

# Cambridge O Level

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**COMPUTER SCIENCE****2210/22**

Paper 2 Algorithms, Programming and Logic

**May/June 2025****MARK SCHEME**

Maximum Mark: 75

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**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.

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This document consists of **13** printed pages.

**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
FT	Follow through
REP	Repetition
I	Ignore
BOD	Benefit of doubt given
TV	Content of response too vague
NAQ	Not answered question
✗	Omission
✗	Section not relevant
✗	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

Annotation	Meaning
<b>R2</b>	Required item two
<b>R3</b>	Required item three
<b>✓ 1</b>	Correct awarding one mark
<b>✓ 2</b>	Correct awarding two marks
<b>✓ 3</b>	Correct awarding three marks
<b>✓ 4</b>	Correct awarding four marks
<b>✓ 5</b>	Correct awarding five marks
<b>✓ 6</b>	Correct awarding six marks
<b>✓ 7</b>	Correct awarding seven marks
<b>✓ 8</b>	Correct awarding eight marks
<b>✓ 9</b>	Correct awarding nine marks

### Mark scheme abbreviations

/	separates alternative words / phrases within a marking point
//	separates alternative answers within a marking point
<b><u>underline</u></b>	actual word given must be used by candidate (grammatical variants accepted)
<b>max</b>	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	D	1

Question	Answer	Marks
2	<p><b>One mark for each correct line, max three</b></p> <p><b>Component part</b></p> <pre> graph LR     process[process] --- height[the height of the fence the length of the fence]     process --- paint1[The amount of paint required is 40 square metres.]     output[output] --- paint2[the colour of the paint]     input[input] --- fence[The area of fence is calculated as 40 square metres.]   </pre> <p><b>Example statements</b></p> <ul style="list-style-type: none"> <li>the height of the fence the length of the fence</li> <li>The amount of paint required is 40 square metres.</li> <li>the colour of the paint</li> <li>The area of fence is calculated as 40 square metres.</li> </ul>	3

Question	Answer	Marks
3	<p><b>One mark per correct piece of test data,</b></p> <p><b>Normal test data:</b> -50 (any integer value between 0 and -100, inclusive)  <b>Abnormal test data:</b> 50 (any value outside the range 0 and -100, inclusive, or any non-numeric input and non-integers)  <b>Extreme test data:</b> 0 // -100  <b>Boundary test data:</b> 1 // 0 // -100 // -101</p>	4

Question	Answer	Marks
4(a)	To check that the value entered has not changed on input.	1

Question	Answer	Marks
4(b)	<p><b>One</b> mark per mark point, <b>max six</b></p> <p>MP1 At least one appropriate working loop      MP2 First inputs of numbers all stored in array <b>Numbers</b>      MP3 Correct second input made for each number      MP4 Working selection statement to compare first and second inputs one at a time      MP5 If numbers don't match, appropriate output, including both values input and a message requiring re-input      MP6 New input stored in current array location (replacing original input)      MP7 Final output confirming completion, <b>outside loop</b>.</p> <p><b>For example,</b></p> <pre>// variable and array declarations or initialisations // are not required for this question FOR Index ← 1 TO 10     INPUT Numbers [Index] NEXT Index FOR Index ← 1 TO 10     INPUT CheckNumber     IF CheckNumber &lt;&gt; Numbers [Index]         THEN             OUTPUT CheckNumber, " and ", Numbers [Index], " do                 not match. Please re-enter the number. "             INPUT Numbers [Index]         ENDIF     NEXT Index     OUTPUT "The check has been completed."</pre>	<b>6</b>

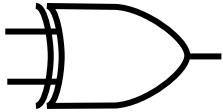
Question	Answer	Marks
5(a)	<p><b>One mark per mark point</b></p> <ul style="list-style-type: none"> <li>• Line 01 / DECLARE Names : ARRAY[1:500] OF REAL should be DECLARE Names : ARRAY[1:500] OF STRING</li> <li>• Line 09 / Total <math>\leftarrow</math> 100 should be Total <math>\leftarrow</math> 0</li> <li>• Line 11 / INPUT Names[Index] should be INPUT Names[Counter]</li> <li>• Line 13 / Total <math>\leftarrow</math> Counter + Heights[Counter] should be Total <math>\leftarrow</math> Total + Heights[Counter]</li> <li>• Line 20 / OUTPUT "The shortest height is ", Heights should be OUTPUT "The shortest height is ", Shortest or OUTPUT "The shortest height is ", Heights[Index]</li> </ul> <pre> 01 DECLARE Names : ARRAY[1:500] OF <b>STRING</b> 02 DECLARE Heights : ARRAY[1:500] OF REAL 03 DECLARE Shortest : REAL 04 DECLARE Total : REAL 05 DECLARE Counter : INTEGER 06 DECLARE Index : INTEGER 07 Shortest <math>\leftarrow</math> 500 08 Index <math>\leftarrow</math> 0 09 Total <math>\leftarrow</math> <b>0</b> 10 FOR Counter <math>\leftarrow</math> 1 TO 500 11     INPUT Names[<b>Counter</b>] 12     INPUT Heights[Counter] 13     Total <math>\leftarrow</math> <b>Total</b> + Heights[Counter] 14     IF Heights[Counter] &lt; Shortest 15         THEN 16             Shortest <math>\leftarrow</math> Heights[Counter] 17             Index <math>\leftarrow</math> Counter 18     ENDIF 19 NEXT Counter 20 OUTPUT "The shortest height is ", <b>Shortest</b> 21 OUTPUT "The shortest person is ", Names[Index] 22 OUTPUT "The average height is ", Total / 500 </pre>	5
5(b)	<p><b>One mark per mark point</b></p> <p>MP1 Output statement with correct calculation of average, or use of a variable average.</p> <p>MP2 Correct use of ROUND function set to 1 decimal place.</p> <p><b>For example,</b></p> <pre>OUTPUT ROUND(Total / 500, 1)</pre>	2

Question	Answer	Marks
5(c)	<p><b>One mark per statement, max four</b></p> <p>MP1 Declaration of new variable for tallest person / largest value at start of algorithm</p> <p>MP2 Initialisation of largest variable to a low number e.g. 0</p> <p>MP3 New selection statement after input of height to compare it with current largest value</p> <p>MP4 If input of height is larger than current largest variable, it should become the new largest value</p> <p>MP5 <b>Outside the loop</b>, output the current value of the largest variable.</p>	4

Question	Answer	Marks																																																																																																												
6(a)	<p><b>One mark per mark point</b></p> <p>MP1 Correct Number and Index columns</p> <p>MP2 Correct Word column</p> <p>MP3 Correct Continue column</p> <p>MP4 Correct V1 and V2 column</p> <p>MP5 Correct L1 and L2 column</p> <p>MP6 Correct OUTPUT column</p> <table border="1"> <thead> <tr> <th>Number</th> <th>Index</th> <th>Word</th> <th>Continue</th> <th>V1</th> <th>V2</th> <th>L1</th> <th>L2</th> <th>OUTPUT</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>1</td> <td>RACECAR</td> <td>TRUE</td> <td>1</td> <td>7</td> <td>R</td> <td>R</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>2</td> <td>6</td> <td>A</td> <td>A</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>3</td> <td>5</td> <td>C</td> <td>C</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>4</td> <td>4</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Successful</td> </tr> <tr> <td></td> <td>2</td> <td>TREAT</td> <td>TRUE</td> <td>1</td> <td>5</td> <td>T</td> <td>T</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td>2</td> <td>4</td> <td>R</td> <td>A</td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td>FALSE</td> <td></td> <td></td> <td></td> <td></td> <td>NOT successful</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Number	Index	Word	Continue	V1	V2	L1	L2	OUTPUT	2	1	RACECAR	TRUE	1	7	R	R						2	6	A	A						3	5	C	C						4	4												Successful		2	TREAT	TRUE	1	5	T	T						2	4	R	A					FALSE					NOT successful																												6
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6(b)	Finds words that read the same forwards and backwards.	1																																																																																																												

Question	Answer	Marks
6(c)	<p><b>One</b> mark per mark point, <b>max three</b></p> <p>MP1 Uses an index to mark the start and end of each word // uses <math>v1</math> to mark the start of the word and <math>v2</math> to mark the end</p> <p>MP2 After each check, these are moved to the next character in the word at each end of the word // <math>v1</math> is incremented by 1 and <math>v2</math> is decremented by 1 after each check.</p> <p>MP3 When the two indexes match or cross, the whole word has been checked // When <math>v1 = v2</math> or <math>v1 &gt; v2</math>, the whole word has been checked</p> <p>MP4 The algorithm will exit if it is found that two compared letters are not the same.</p>	3

Question	Answer	Marks
7(a)	<p><b>One</b> mark per mark point, max <b>six</b></p> <p>MP1 input Value MP2 correct check that Value is between -20 and 50, exclusive MP3 totalling values MP4 counting number of values MP5 checking Count = 50 / <math>\geq</math> 50 MP6 output of total and average</p> <pre> graph TD     START((START)) --&gt; Init[Count ← 0]     Init --&gt; Total[Total ← 0]     Total --&gt; INPUT[/INPUT Value/]     INPUT --&gt; Decision{IS Value &lt;= -20 OR Value &gt;= 50 ?}     Decision -- No --&gt; Add[Total ← Total + Value]     Add --&gt; Count[Count ← Count + 1]     Count --&gt; Decision     Decision -- Yes --&gt; STOP((STOP))     Decision -- No --&gt; OUTPUT1[/OUTPUT Total/]     OUTPUT1 --&gt; OUTPUT2[/OUTPUT Total/50/]     </pre>	6
7(b)	<p><b>One</b> mark per statement</p> <p>MP1 Change INPUT Value so that it saves values into an array MP2 ... using the counter as the index MP3 <b>Outside the (first) loop</b>, set up a loop that will iterate 50 times MP4 Use an output statement inside the (second) loop to output the contents of the array, using the counter as the index.</p>	4

Question	Answer	Marks															
8(a)	<p><b>One</b> mark for the logic gate and <b>one</b> mark for the truth table</p> <p><b>XOR logic gate symbol:</b></p>  <p><b>Truth table:</b></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	<b>2</b>
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0	0	0															
0	1	1															
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8(b)(i)	<p><b>One</b> mark per mark point</p> <p>MP1 A AND MP2 (NOT B OR NOT C) // NOT(B AND C) // (B NAND C)</p> <p><b>Or</b></p> <p><b>One</b> mark per mark point</p> <p>MP3 A AND NOT B MP4 OR A AND NOT C</p> <p><b>Example answers</b></p> <p>(X =) A AND (NOT B OR NOT C) // A AND NOT (B AND C) // A AND (B NAND C) (X =) A AND NOT B OR A AND NOT C</p>	<b>2</b>															

Question	Answer	Marks																																				
8(b)(ii)	<p><b>Four</b> marks for eight correct outputs  <b>Three</b> marks for six or seven correct outputs  <b>Two</b> marks for four or five correct outputs  <b>One</b> mark for two or three correct outputs</p> <table border="1"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> <th>X</th> </tr> </thead> <tbody> <tr><td>0</td><td>0</td><td>0</td><td>0</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>0</td></tr> <tr><td>0</td><td>1</td><td>1</td><td>0</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>1</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>1</td></tr> <tr><td>1</td><td>1</td><td>1</td><td>0</td></tr> </tbody> </table>	A	B	C	X	0	0	0	0	0	0	1	0	0	1	0	0	0	1	1	0	1	0	0	1	1	0	1	1	1	1	0	1	1	1	1	0	4
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Question	Answer	Marks										
9(a)	<p><b>Two</b> marks for all four fields correctly identified  <b>One</b> mark for two or three fields correctly identified</p> <table border="1"> <thead> <tr> <th>Data type</th> <th>Field</th> </tr> </thead> <tbody> <tr><td>Boolean</td><td>Subway</td></tr> <tr><td>integer</td><td>Population // Founded // Identification</td></tr> <tr><td>real</td><td>AverageIncome</td></tr> <tr><td>text</td><td>Name // Country // Continent // Identification</td></tr> </tbody> </table>	Data type	Field	Boolean	Subway	integer	Population // Founded // Identification	real	AverageIncome	text	Name // Country // Continent // Identification	2
Data type	Field											
Boolean	Subway											
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real	AverageIncome											
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9(b)	<p><b>One</b> mark per mark point</p> <p>MP1 All correct fields in SELECT  MP2 Correct use of key word FROM  MP3 Correct field in WHERE: Continent  MP4 Correct criterion in WHERE: "Asia" // 'Asia'</p> <p><b>Correct code:</b></p> <pre>SELECT Name, Country, Population FROM CapitalCity WHERE Continent = "Asia"; // 'Asia';</pre>	4										

Question	Answer	Marks
10	Due to an issue with this question, the question has been removed from the question paper.	<b>15</b>