MODULE K ALGORITHM DESIGN · K6

Flowcharts: mark scheme

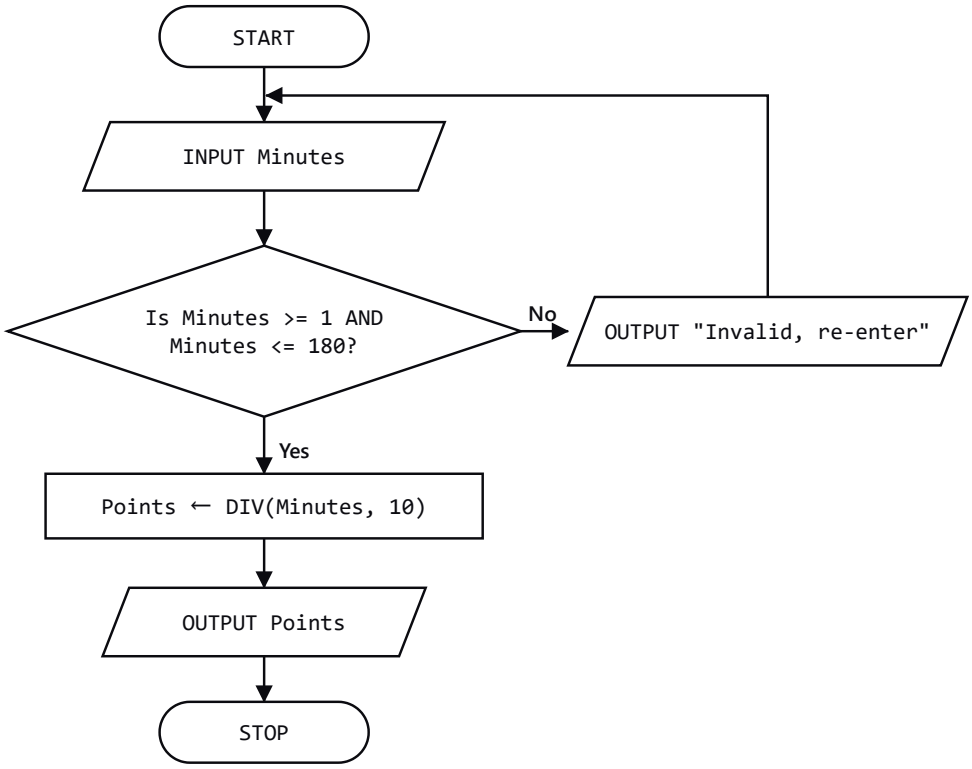
22 marks · Cambridge 0478 syllabus 7.3 (purpose of an algorithm), 7.7 (trace tables), 7.8 (identify and correct errors), 7.9 (write and amend algorithms using flowcharts) and section 4 (flowchart symbols)

How to use. One mark per bullet point up to the max shown. **//** separates alternative answers; **/** separates alternative words. Words in (brackets) are not needed for the mark. Credit any other valid answer that shows the same understanding. Conditions must be written precisely (e.g. `Minutes > 180`, not "Minutes is more than 180").

<table>
<tr><th>QUESTION</th><th>ANSWER</th><th>MARKS</th><th>GUIDANCE</th></tr>
<tr><td>1(a)
0478 section 4</td><td>Decision (diamond) → question with two possible outcomes, such as Yes or No
Terminator (rounded rectangle) → where the algorithm starts or stops
Subroutine (rectangle with double sides) → call to a separate flowchart that is not joined to this one
Input/Output (parallelogram) → data going into, or coming out of, the algorithm</td><td>4</td><td>One mark for each correct line. More than one line from a symbol scores 0 for that symbol. The description "something being performed or done" (process) is not used.</td></tr>
<tr><td>2(a)
0478 7.7</td><td>Count: 0, 1, 2, 3, 4, 5
Cars: 38, 45, 22, 45, 41
Busy: 0, 1, 2, 3
Largest: 0, 38, 45
OUTPUT: 3, 45
<table><tr><th>COUNT</th><th>CARS</th><th>BUSY</th><th>LARGEST</th><th>OUTPUT</th></tr><tr><td>0</td><td></td><td>0</td><td>0</td><td></td></tr><tr><td></td><td>38</td><td></td><td>38</td><td></td></tr><tr><td>1</td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>45</td><td>1</td><td>45</td><td></td></tr><tr><td>2</td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>22</td><td></td><td></td><td></td></tr><tr><td>3</td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>45</td><td>2</td><td></td><td></td></tr><tr><td>4</td><td></td><td></td><td></td><td></td></tr><tr><td></td><td>41</td><td>3</td><td></td><td></td></tr><tr><td>5</td><td></td><td></td><td></td><td>3</td></tr><tr><td></td><td></td><td></td><td></td><td>45</td></tr></table></td><td>5</td><td>One mark per correct column (values in the correct order). Values may sit on different rows from those shown. Largest must not change for the second 45. OUTPUT: 3 then 45, with no other values.</td></tr>
</table>

QUESTION	ANSWER	MARKS	GUIDANCE
2(b) 0478 7.3	Any two from: inputs the number of cars for each of five crossings counts the number of crossings with more than 40 cars // counts the busy crossings finds the largest number of cars carried on a crossing outputs the number of busy crossings and the largest number of cars	**2**	max 2. Do not accept "counts the cars" alone or "finds the total". Do not accept "40 or more" (the check is more than 40).
3(a) 0478 7.9 (totalling 7.4)	One mark per bullet: set a total to zero before the loop, e.g. add `Total ← 0` to the first process box // before `INPUT Cars` add a process box inside the loop, after `INPUT Cars`, with `Total ← Total + Cars` add an output box after the loop, e.g. `OUTPUT Total` on the Yes branch of `Is Count = 5?` (before STOP)	**3**	Any sensible variable name. The first mark is not given if the total is set to zero inside the loop. The second mark needs the addition to be inside the loop. Accept the changes described in words if the position is clear.
4(a) 0478 7.8	One mark for each error identified **and** corrected: `INPUT Speed` is in a process symbol // rectangle → use an input/output symbol // parallelogram `Is Speed < 30?` outputs "Slow down" for slow vehicles → `Is Speed > 30?` // `Is Speed <= 30?` with the Yes/No labels swapped the No flow line from `Is Count = 10?` goes back above `Count ← 0`, so Count is reset each time and the loop never ends → the flow line should go back to `INPUT Speed` // between `Count ← 0` and `INPUT Speed`	**3**	Errors may be given in any order. Do not accept `Is Speed >= 30?` (30 is not over 30). For the third error accept "Count ← 0 is inside the loop" with a correction that moves the loop-back point below it.
5(a) 0478 7.9, section 4 (range check 7.5(a))	One mark per bullet point, max 5: START and STOP terminators used `INPUT Minutes` in an input/output symbol decision symbol checking both limits, e.g. `Is Minutes >= 1 AND Minutes <= 180?` // two decisions // `Is Minutes < 1 OR Minutes > 180?` with Yes/No to match ...if invalid, an error message is output (input/output symbol) and a flow line goes back to the input `Points ← DIV(Minutes, 10)` in a process symbol `OUTPUT Points` in an input/output symbol, after the calculation, before STOP all flow lines have arrows and both decision outcomes are labelled Yes/No (or True/False) *An example answer is drawn below the table.*	**5**	Accept `Minutes DIV 10`. Do not accept `Minutes / 10` (not integer division) or ROUND. Do not award the decision mark for a condition written in words (e.g. "Is it between 1 and 180?") or if only one limit is checked. Accept `Minutes > 0` for the lower limit. Non-standard symbols lose the mark for that box only.

Example answer for 5(a)



Total: 22 marks