MODULE O ROBUST PROGRAMS · O5

Why we test: testing in the coding and testing stages: mark scheme

20 marks · Cambridge 0478 syllabus (exams 2026-2028) 7.1 (program development life cycle: coding = writing program code and iterative testing; testing = testing program code with the use of test data), 7.6 (suggest and apply suitable test data: normal, abnormal, extreme, boundary), 7.8 (identify errors in given algorithms and suggest ways of correcting these errors)

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. Use the syllabus stage names (analysis, design, coding, testing); "final testing" or "terminal testing" used to mean the testing stage may be credited where the description is correct.

QUESTION	ANSWER	MARKS	GUIDANCE
1(a) 0478 7.1	One mark for each correct row: Cost module tested on its own as soon as it is written: Coding Complete program run with normal, abnormal, extreme and boundary data: Testing Error corrected in the receipt module and the module tested again: Coding Complete program checked against all the requirements: Testing	**4**	A row with both boxes ticked scores 0.
2(a) 0478 7.1	Iterative (testing)	**1**	Do not credit "unit testing", "module testing" or "dry run": the syllabus term is required.
3(a) 0478 7.1, 7.6	One mark for each: Test 2: 15 Test 3: 21	**2**	Accept $15 // 15.00 and $21 // 21.00. The expected result comes from the company's charges, not from the code: do not credit 20 for Test 2.
3(b) 0478 7.1	Test 2 // the test with 5 hours	**1**	Mark on its own: no follow through from 3(a). More than one test named scores 0.

QUESTION	ANSWER	MARKS	GUIDANCE
3(c) 0478 7.8	One mark for each: Line 03 `IF Hours >= 5` // `IF Hours > 4`	**2**	The two marks are independent. Accept the correction written in words only if it is precise, e.g. "change > to >=" // "change 5 to 4". Accept `IF 5 <= Hours`. Do not credit `IF Hours = 5`, "=>", "≥" or a change to line 05 or 07.
3(d) 0478 7.1	Tests the function / module again // runs the (three) tests again (to check that the error has been corrected / no new error has been made)	**1**	Do not credit "moves on to the testing stage" or "writes the next module" alone: the module must be tested again first.
4(a) 0478 7.6, 7.1	One mark for each correct row (value **and** accept/reject both correct): Normal: any whole number from 1 to 8, e.g. 3 // Accept Extreme: 1 // 8 // Accept Abnormal: any value that is not a whole number from 1 to 8, e.g. 0 // 9 // −2 // 15 // 2.5 // "six" // Reject	**3**	A row with only one of the two cells correct scores 0 for that row. Normal: values 2 to 7 are the best answers; also accept 1 or 8 (they should be accepted). Extreme: only 1 or 8. Do not credit 0 or 9 as extreme data (they are rejected values). Abnormal: credit any value that should be rejected, including 0 or 9.
4(b) 0478 7.1	Any two from: Compares the actual result / outcome of each test with the expected result / outcome If they are the same, the test is passed // the program works as expected for that data If they are different / a test fails, the error is found and corrected (in the program code) ... and the test(s) are run again Records the results (to show the program meets the requirements)	**2**	max 2. Do not credit "checks it works" or "looks at the results" alone.

QUESTION	ANSWER	MARKS	GUIDANCE
5(a) 0478 7.1	Any four from: **Coding stage** Testing is carried out while the program code is being written Each module is tested separately / on its own (e.g. the cost module / `HireCost` function) Errors found are corrected and the module is tested again (iterative testing) **Testing stage** Testing is carried out when the program is complete / after coding has finished The complete / whole program is tested // all the modules are tested together (e.g. hours check, cost and receipt modules working together) Uses (a set of) test data // normal, abnormal, extreme and boundary data (e.g. 0, 1, 4, 8 and 9 hours) Checks that the program meets (all) the requirements (from the analysis stage)	**4**	max 4. Max 3 if only one stage is described. Max 3 if the answer makes no reference to the bike-hire program. Credit a correct example in context once per stage. Do not credit "checks for errors" alone, which is true of both stages.

Total: 20 marks