MODULE K ALGORITHM DESIGN · K7

Turning a problem into an algorithm: mark scheme

21 marks · OCR J277 spec 2.1.2: identify the inputs, processes and outputs for a problem; create, complete and refine algorithms using pseudocode, flowcharts, Exam Reference Language or a high-level language (sequence, selection, iteration)

How to use. 1 mark per bullet up to the maximum shown. **/** separates alternative answers. Words in (brackets) are not needed for the mark. Allow any logically valid method in the algorithm questions. Minor syntax slips are not penalised; a repeated slip (e.g. spaces in an identifier, == used for assignment) is penalised once, then follow through. Do not accept maths symbols such as ×, ≥ or ≤ in code answers. Example answers are one possible response, not the only one.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) J277 2.1.2	**Input:** the number of pages printed (today) **Process:** any one from: check whether more than 30 pages were printed / subtract 30 from the number of pages / multiply the extra pages by 15 / work out the charge **Output:** the charge (in pence)	**3**	1 mark per row. Credit any other valid process. Do not accept "the charge" as an input, or "the number of pages" as an output. Do not accept "printing" / "the printer prints the pages" as the process.
1(b) J277 2.1.2	Multiply the extra pages by 15: **Sequence** Charge nothing if 30 pages or fewer: **Selection** Keep asking until 1 to 500 is entered: **Iteration**	**3**	1 mark per correct row. A row with more than one tick scores 0.

2 J277 2.1.2	1 mark each:
	Input (and store) the number of pages
	Attempt at selection that checks the number of pages
	... with the correct boundary: more than 30 (e.g. `pages > 30` / `pages >= 31` / `pages >= 30` / `pages <= 30` with the branches the other way round)
	Charge worked out as (pages − 30) multiplied by 15 when more than 30 pages are printed
	Charge is 0 when 30 or fewer pages are printed, **and** the charge is output in both cases
	Example answer (ERL):
	`pages = int(input("Pages printed today"))`
	`charge = 0`
	`if pages > 30 then`
	`  charge = (pages - 30) * 15`
	`endif`
	`print(charge)`
		5	Max 5. Accept a flowchart, pseudocode, ERL or any high-level language. In a flowchart, the decision must be a diamond with both exits labelled (Yes/No or True/False). Accept `pages * 15 - 450` for the calculation. Allow charge set to 0 at the start instead of in an else branch. Do not give the boundary mark for `pages > 31` / `pages >= 32`. Allow `pages >= 30` / `pages > 29`, because the calculation gives a charge of 0 at 30 pages. Do not accept a calculation written in English ("times the extra pages by the price") without the values.

QUESTION	ANSWER	MARKS	GUIDANCE

3(a)
J277 2.1.2
	1 mark each to max 3:
	Input of the number of pages
	A loop that repeats while the value is invalid / until the value is valid
	… with a correct condition that checks both limits (e.g. `pages < 1 OR pages > 500` to repeat / `pages >= 1 AND pages <= 500` to stop)
	The number of pages is input again inside the loop
	Example answer (ERL):
	`pages = int(input("Pages printed today"))`
	`while pages < 1 OR pages > 500`
	`  pages = int(input("Enter a number from 1 to 500"))`
	`endwhile`
	or
	`do`
	`  pages = int(input("Pages printed today"))`
	`until pages >= 1 AND pages <= 500`
		3	Max 3. A single `if` with no loop (asks again only once): max 1. Do not credit a condition with a missing variable (e.g. `pages < 1 OR > 500`) or AND/OR the wrong way round (e.g. `while pages < 1 AND pages > 500`). Accept `pages <= 0 OR pages >= 501`. In a flowchart, accept a decision with an arrow back to the input.

4(a) J277 2.1.2	Total: a meaningful identifier, e.g. `totalPassengers` / `total`, **and** starting value 0 Count: a meaningful identifier, e.g. `busyCrossings` / `count`, **and** starting value 0	**2**	1 mark per row; both the identifier and the starting value are needed. Do not accept identifiers with spaces, single letters (e.g. x), or reserved words such as `input` / `print`. Accept underscores (`total_passengers`).

QUESTION	ANSWER	MARKS	GUIDANCE

4(b)
J277 2.1.2
	1 mark each to max 5:
	A loop that runs 8 times
	Input of the number of passengers inside the loop
	Number of passengers added to a running total inside the loop
	Selection checking more than 150 passengers (`> 150` / `>= 151`)
	… count increased by 1 only when the condition is true
	Total **and** count both output after (outside) the loop
	Example answer (ERL):
	`totalPassengers = 0`
	`busyCrossings = 0`
	`for crossing = 1 to 8`
	`  passengers = int(input("Passengers on this crossing"))`
	`  totalPassengers = totalPassengers + passengers`
	`  if passengers > 150 then`
	`  busyCrossings = busyCrossings + 1`
	`  endif`
	`next crossing`
	`print("Total passengers: " + str(totalPassengers))`
	`print("Crossings over 150: " + str(busyCrossings))`
		5	Max 5. ERL or a high-level language only: a flowchart, structured English or bullet points score 0. Allow `for crossing = 0 to 7` and Python `range(8)`. Uninitialised total/count can be assumed to start at 0. Do not give the condition mark for `>= 150`. Do not accept `busyCrossings =+ 1`. Total or count reset inside the loop: do not give the running-total / count mark.

Total: 21 marks