MODULE K ALGORITHM DESIGN · K8

Trace tables and dry runs: mark scheme

21 marks · OCR J277 spec 2.1.2: trace tables; create and use trace tables to follow an algorithm; identify syntax/logic errors in code and suggest fixes

How to use. 1 mark per bullet up to the maximum shown. **/** separates alternative answers. Words in (brackets) are not needed for the mark. **Trace tables:** 1 mark for each correct sequence of values in a column, in the right order. A value may be repeated on later rows (do not penalise). Rows may be laid out differently from the example, as long as the order of changes in each column is right. Outputs are written without `print` and without quotation marks; a blank cell means no output, but a cell holding a mark such as "-" or "x" in the Output column may be read as an output. 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)
J277 2.1.2</td><td>To follow an algorithm (step by step) / to record the values of the variables (and outputs) as the algorithm runs
To check an algorithm works / gives the expected output / to find (logic) errors in an algorithm
To work out what an algorithm does / its purpose</td><td>1</td><td>Any 1 bullet. Accept "to test / check the algorithm (by hand)". Do not accept "to store data" / "to make the program run faster".</td></tr>
<tr><td>1(b)
J277 2.1.2</td><td>Logic (error)</td><td>1</td><td>Do not accept syntax error / runtime error.</td></tr>
<tr><td>2(a)
J277 2.1.2</td><td>height: 0, 30, 75, 95, 110
boxes: 0, 1, 2, 3, 4
boxSize: 30, 45, 20, 15 (and no 40)
Output: 4, once, in the last row (after all the other values)
<table><tr><th>height</th><th>boxes</th><th>boxSize</th><th>Output</th></tr><tr><td>0</td><td>0</td><td></td><td></td></tr><tr><td>30</td><td>1</td><td>30</td><td></td></tr><tr><td>75</td><td>2</td><td>45</td><td></td></tr><tr><td>95</td><td>3</td><td>20</td><td></td></tr><tr><td>110</td><td>4</td><td>15</td><td></td></tr><tr><td></td><td></td><td></td><td>4</td></tr></table></td><td>4</td><td>1 mark per correct column. The loop ends because 110 is not less than 100, so the fifth input (40) is never read: boxSize containing 40 = 0 for the boxSize column, and height or boxes carried on past 110 / 4 = 0 for that column. Output given as anything other than 4 (e.g. 110) = 0 for Output.</td></tr>
</table>

<table>
<tr><th>QUESTION</th><th>ANSWER</th><th>MARKS</th><th>GUIDANCE</th></tr>
<tr><td>3(a)
J277 2.1.2</td><td>i: 1, 2, 3, 4
highest: 12, 17, 21 (only)
day: 0, 1, 3 (only)
Output: Day 3: 21
<table><tr><th>i</th><th>highest</th><th>day</th><th>Output</th></tr><tr><td></td><td>12</td><td>0</td><td></td></tr><tr><td>1</td><td>17</td><td>1</td><td></td></tr><tr><td>2</td><td></td><td></td><td></td></tr><tr><td>3</td><td>21</td><td>3</td><td></td></tr><tr><td>4</td><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td><td>Day 3: 21</td></tr></table></td><td>4</td><td>1 mark per correct column. highest and day must not change when i is 2 (9) or 4 (15); repeating the current value (17 / 1 at i = 2; 21 / 3 at i = 4) is fine. A 9 or 15 in highest = 0 for that column. Output: allow small spacing/punctuation slips (e.g. Day 3 21); do not accept 21 alone or Day 4: 21.</td></tr>
<tr><td>3(b)
J277 2.1.2</td><td>Finds the highest / largest / maximum temperature (in the array)
Finds / outputs the position / index / day number of the highest temperature
Outputs the highest temperature (with its position)</td><td>2</td><td>1 mark per bullet, max 2. A line-by-line description with no overall result (e.g. “it loops from 1 to 4 and compares”) = max 1. Do not accept “sorts the temperatures” / “finds the hottest day of the year”.</td></tr>
<tr><td>4(a)
J277 2.1.2</td><td>count: 1, 2, 3, 4 and reading: 8, 6, 10, 4
total: 0, 8, 6, 10, 4
average: 1 / 1.0 and Output: 1 / 1.0 (after the loop)
<table><tr><th>count</th><th>reading</th><th>total</th><th>average</th><th>Output</th></tr><tr><td></td><td></td><td>0</td><td></td><td></td></tr><tr><td>1</td><td>8</td><td>8</td><td></td><td></td></tr><tr><td>2</td><td>6</td><td>6</td><td></td><td></td></tr><tr><td>3</td><td>10</td><td>10</td><td></td><td></td></tr><tr><td>4</td><td>4</td><td>4</td><td></td><td></td></tr><tr><td></td><td></td><td></td><td>1.0</td><td>1.0</td></tr></table></td><td>3</td><td>1 mark per bullet. The trace must follow the code as written: a total column of 0, 8, 14, 24, 28 (the corrected algorithm) = 0 for total, and an average / Output of 7 = 0 for the third mark. FT: average and Output correct for the candidate’s final total ÷ 4.</td></tr>
<tr><td>4(b)
J277 2.1.2</td><td>Line 04
<code>total = total + reading</code></td><td>2</td><td>1 mark for the line number, 1 for the refined line. Accept <code>total += reading</code> / <code>total = reading + total</code>. Accept the refined line with no line number given. Do not accept an English description alone (“add reading to total”). Do not accept <code>total =+ reading</code>.</td></tr>
</table>

<table>
<tr><th>QUESTION</th><th>ANSWER</th><th>MARKS</th><th>GUIDANCE</th></tr>
<tr>
<td>5(a)
J277 2.1.2</td>
<td>Column headings: one for each variable (n, steps) and one for Output
n: 13, 6, 3, 1
steps: 0, 1, 2, 3
Output: 3, once, after the other values
<table>
<tr><th>n</th><th>steps</th><th>Output</th></tr>
<tr><td>13</td><td>0</td><td></td></tr>
<tr><td>6</td><td>1</td><td></td></tr>
<tr><td>3</td><td>2</td><td></td></tr>
<tr><td>1</td><td>3</td><td></td></tr>
<tr><td></td><td></td><td>3</td></tr>
</table>
</td>
<td>4</td>
<td>1 mark per bullet. Allow an extra Line number column (not marked) and the fourth column left blank.
Headings: variable names must match the code; allow “print” for Output. n uses integer division (13 DIV 2 = 6): 6.5 / 3.25 / 1.625 = 0 for n. Do not award the n or steps mark if the column carries on after n reaches 1.
Award the n, steps and Output marks for correct values even if headings are missing or wrong, provided it is clear which variable each column traces.</td>
</tr>
</table>

Total: 21 marks