Grade 12 A/L ICT · Lesson 7

7.8 Developing and Testing the System

Syllabus 7.8. After design, programmers do **program development** and **database development**. The system is then **tested** with planned **test cases**, using **white box** and **black box** testing at four levels: **unit, integration, system and acceptance** testing.

1. Development

Program development codes each module from the EPDs and UI designs. **Database development** creates tables, keys, indexes and validation rules from the data dictionary.

2. Test cases

A **test case** states the input, the **expected output** and later the actual result. Good test data includes **normal**, **boundary** (extreme) and **erroneous** values.

Function under test

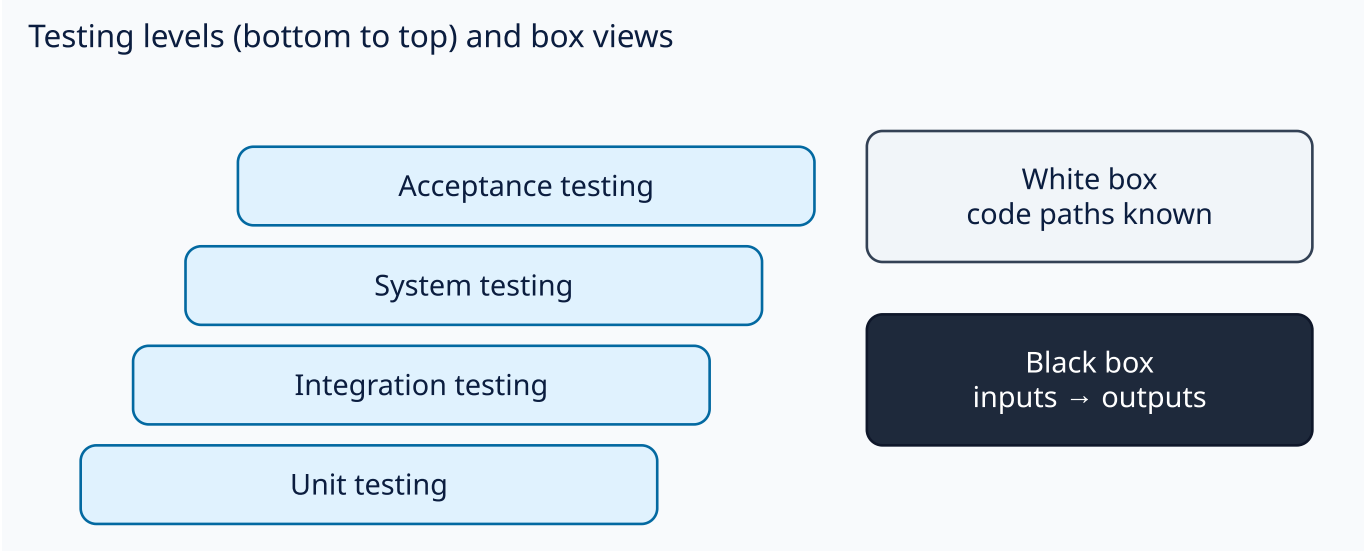
```
FUNCTION grade(m)
  IF m < 0 OR m > 100 THEN RETURN "Invalid"
  IF m >= 75 THEN RETURN "A"
  IF m >= 65 THEN RETURN "B"
  IF m >= 50 THEN RETURN "C"
  IF m >= 35 THEN RETURN "S"
  RETURN "W"
END FUNCTION
```

Test	Mark input	Class	Expected output
1	−1	Invalid	Invalid
2	0	Valid	W
3	1	Valid	W
4	99	Valid	A
5	100	Valid	A
6	101	Invalid	Invalid

🧱 **Worked example: Design boundary value tests for a mark field that accepts 0–100.** Test just below, on and just above each limit: **−1, 0, 1, 99, 100, 101**. 4 are valid and 2 (−1, 101) must be rejected. For **white box** coverage of grade(), one test per branch needs **6 tests** (Invalid, A, B, C, S, W).

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3. Testing methods and levels



Testing levels

White box
Tester knows the code; tests paths, loops and conditions.

Black box
Tester checks inputs vs expected outputs without seeing code.

Unit → Integration
Test each module, then modules working together.

System → Acceptance
Test the whole system, then users confirm it meets requirements.

💡 Developers do unit tests; the client does acceptance tests.

🚀 **Beyond the syllabus (2026 update)** *Not required for the exam – read for interest.* Automated test pipelines in 2026 run thousands of unit tests every time code is changed.

Key Words

Program development – Writing code for each module.

Database development – Creating tables, keys and rules.

Test case – Input with expected output for a test.

White box testing – Testing with knowledge of internal code.

Black box testing – Testing inputs and outputs without seeing code.

Unit testing – Testing one module alone.

Integration testing – Testing modules working together.

System testing – Testing the complete system against the specification.

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Acceptance testing – Users confirm the system meets their needs.

Boundary value – Value on or next to a valid limit.

Erroneous data – Invalid data that should be rejected.

Expected output – Result the system should produce.

Sample Q&A

1. What is a test case?

> **Answer:** A planned input with its expected output (and actual result).

2. White box vs black box?

> **Answer:** White box uses the code structure; black box only inputs and outputs.

3. List the four test levels.

> **Answer:** Unit, integration, system, acceptance.

4. Boundary tests for 0–100?

> **Answer:** −1, 0, 1, 99, 100, 101.

5. Who does acceptance testing?

> **Answer:** The client / end users.

6. Why integration testing?

> **Answer:** Modules that work alone may fail when passing data to each other.

MCQ

1. Testing with full knowledge of the code is

A. acceptance testing
B. black box testing
C. pilot testing
D. white box testing
E. direct testing

2. Checking outputs for given inputs without code is

A. black box testing
B. white box testing
C. unit coding
D. gap analysis
E. data migration

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3. Testing a single module alone is

A. parallel running
B. system testing
C. acceptance testing
D. unit testing
E. integration testing

4. Users confirming the system meets needs is

A. white box testing
B. unit testing
C. integration testing
D. BSO
E. acceptance testing

5. For a 0–100 field, which value is erroneous?

A. 0
B. 99
C. 1
D. 100
E. 101

6. Boundary value tests for 0–100 use

A. 50 only
B. −50, 150
C. 10, 20, 30
D. −1, 0, 1, 99, 100, 101
E. 0 and 100 only

7. grade(70) returns

A. A
B. B
C. C
D. S
E. Invalid

8. Branch coverage of grade() needs at least

A. 4 tests
B. 10 tests
C. 12 tests
D. 6 tests
E. 1 test

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9. Which term means: “Writing code for each module”?

A. Erroneous data
B. Unit testing
C. Program development
D. Test case
E. System testing

10. Which term means: “Creating tables, keys and rules”?

A. Integration testing
B. Database development
C. Acceptance testing
D. White box testing
E. Expected output

11. Which term means: “Input with expected output for a test”?

A. Program development
B. Black box testing
C. Test case
D. System testing
E. Boundary value

12. Which term means: “Testing with knowledge of internal code”?

A. White box testing
B. Unit testing
C. Erroneous data
D. Database development
E. Acceptance testing

13. Which term means: “Testing inputs and outputs without seeing code”?

A. Boundary value
B. Black box testing
C. Expected output
D. Test case
E. Integration testing

14. Which term means: “Testing one module alone”?

A. Unit testing
B. Program development
C. White box testing
D. System testing
E. Erroneous data

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15. Which term means: “Testing modules working together”?

A. Database development
B. Acceptance testing
C. Integration testing
D. Expected output
E. Black box testing

16. Which term means: “Testing the complete system against the specification”?

A. Program development
B. Boundary value
C. Unit testing
D. Test case
E. System testing

17. Which term means: “Users confirm the system meets their needs”?

A. Database development
B. Integration testing
C. Acceptance testing
D. White box testing
E. Erroneous data

18. Which term means: “Value on or next to a valid limit”?

A. Black box testing
B. Boundary value
C. Test case
D. System testing
E. Expected output

19. Which term means: “Invalid data that should be rejected”?

A. Erroneous data
B. White box testing
C. Unit testing
D. Acceptance testing
E. Program development

20. Which term means: “Result the system should produce”?

A. Database development
B. Boundary value
C. Integration testing
D. Black box testing
E. Expected output

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Structured Questions

1. Distinguish program and database development. *(2 marks)*

> Program: coding modules; database: tables, keys, indexes, validation.

2. Explain white and black box testing. *(2 marks)*

> White: internal paths; black: input/output vs specification.

3. Describe the four testing levels in order. *(4 marks)*

> Unit; integration; system; acceptance by users.

4. Design boundary test data for marks 0–100. *(3 marks)*

> −1, 0, 1, 99, 100, 101; valid 4; invalid −1, 101.

5. Write a test case table entry for grade(55). *(4 marks)*

> Input 55; normal data; expected C; record actual result.

Summary

- Develop programs and database from the design.
- Test cases give input and expected output.
- White box = code; black box = behaviour.
- Unit → integration → system → acceptance.
- Use normal, boundary and erroneous data.

MCQ answer key – 7.8

1. **D** – White box.
2. **A** – Black box.
3. **D** – Unit.
4. **E** – Acceptance.
5. **E** – Above limit.
6. **D** – Below/on/above.
7. **B** – 70 ≥ 65.
8. **D** – One per branch.
9. **C** – Program development – Writing code for each module.
10. **B** – Database development – Creating tables, keys and rules.
11. **C** – Test case – Input with expected output for a test.
12. **A** – White box testing – Testing with knowledge of internal code.
13. **B** – Black box testing – Testing inputs and outputs without seeing code.
14. **A** – Unit testing – Testing one module alone.
15. **C** – Integration testing – Testing modules working together.

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16. **E** – System testing – Testing the complete system against the specification.
17. **C** – Acceptance testing – Users confirm the system meets their needs.
18. **B** – Boundary value – Value on or next to a valid limit.
19. **A** – Erroneous data – Invalid data that should be rejected.
20. **E** – Expected output – Result the system should produce.

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