MODULE K ALGORITHM DESIGN · K1

Sub-systems, abstraction, decomposition, and inputs, processes, outputs and storage: mark scheme

21 marks · Cambridge 0478 syllabus 7.1 (analysis: abstraction, decomposition of the problem), 7.2(a) (every computer system is made up of sub-systems, which are made up of further sub-systems) and 7.2(b) (how a problem can be decomposed into its component parts: inputs, processes, outputs, storage)

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. Credit any other valid answer that shows the same understanding. In questions 2, 3 and 5, answers must apply to the scenario given.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) 0478 7.2(a)	B (Every computer system is made up of sub-systems, which are made up of further sub-systems)	**1**	More than one box ticked scores 0.
2(a) 0478 7.2(a)	Any two from: Temperature sensing // reading the room temperatures User interface // phone app // owner's settings Timetable // scheduling // timer Radiator control // switching radiators on and off // heating control Comparing room temperature with target temperature // decision making	**2**	max 2. Credit any other sensible sub-system of this heating system. Accept a named hardware or software part with a clear job (e.g. "the sensors that read the temperature"). Do not accept "input" / "output" / "hardware" / "software" alone.
2(b) 0478 7.2(a)	Two further sub-systems that belong to the chosen sub-system, e.g.: **Phone app:** set the target temperature // set the weekly timetable // display the current temperature of each room // log in **Temperature sensing:** read a sensor in each room // convert / send the reading to the controller **Timetable:** store the timetable // check the current day and time against the timetable **Radiator control:** decide if a radiator should be on // send the on / off signal to each radiator	**2**	One mark per valid further sub-system, max 2. Each must be a smaller part of the sub-system chosen. If no sub-system is named, credit answers that are clearly smaller parts of one sub-system from 2(a). Do not credit a repeat of a sub-system already given in 2(a) as a separate sub-system.
3(a) 0478 7.1 (analysis)	Any two from: Removing / discarding / ignoring details (of the problem) that are not relevant // not needed // hiding complexity Keeping // focusing on the key elements // the details needed to solve the problem Simplifying the problem	**2**	max 2. Do not accept "breaking the problem into parts" (decomposition). No mark for repeating that it happens at the analysis stage.

QUESTION	ANSWER	MARKS	GUIDANCE
3(b) 0478 7.1 (analysis)	Any two from: Engine room // machinery // pipes // wiring Crew-only areas // staff rooms Exact sizes / measurements of rooms // decks Furniture // fittings inside rooms Materials // colours of walls / floors The sea // the shape of the hull // the ship's route	**2**	max 2. Credit any other detail a passenger does not need to find their cabin, the café, the toilets or the lifeboat stations. Do not credit cabins, café, toilets, lifeboat stations, deck numbers, stairs / lifts or "you are here".
4(a) 0478 7.2(b)	Number of steps shown on the watch face: Output Heart rate read from a sensor: Input Step totals for the last 30 days: Storage Working out the average heart rate: Process	**4**	One mark per correct row. A row with more than one box ticked scores 0.
5(a) 0478 7.2(b)	**Inputs** (max 2): Membership number // card ID (from scanning the card) Maximum number of people allowed in the pool (entered by the lifeguard) Today's date // the current date and time (from the system clock) **Processes** (max 2): Look up / search for the member's details Check the membership has not expired // compare the expiry date with today's date Check whether the pool is full // compare the number in the pool with the maximum Add 1 to the number of people in the pool **Outputs** (max 2): (Signal to) open the gate Welcome message with the member's name Message saying why the member cannot enter // membership expired // pool full **Storage** (max 2): Members' details // membership numbers, names, expiry dates Date and time of every entry Number of people in the pool Maximum number of people allowed	**8**	One mark per correct entry in the correct row, max 2 per row. An answer in the wrong row scores 0 (e.g. "welcome message" as storage). The same answer written twice scores once. The maximum number of people can be credited as both an input and storage. Accept "scan the card" as an input.

Total: 21 marks