MODULE M PROGRAMMING · M14

Nested selection and nested loops: mark scheme

22 marks · Cambridge 0478 syllabus 8.1.5 (nested statements: nested selection and iteration), 8.2 (2D arrays, nested iteration), 7.7 (trace tables), 7.8 (identify and correct errors), 7.9 (write algorithms), 7.5 (validation)

How to use. One mark per creditworthy point up to the maximum shown. **/** separates alternative words; **//** separates alternative answers. Words in (brackets) are not needed for the mark. Algorithm answers must be in pseudocode; marks are for the features listed, not for one exact algorithm. Ignore minor slips in case and spacing. Accept `<-` or `=` for assignment. Do not accept English ("is more than") or maths symbols (≥, ≤, ≠) in place of operators. Credit any other valid answer that shows the same understanding.

<table>
<tr><th>QUESTION</th><th>ANSWER</th><th>MARKS</th><th>GUIDANCE</th></tr>
<tr><td>1(a)
0478 8.1.5</td><td>One mark for each correct row:
• P: No nesting
• Q: Nested selection
• R: Nested iteration</td><td>3</td><td>More than one tick in a row: 0 for that row. Algorithm P has two IF statements one after the other, not one inside the other.</td></tr>
<tr><td>2(a)
0478 7.7, 8.1.5, 8.2</td><td>One mark for each correct column:
• <code>Row</code>: 1, 2
• <code>Col</code>: 1, 2, 3, 1, 2, 3
• <code>Count</code>: 0, 1, 2, 0, 1
• OUTPUT: 2, 1
Example completed table:
<table>
<tr><th>ROW</th><th>COL</th><th>COUNT</th><th>OUTPUT</th></tr>
<tr><td>1</td><td></td><td>0</td><td></td></tr>
<tr><td></td><td>1</td><td>1</td><td></td></tr>
<tr><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td>3</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td></td><td>2</td></tr>
<tr><td>2</td><td></td><td>0</td><td></td></tr>
<tr><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td>2</td><td>1</td><td></td></tr>
<tr><td></td><td>3</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>1</td></tr>
</table></td><td>4</td><td>Values must be in the correct order. Values may be repeated on later rows. <code>Count</code> must show the reset to 0 for row 2. The OUTPUT column must show 2 then 1 only, with no quotation marks needed. Do not penalise a final <code>Col</code> of 4 or <code>Row</code> of 3. Working: row 1 has 12 and 15 above 10; row 2 has only 11 above 10.</td></tr>
</table>

QUESTION	ANSWER	MARKS	GUIDANCE
3(a) 0478 8.1.5	One mark for each correct row: • 15, 3: Heating on • 15, 0: Low heat • 18, 2: Heating off	**3**	Ignore quotation marks. Row 3: 18 < 18 is FALSE, so the ELSE on line 11 runs.
3(b) 0478 8.1.5	Any **one** from: • the condition on line 03 is FALSE (21 is not less than 18) so the ELSE branch / line 12 is executed instead • line 05 is nested inside the THEN branch of the IF on line 03 // the inner IF is only checked when the outer condition is TRUE	**1**	"Because it is warm / over 18" alone = 0 unless linked to the line 03 condition being FALSE or the inner IF being skipped.
4(a) 0478 7.8, 8.1.5, 8.2	One mark for each line identified, one mark for each matching correction: • Line 06 • `NotDone ← NotDone + 1` • Line 08 • `NEXT Room`	**4**	The correction mark needs the right line number. Line 08: the inner loop must be closed with its own identifier. Do not accept changing line 10 (it correctly closes the outer loop), line 02 or line 04. Do not accept moving line 02 outside the outer loop (the count must restart for each floor).
4(b) 0478 8.1.5	60	**1**	5 floors × 12 rooms = 60. Accept "5 × 12".

QUESTION	ANSWER	MARKS	GUIDANCE

5(a)
0478 7.9, 8.1.5, 7.5
	One mark per bullet point. Max 6:
	• counter initialised to 0 before the loop
	• count-controlled loop that runs 7 times, e.g. `FOR Day ← 1 TO 7` … `NEXT Day` // any loop that runs exactly 7 times
	• `INPUT` of the reading inside a condition-controlled loop (`REPEAT ... UNTIL` // `WHILE ... ENDWHILE`) that is nested inside the 7-day loop
	• correct validation condition: accepts 0 to 200 inclusive and repeats the input for any other value
	• `IF Rain > 25 THEN Count ← Count + 1` inside the 7-day loop, after the reading has been validated
	• `OUTPUT` of the count with a message, after the 7-day loop
	Example:
	`Count ← 0`
	`FOR Day ← 1 TO 7`
	`  REPEAT`
	`  OUTPUT "Enter rainfall in mm for day ", Day`
	`  INPUT Rain`
	`  IF (Rain < 0) OR (Rain > 200) THEN`
	`  OUTPUT "Invalid: enter 0 to 200"`
	`  ENDIF`
	`  UNTIL (Rain >= 0) AND (Rain <= 200)`
	`  IF Rain > 25 THEN`
	`  Count ← Count + 1`
	`  ENDIF`
	`NEXT Day`
	`OUTPUT "Days with more than 25 mm: ", Count`
		6	Accept any sensible identifiers. An error message is not required. Validation with a single IF (only one re-entry) does not get the third or fourth mark. A WHILE loop with an INPUT before it and another INPUT inside it is acceptable. Boundary errors (`> 0`, `< 200`) lose the fourth mark; `Rain >= 25` loses the fifth mark. A counter reset inside the loop, or output inside the loop, loses that mark. Program code (e.g. Python) in place of pseudocode: 0.

Total: 22 marks