

Software Testing (1DL610) Final Examination

HT23 Period 2

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General Instructions:

- Read these instructions in full before you start looking at the questions.
- You have up to 5 hours.
- The final exam consists of two parts:

Part I: The first part has 20 Multiple Choice questions with only one correct answer among the choices. These questions are worth 1 point each, for a total of 20 points.

Part II: The second part has Multiple Answer questions where any subset of answers may be correct. These questions are worth 2 points each, for a total of 40 points. If you mark ALL of the correct options and NONE of the wrong options, you get 2 points, otherwise you get 0 points.

There is no negative marking for either part for incorrect answers. Maximum marks you can score are 60.

- Suppose you score M marks in total in this exam. Your grade (assuming you pass the assignments and TDD lab) will be determined as follows:
 $0 \leq M \leq 29$ is grade U
 $30 \leq M \leq 39$ is grade 3
 $40 \leq M \leq 50$ is grade 4
 $51 \leq M \leq 60$ is grade 5
- Ensure that your question paper contains all 40 questions as well as the **answer sheet** which is given at the end.
- Mark your answers on the answer sheet with a \times over the correct answer (for multiple choice) or over each of the correct answers (for multiple answer). We recommend that you transfer the answers to the answer sheet **just before you are ready to submit and leave**. Any uncrossing, recrossing or other modification on the answer sheet after entering the answer for a question will automatically get you a 0 for that question.
- **Turn in only the answer sheet (along with the Front Sheet For Exams), you can keep the questions section.**

Part I. MULTIPLE CHOICE QUESTIONS (EXACTLY ONE OPTION IS CORRECT. WORTH 1 POINT EACH).

1. Which of the following is a part of validation?
 - A. Unit testing
 - B. Integration testing
 - C. System testing
 - D. Acceptance testing
2. Which of the following inputs leads to a failure of the program below?

```
#function which checks if a number is prime
def is_prime(n):
    if n <= 1:
        return False
    if n==2:
        return True
    sqrt_n =int(math.sqrt(n))
    for i in range(2,sqrt_n):
        if n%i==0:
            return False
    return True
```

 - A. 16
 - B. 20
 - C. 25
 - D. 36
3. Which of the following is true?
 - A. Verification checks whether we are building the right product.
 - B. Alpha testing is a form of validation.
 - C. The V model is primarily focused on validation.
 - D. Unit testing is a form of validation.
4. Which of the following is true of unit testing?
 - A. While unit testing, local variables need to be considered as input.
 - B. Unit testing of all functions ensures that the program as a whole works properly.
 - C. External files which are read by a function need not be considered while unit testing that function.
 - D. A dummy program that is used to replace an external function that needs to be called is termed a stub.
5. Which of the following, has as its main purpose, the setting up of preconditions for a test?
 - A. Test fixture
 - B. Test runner
 - C. Test suite
 - D. Test value
6. The actual running of the test is called
 - A. Arrange
 - B. Act
 - C. Assert

- D. Cleanup
7. Agile development came into being because
 - A. the cost-of-change was increasing rapidly.
 - B. the traditional assumptions about software development were no longer valid.
 - C. the military wanted a new way of doing things to accommodate their needs.
 - D. it was better suited for complex modelling situations.
 8. In an Input Domain Model, if there are 2 characteristics with 3 blocks each, then the total number of subblocks is
 - A. 6
 - B. 8
 - C. 9
 - D. 5
 9. Suppose there are 4 characteristics C_1 , C_2 , C_3 and C_4 which have 3, 4, 5 and 6 blocks respectively. Then under Base Choice Coverage the number of tests will be
 - A. 13
 - B. 15
 - C. 17
 - D. 19
 10. Which statement is true about a basic block of a Control Flow Graph?
 - A. It is a less efficient way to draw the CFG as compared to assigning nodes to each individual line.
 - B. It encompasses a sequence of statements which contains both an if and the corresponding else condition.
 - C. It corresponds to the sequence of statements which are between the call and return of an external function.
 - D. It has only a single entry point and a single exit point.
 11. In the context of Input Domain Modelling, when we have characteristics C_1 and C_2 on the same input space, the occurrence of invalid combinations means
 - A. there exist block B_1 of characteristic C_1 and block B_2 of characteristic C_2 which are exactly the same.
 - B. there exist block B_1 of characteristic C_1 and block B_2 of characteristic C_2 which have an empty intersection.
 - C. the total union of all blocks of both characteristics is not complete.
 - D. the total intersection of all blocks of both characteristics is not empty.
 12. The expressions $e_1 = \neg(A \wedge B)$ and $e_2 = \neg A \wedge \neg B$ are related in the following way:
 - A. e_1 implies e_2 but not the other way around.
 - B. e_2 implies e_1 but not the other way around.
 - C. Neither implies the other.
 - D. They are equivalent.
 13. The number of tests required in the Combinatorial Coverage of the expression $(A \wedge (x = 1)) \vee \neg A$ is
 - A. 3
 - B. 4
 - C. 8
 - D. 9

14. The primary reason for employing Active Clause Coverage is that
 - A. we would like to know when a clause is responsible for changing the value of the predicate.
 - B. we would like to focus on the clauses which are important from a programming perspective.
 - C. a clause which is active is unaffected by Clause Coverage.
 - D. a clause which is active is unaffected by Predicate Coverage.
15. In the case of top-down integration the driver is
 - A. created separately for each level.
 - B. the component just above the current component being tested.
 - C. any component that calls a function within in the scope of the component being tested.
 - D. the main program.
16. The number of stubs required for breadth-first top-down integration as compared to depth-first top-down integration is
 - A. less for breadth-first as compared to depth-first
 - B. the same for both
 - C. more for breadth-first as compared to depth-first
 - D. less for breadth-first, but only in the case where the control flow forms a complete binary tree.
17. Which of the following is true of configuration testing as a part of system testing?
 - A. It is primarily done during the initial setup.
 - B. It is based on the record of dependencies maintained.
 - C. It is particularly necessary for systems which deal with large amounts of user data.
 - D. It is particularly important for systems which are exposed to the public.
18. Which of the following is also called "structural testing"?
 - A. Black-box testing
 - B. White-box testing
 - C. Grey-box testing
 - D. None of the above
19. The central component of Structured Analysis as envisaged by Douglas Ross is
 - A. Data dictionary
 - B. Control flow
 - C. Entity relationships
 - D. Process specification
20. Which of the following is true about the IEEE 829-2008 standard description of test plans?
 - A. a master test plan is meant to apply only to a single project.
 - B. a level test plan includes details of who is doing which task.
 - C. a level test plan describes testing activities at different levels.
 - D. a level test plan should be complete and not makes references to external documents.

Part II. MULTIPLE ANSWER QUESTIONS. (ANY SUBSET OF ANSWERS MAY BE THE RIGHT SUBSET. WORTH 2 POINTS EACH.)

21. Which of the following is true of the Model-Driven Test Design (MDTD) approach?
- A. It starts with a software artifact.
 - B. Coverage criteria are applied to abstractions of the artifact.
 - C. Test requirements are created after selection of input values.
 - D. The final step is test execution.
22. Which of the following is true of reachability in the RIPR model?
- A. Reachability means a fault can be reached.
 - B. Reachability always results in the propagation of errors.
 - C. An appropriate input has to be selected to achieve reachability.
 - D. Reachability always results in incorrect output.
23. Which of the following is true of the V-model of software testing levels?
- A. Implementation sits at the mid point.
 - B. MDTD is focused on unit testing.
 - C. Different design levels may correspond to the same testing phase.
 - D. Unit testing corresponds to detailed design.
24. Which of the following is true of coverage criteria?
- A. Coverage criteria are required because it is mathematically impossible to find all bugs.
 - B. The technique of combining coverage criteria defined on individual inputs to obtain a unified coverage criterion for the whole domain is called interface-based design.
 - C. Coverage criteria may specify particular inputs it is necessary to cover
 - D. Coverage criteria are required to deal with exponential growth also known as combinatorial explosion.
25. Which of the following statements is true about Input domain modelling (IDM)?
- A. IDM is about creating an abstraction of the input space.
 - B. IDM tries to partition the input space such that different members of a particular equivalence class behave differently.
 - C. A test suite is always formed by picking exactly one member of each equivalence class while using IDM and ensuring that no equivalence class is missed out.
 - D. Test cases are created from the test values picked.
26. `#function which returns type of triangle`
`def triang(n1,n2,n3):`
 `#code which checks if n1,n2,n3 form`
 `#a triangle. If not, returns "Invalid input"`

 `#code which checks if all sides are equal`
 `#returns "Equilateral triangle"`

 `#code which checks if two sides are equal`
 `#returns "Isosceles triangle"`

 `#code which checks if all three unequal`
 `#returns "Scalene triangle"`

Suppose we use create a partition of the input space of all integer-triples of the above triang function with the characteristic "type of triangle" with the following four blocks: (1) all three sides are equal, (2) there exist two sides which are equal, (3) all three sides are unequal and (4) not a triangle; then which of the following statements is true?

- A. The blocks form a complete partitioning
 - B. The blocks are pairwise disjoint
 - C. The partition is based on interface-based design.
 - D. The two inputs $n1 = 4, n2 = 4, n3 = 3$ and $n1 = 3, n2 = 4, n3 = 4$ belong to the same block.
27. We are in the Red phase of Test Driven Development
- A. Right after we have passed all the tests.
 - B. Right after we have written a new test.
 - C. Right after a test failure.
 - D. Right before we write new code for the purpose of refactoring.
28. The advantages of functionality-based Input Domain Modelling (IDM) over interface-based IDM are
- A. It is easier to generate tests.
 - B. The domain knowledge of the tester can be incorporated.
 - C. The requirements are better reflected.
 - D. It is easy to come up with characteristics.
29. Consider the following function:

```

V1 def searchAndBuyProduct():
V2     login_info = None
V3     marker = True
V4     #Login as a user
V5     while marker:
V6         login_info = login()
V7         if login_info is not None:
V8             marker = False
V9             break
V10    #Search for products then begin to shop
V11    while True:
V12        search = input("Search for products in inventory
                        (type all for whole inventory):")
V13        if search.lower() == "all":
V14            display_csv_as_table("products.csv")
V15        else:
V16            display_filtered_table("products.csv", search)
V17        check = input("Ready to shop? (Y/N)")
V18        if check.lower() == "y":
V19            break
V20    checkoutAndPayment(login_info)

```

Which are the lines where the control flow exits the searchAndBuyProduct() function?

- A. V1
- B. V6
- C. V12
- D. V7

For questions 30 and 31, consider the following graph $G = (N, E, N_0, N_f)$ where
 $N = \{v1, v2, v3, v4, v5, v6, v7\}$,
 $E = \{(v1, v2), (v2, v4), (v1, v3), (v4, v5), (v5, v7), (v2, v6), (v6, v1)\}$
 $N_0 = \{v1\}$ and $N_f = \{v6, v7\}$

30. In the above graph, which of the following are prime paths?
- A. $v1, v2, v6$

- B. $v1, v3$
 - C. $v2, v6, v1, v2$
 - D. $v1, v2, v3, v4, v5, v7$
31. In the above graph, consider $p = v1, v2, v6, v3$. Which of the follow statements are true?
- A. There is a path p' which tours p
 - B. There is a path p' which tours p with detours only.
 - C. There is a path p' which tours p with sidetrips only.
 - D. There is a path p' which tours p and contains both detours and sidetrips.
32. Consider the expression $e = (A \vee \neg B) \wedge C$ and the truth assignment f given by $A = True, B = False, C = False$. Which of the following are true?
- A. A determines e at f
 - B. C determines e at f
 - C. The test set $T = \{f, f'\}$ where f' assigns $A = False, B = False, C = True$ achieves Predicate Coverage.
 - D. The test set $T = \{f, f'\}$ where f' assigns $A = True, B = True, C = True$ achieves Predicate Coverage.
33. Suppose we are allowed a maximum of 4 tests. Which coverage criteria will we be able to fulfill for the expression $e = A \vee \neg B \vee \neg C$
- A. Clause Coverage
 - B. Predicate Coverage
 - C. Combinatorial Coverage
 - D. Active Clause Coverage
34. Which of the following is true?
- A. The expression $(A \wedge B) \vee \neg C$ is in Disjunctive Normal Form
 - B. If an assignment of truth values makes a term true, then it makes every subterm of the term true.
 - C. A term can be prime yet redundant.
 - D. Syntactic coverage will stay the same as long as the truth table of the predicate remains the same.
35. Which of the following is true of regression testing?
- A. It is done after each new feature implemented in the software.
 - B. It can follow after successful debugging.
 - C. It involves running all of the units tests for all of the functions again.
 - D. It is also called glass-box testing.
36. Which of the following are true of smoke testing?
- A. It is done on a monthly basis.
 - B. It focuses on tests which expose errors which will stop the build from achieving the functionality.
 - C. Smoke testing focuses on and verifies a particular critical component.
 - D. Smoke testing helps with figuring out the source of errors.
37. Which of the following are true of sandwich testing?
- A. It is a combination of of top-down integration for the first layers and bottom-up integration for the last layers of the control flow.
 - B. It helps mitigate the problems with data flow that occur if we exclusively use a top-down approach.

- C. A alternative to sandwich testing is to create simpler stubs, ensuring the mitigation of problems when using exclusively top-down testing.
 - D. An increased number of drivers can be used to mitigate the problems instead of introducing sandwich testing.
38. In an Entity Relationship Diagram (ERD) which of the following are true?
- A. Modality means how many different modes or ways in which two entities are related
 - B. Modality can take values 0, 1 or ∞ based on whether no edge exists, edge is drawn from the left entity to the right entity or edge is drawn from right entity to the left entity respectively.
 - C. Cardinality measures the total number of entities in the ERD.
 - D. Cardinality is measured separately for each of the two entities which are joined by a relationship in an ERD, with respect to the other entity.
39. Which of the following statements is true about a use case diagram?
- A. An actor is always an entity external to the system.
 - B. Multiple entities can take on the role of the same actor.
 - C. A use case is a behaviour of an actor that brings value to the company.
 - D. Use case documentation includes preconditions which specify when the use case can start.
40. Which of the following is true of the Test traceability matrix (TTM) in a Level Test Plan?
- A. TTM includes details of why a test was included.
 - B. TTM includes details of what a test actually tests.
 - C. TTM gives details about the origin of a test.
 - D. TTM gives details about the test influence on future stages.

Answer Sheet

Remember to submit the Front Sheet For Exams with your details along with this Answer Sheet. You can keep the question paper. In case you want to be safe, you can also enter your details below.

Course Name:
Exam code:
Semester when you first registered for the course:
Programme:
Table number:
Time for submitting the exam:
Date:

Multiple Choice Questions

- 1 ☐ A ☐ B ☐ C ☐ D
- 2 ☐ A ☐ B ☐ C ☐ D
- 3 ☐ A ☐ B ☐ C ☐ D
- 4 ☐ A ☐ B ☐ C ☐ D
- 5 ☐ A ☐ B ☐ C ☐ D
- 6 ☐ A ☐ B ☐ C ☐ D
- 7 ☐ A ☐ B ☐ C ☐ D
- 8 ☐ A ☐ B ☐ C ☐ D
- 9 ☐ A ☐ B ☐ C ☐ D
- 10 ☐ A ☐ B ☐ C ☐ D
- 11 ☐ A ☐ B ☐ C ☐ D
- 12 ☐ A ☐ B ☐ C ☐ D
- 13 ☐ A ☐ B ☐ C ☐ D
- 14 ☐ A ☐ B ☐ C ☐ D
- 15 ☐ A ☐ B ☐ C ☐ D
- 16 ☐ A ☐ B ☐ C ☐ D
- 17 ☐ A ☐ B ☐ C ☐ D
- 18 ☐ A ☐ B ☐ C ☐ D
- 19 ☐ A ☐ B ☐ C ☐ D
- 20 ☐ A ☐ B ☐ C ☐ D

Multiple Answer Questions

- 21 ☐ A ☐ B ☐ C ☐ D
- 22 ☐ A ☐ B ☐ C ☐ D
- 23 ☐ A ☐ B ☐ C ☐ D
- 24 ☐ A ☐ B ☐ C ☐ D
- 25 ☐ A ☐ B ☐ C ☐ D
- 26 ☐ A ☐ B ☐ C ☐ D
- 27 ☐ A ☐ B ☐ C ☐ D
- 28 ☐ A ☐ B ☐ C ☐ D
- 29 ☐ A ☐ B ☐ C ☐ D
- 30 ☐ A ☐ B ☐ C ☐ D
- 31 ☐ A ☐ B ☐ C ☐ D
- 32 ☐ A ☐ B ☐ C ☐ D
- 33 ☐ A ☐ B ☐ C ☐ D
- 34 ☐ A ☐ B ☐ C ☐ D
- 35 ☐ A ☐ B ☐ C ☐ D
- 36 ☐ A ☐ B ☐ C ☐ D
- 37 ☐ A ☐ B ☐ C ☐ D
- 38 ☐ A ☐ B ☐ C ☐ D
- 39 ☐ A ☐ B ☐ C ☐ D
- 40 ☐ A ☐ B ☐ C ☐ D