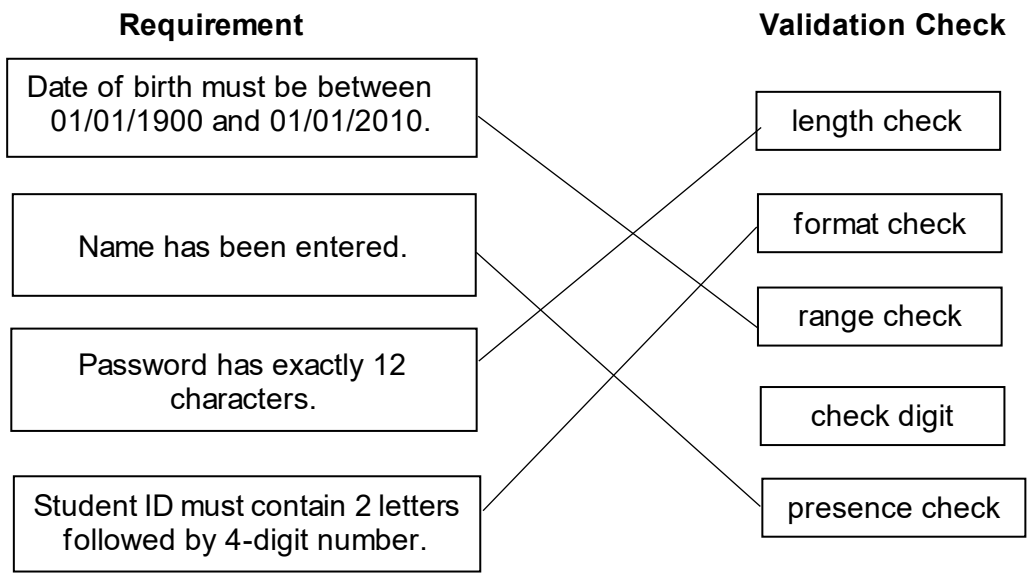
Mark scheme abbreviations

/	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.

© Cambridge University Press & Assessment 2025

Question	Answer	Marks
1	C	1

Question	Answer	Marks
2(a)	**One** mark for each correct line.  	4
2(b)	**One** mark for check, **two** marks for description. • Visual check [1] … • …look at the data that has been entered [1] and confirm it matches [1] • Double entry check [1] … • …enter data twice [1] and only accept identical values [1]	3

© Cambridge University Press & Assessment 2025

Question	Answer	Marks

3	**One** mark per bullet point
	
	• Initialising a count variable outside of loop
	• Correct use of loop with condition for 10 times (`WHILE (DO)...ENDWHILE, REPEAT...UNTIL`) with close
	• Incrementing the count variable inside the loop
	• Rest of algorithm correct
	
	Examples
	
	`Count ← 1`
	`REPEAT`
	`  OUTPUT "Please enter a name"`
	`  INPUT Name`
	`  Names[Count] ← Name`
	`  Count ← Count + 1`
	`UNTIL Count > 10`
	
	Or
	
	`Count ← 1`
	`WHILE Count <= 10 DO`
	`  OUTPUT "Please enter a name"`
	`  INPUT Name`
	`  Names[Count] ← Name`
	`  Count ← Count + 1`
	`ENDWHILE`
		4

© Cambridge University Press & Assessment 2025

Question	Answer	Marks

4(a)	**One** mark per bullet point. **Max** 5
	
	• Correct input of number
	• Use of substring ( )
	• …to extract the correct number
	• Correct use of IF statements/Case statement with matching `END IF` / `END CASE`
	• Output of matching locations
	• Output of unknown
	
	Example
	
	`OUTPUT "Please enter a telephone number "`
	`INPUT Telephone`
	`Value ← SUBSTRING(Telephone, 2, 2)`
	`IF Value = "44"`
	`  THEN`
	`    OUTPUT "UK"`
	`  ELSE`
	`    IF Value = "20"`
	`      THEN`
	`        OUTPUT "Egypt"`
	`      ELSE`
	`        OUTPUT "Unknown"`
	`    ENDIF`
	`ENDIF`
		5

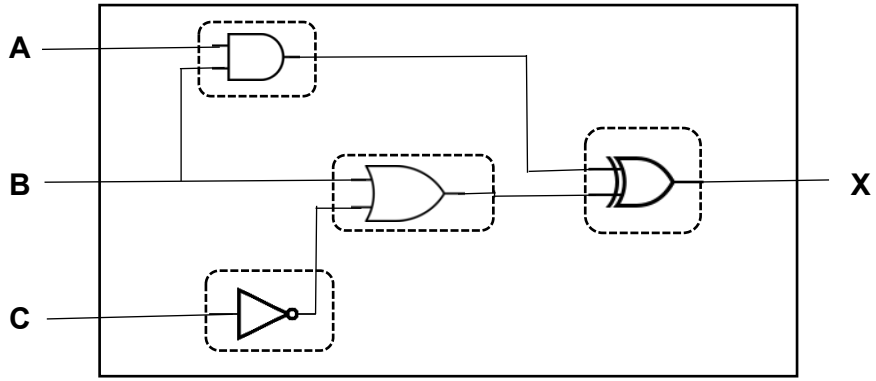
4(b)	**One** mark per bullet point. **Max** 3 • Find length of input. • Use a suitable loop (repeat/while). • Using the correct condition • Prompt for a 13-digit telephone number and input number inside loop.	**3**

© Cambridge University Press & Assessment 2025

Question	Answer	Marks
5	**One** mark for each bullet point • MOD – returns the remainder of a division calculation. • Example: `X ← MOD(10, 3)` • DIV – Integer division/returns the quotient of a division. • Example: `Y ← DIV(10, 3)`	**4**

Question	Answer	Marks
6(a)	**One** mark for each line identified and corrected. Line 02 – should be `N ← ROUND(RANDOM() * 99, 0) + 1` Line 12 – should be `OUTPUT "The number is higher than your guess"` Line 14/15 - `Counter ← Counter + 1` should be placed after Line 15/After `ENDIF`/before `UNTIL G = N`/before Line 16 Line 17 – should be `OUTPUT "Well done, you took ", Counter, " attempts"`	**4**
6(b)	**One** mark for method, **one** mark for example – **max** 2. • Meaningful identifiers, `N` should be `Number`. • Comments, `// loops until the guess equals the number` • Procedures/functions, making the algorithm a procedure/function	**2**

© Cambridge University Press & Assessment 2025

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>7(a)</td><td>One mark for each correct gate, with the correct input(s) as shown.

</td><td>4</td></tr>
<tr><td>7(b)</td><td>
<table>
<tr><th>A</th><th>B</th><th>C</th><th>X</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>
4 marks for 8 correct outputs
3 marks for 6/7 correct outputs
2 marks for 4/5 correct outputs
1 mark for 2/3 correct outputs</td><td>4</td></tr>
</table>

© Cambridge University Press & Assessment 2025

Question	Answer	Marks
8(a)(i)	Boolean	**1**
8(a)(ii)	There are **only** 2 responses / **Only** Yes and No / True and False	**1**
8(b)	**Two** marks for all three correct **One** mark for one/two correct BC02 The Fountain 9:10 BC08 Sunset Quay 12:01 BC27 The University 16:45	**2**

8(c)	**One** mark per correct statement
	
	`SELECT Destination`
	`FROM BUS`
	`WHERE Return = Yes;`
		3

© Cambridge University Press & Assessment 2025

Question	Answer	Marks

9(a)	**One** mark for each correct line
	
	`DECLARE A: INTEGER`
	`DECLARE B: STRING`
		2

9(b)	**One** mark for using `FUNCTION` and `ENDFUNCTION` and `RETURNS STRING`
	One mark for naming the function Odds.
	One mark for defining the parameter correctly.
	One mark for determining if odd/even using `MOD`/`DIV`/`ROUND` using parameter.
	One mark for correctly returning 'Odd' and 'Even'.
	One mark for correct function call
	
	Example:
	
	`FUNCTION Odds(X: INTEGER) RETURNS STRING`
	`  IF MOD(X, 2) = 0`
	`  THEN`
	`  RETURN "Even"`
	`  ELSE`
	`  RETURN "Odd"`
	`  ENDIF`
	`ENDFUNCTION`
	
	`B ← Odds(A)`
		6

© Cambridge University Press & Assessment 2025

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>10(a)</td><td>One mark for each correct column

<table>
<tr><th>Score</th><th>Grade</th><th>OUTPUT</th></tr>
<tr><td>21</td><td>D</td><td>You achieved a D</td></tr>
<tr><td>46</td><td>C</td><td>You achieved a C</td></tr>
<tr><td>63</td><td>C</td><td>You achieved a C</td></tr>
<tr><td>91</td><td>C</td><td>You achieved a C</td></tr>
<tr><td>12</td><td>D</td><td>You achieved a D</td></tr>
</table>

Candidates can be awarded all three marks if they have provided only the correct first row.</td><td>3</td></tr>
<tr><td>10(b)</td><td>One mark per bullet point. Max four

• Change the decision in the first decision box to <code>IS Score >= 80 ?</code>
• Change the decision in the last decision box to <code>IS Score >= 40 ?</code>
• Change process box from <code>Grade ← "C"</code> to <code>Grade ← "A"</code>
• Change process box from <code>Grade ← "A"</code> to <code>Grade ← "C"</code>
• Add output box instructing users to input score or input −1 before the input box // initialising a counter // incrementing counter.
• Add decision box for loop with exit condition.
• Correct arrows to show looping</td><td>4</td></tr>
</table>

© Cambridge University Press & Assessment 2025

Question	Answer	Marks
11	Marks are available for: • AO2 (maximum 9 marks) • AO3 (maximum 6 marks) **Data Structures required** names shown underlined must be used as given in the scenario Arrays or lists CompetitorName, CompetitorScore, Points **Requirements (techniques)** R1 inputs and validates the points for each event for each competitor (nested iteration, iteration, input, output) R2 finds and outputs the name of the competitors with the highest score for each event (nested iteration, output and selection) R3 totals the score for each competitor, finds and outputs the names with the highest score for all five events(iteration, totalling, output and selection)	**15**

© Cambridge University Press & Assessment 2025

Question	Answer	Marks

11	**Example 15-mark answer in pseudocode.**
	
	// meaningful identifier names and appropriate data structures (variables, constants and the given arrays) to store all the data required. Note that candidates did **not** need to declare any arrays or variables as stated in the question paper.
	
	`DECLARE Points : ARRAY [1 : 25] OF REAL`
	`DECLARE Highest : ARRAY [1 : 5] OF REAL`
	
	`Winner ← 0`
	`Max ← 0`
	
	`FOR Count ← 1 TO 25  //initialising array`
	`  Points[Count] ← 0`
	`NEXT Count`
	
	`FOR Count ← 1 TO 5  //initialising array`
	`  Highest[Count] ← 0`
	`NEXT Count`
	
	Requirement 1
	
	`FOR Event ← 1 TO 5`
	`    For X ← 1 TO 25   // loops through each entrant`
	`        REPEAT`
	`            OUTPUT "Please enter a score between 0 and 100 for ", Competitor[X], " for event ", Event`
	`            INPUT Score`
	`        UNTIL Score >= 0 AND Score <= 100 //validates score`
	`        CompetitorScore[X, Event] ← Score  //stores score for each Event`
	`        Points[X] ← Points[X] + Score  //can total score here`
	`    NEXT X`
	`NEXT Event`
		15

© Cambridge University Press & Assessment 2025

Question	Answer	Marks

11	Requirement 2
	
	FOR Event ← 1 TO 5
	  For X ← 1 TO 25
	  IF CompetitorScore[X, Event] > Highest[Event] //calculates the highest score
	  THEN
	  Highest[Event] = CompetitorScore[X, Event]
	  ENDIF
	  NEXT X
	NEXT Event
	
	FOR Event ← 1 TO 5 //outputs the names of competitors with the highest score
	  For X ← 1 TO 25
	  OUTPUT "The winner of a medal for the highest score in event ", Event
	  IF CompetitorScore[X, Event] = Highest[Event]
	  THEN
	  OUTPUT CompetitorName[X]
	  ENDIF
	  NEXT X
	NEXT Event
	
	Requirement 3
	
	//points may be calculated here
	For X ← 1 TO 25 //calculates the highest points scored for the five events
	  IF Points[X] > Max
	  THEN
	  Max ← Points[X]
	  ENDIF
	NEXT X
		15

© Cambridge University Press & Assessment 2025

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>11</td><td>

```
//outputs the names of the competitors with the highest score
OUTPUT "The competitors with the highest score for the five events"
For X ← 1 TO 25
    IF Points[X] = Max
      THEN
        OUTPUT CompetitorName[X]
    ENDIF
NEXT X
```

<table>
<tr><th colspan="4">Marking Instructions in italics</th></tr>
<tr><td colspan="4">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</td></tr>
<tr><td>0</td><td>1–3</td><td>4–6</td><td>7–9</td></tr>
<tr><td rowspan="2">No creditable response.</td><td>At least one programming technique has been used.
Any use of selection, iteration, counting, totalling, input and output.</td><td>Some programming techniques used are appropriate to the problem.
More than one technique seen applied to the scenario, check the list of techniques needed.</td><td>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.</td></tr>
<tr><td>Some data has been stored but not appropriately.
Any use of variables or arrays or other language dependent data structures e.g. Python lists.</td><td>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.</td><td>The data structures chosen are appropriate and store all the data required.
The data structures used store all the data required by the scenario.</td></tr>
</table>

</td><td>15</td></tr>
</table>

© Cambridge University Press & Assessment 2025

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>11</td><td>
<table>
<tr><td colspan="4">Marking Instructions in italics</td></tr>
<tr><td colspan="4">AO3: Provide solutions to problems by:
• evaluating computer systems
• making reasoned judgements
• presenting conclusions</td></tr>
<tr><td>0</td><td>1–2</td><td>3–4</td><td>5–6</td></tr>
<tr><td rowspan="5">No creditable response.</td><td>Program seen without relevant comments.</td><td>Program seen with some relevant comment(s).</td><td>The program has been fully commented.</td></tr>
<tr><td>Some identifier names used are appropriate.
Some of the data structures used have meaningful names.</td><td>The majority of identifiers used are appropriately named.
Most of the data structures used have meaningful names.</td><td>Suitable identifiers with names meaningful to their purpose have been used throughout.
All the data structures used have meaningful names.</td></tr>
<tr><td>The solution is illogical.</td><td>The solution contains parts that may be illogical.</td><td>The program is in a logical order.</td></tr>
<tr><td>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.</td><td>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.</td><td>The solution is accurate.
Solution logically performs all the tasks given in the scenario.
Ignore minor syntax errors.</td></tr>
<tr><td>The solution attempts at least one of the requirements.
Solution contains lines of code that attempt at least one task given in the scenario.</td><td>The solution meets most of the requirements.
Solution contains lines of code that perform most tasks given in the scenario.</td><td>The solution meets all the requirements given in the question.
Solution performs all the tasks given in the scenario.</td></tr>
</table>
</td><td>15</td></tr>
</table>

© Cambridge University Press & Assessment 2025