Exam TI1705 / TI2210
Software Testing and Quality Engineering

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Background

- For each question one answer is correct.
- There are 40 questions. Each question has the same weight in the overall grade.
- The use of books, papers, computers, or other material is not permitted.
- The order of questions and options has been automatically randomized.
- Fill in your answers on a separate answer sheet that will be automatically processed.

Questions

Question 1. What is the main difference between a walkthrough and an inspection?

A. An inspection has a trained leader, while a walkthrough has no leader.
B. An inspection is led by the authors, while a walkthrough is led by a trained moderator.
C. Authors are not present during inspections, while they are during walkthroughs.
D. A walkthrough is led by the author, while an inspection is led by a trained moderator.

Question 2. Why are both specification-based and structure-based testing techniques useful?

A. Because specifications tend to be unstructured.
B. They find different types of defects.
C. Both find the same types of defects.
D. Using more techniques is alwas better.

Question 3. You are writing a web service with a public API, which will allow users to write their own applications and integrate with your service. What programming style(s) do you employ?

A. I will use a defensive style for both the public API and the internal classes of the web service.
B. I will use a defensive style for the public API and a demanding style for the internal classes of the web service.
C. I will use a demanding style for both the public API and the internal classes of the web service.
D. I will use a demanding style for the public API and a defensive style for the internal classes of the web service.

Question 4. Consider the situation as described in Figure 1. Assume the precondition of h passes, but that its *postcondition* is failing. Which of the following statements is true? (See also Questions 12 and 9).

A. This most likely requires a fix in *both* your client C and the external library class S.
B. None of the other statements is true.
C. This most likely requires a fix in your client C.
D. This most likely requires a fix in the library class S.

Question 5. Test-Driven Development (TDD) as discussed in class distinguishes an inner and outer feedback loop. What is their role?

A. The outer loop addresses unit testing, and the inner loop functional testing
B. The outer loop addresses functional testing, and the inner loop unit testing.
C. The outer loop addresses non-functional requirements, where as the inner loop addresses functional requirements.
D. The outer loop addresses unit testing, and the inner loop addresses refactoring.

Question 6. Which of the following statements on one-by-one testing is true?

A. If the on point is an in point, the off point is an out point.
B. An out point cannot also be an on point.
C. The in point is included in the set of on points.
D. An out point can never be off point.

Question 7. For the control flow graph shown Figure 4, three tests have been run:

1. Gold card holder who gets upgraded to business class.
2. Non-gold card holder who stays in economy.
3. A person who is bumped from the flight.

What additional test cases would be needed to achieve 100% decision coverage? (See also Question 28).

A. A gold card holder who stays in economy and a non-gold card holder who gets upgraded to business class.
B. A gold card holder and a non-gold card holder who are both upgraded to business class.
C. A gold card holder who is upgraded to business class and a non-gold card holder who stays in economy class.
D. A gold card holder and a non-gold card holder who both stay in economy class.

Question 8. Your heater is set as follows: If the temperature falls below 18 degrees, the heating is switched on. When the temperature reaches 21 degrees, the heating is switched off. Assume the temperature is measured in integers. Which test cases would the one-by-one boundary testing strategy prescribe?

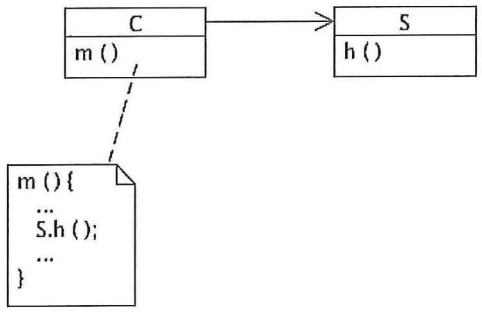
A. 18, 19, 21, 22.
B. 18, 19, 20, 21.
C. 17, 18, 21, 22.
D. 17, 18, 20, 21.

Question 9. Consider the situation as described in Figure 1. Assume that the only reported assertion failure indicates that only the *invariant* of library class S is failing when your test invokes h. Which of the following statements is true? (see also Questions 12 and 4).

A. This most likely requires a fix in your client C.
B. This most likely requires a fix in *both* your client C and the external library class S.
C. This most likely requires a fix in the library class S.
D. None of the other statements is true.

Question 10. To derive test cases from a state machine, you can turn it into a state transition table. How would you extend your test suite in order to test "sneak paths"?

A. I will add a test case per transition.
B. I will add an extra test case for every loop.
C. I will add a test case for every empty cell.
D. I will add a test case for every cell in the transition table.



You are writing a test for a method m in a client class C, which uses library method h from a class S provided by an external supplier. A class diagram illustrating this is shown in Figure 1.
You run the test suite with assertion checking enabled. Your test case fails since h raises one assertion failure.
You seek to identify the cause of the problem. We assume that the assertions themselves are correct, but that the actual implementation (of either the client C or the library S) may be incorrect.

Figure 1: Using a method with a failing assertion.

Question 11. Which of these is a functional test?

A. Checking the effect of high volumes of traffic in a call-center system.
B. Checking how easy the system is to use.
C. Measuring response time on an on-line booking system.
D. Checking the on-line bookings screen information and the database contents against the information on the letter to the customers.

Question 12. Consider the situation as described in Figure 1. Assume it is the *precondition* of h that is failing. Which of the following statements is true? (See also Questions 4 and 9).

A. None of the other statements is true.
B. This most likely requires a fix in *both* your client C and the external library class S.
C. This most likely requires a fix in your client C.
D. This most likely requires a fix in the library class S.

Question 13. Which of the following is a non-functional quality characteristic?

A. Usability.
B. Feasibility.
C. Maintenance.
D. Regression.

Question 14. System test execution on a project is planned for eight weeks. After a week of testing, a tester suggets that the test objective stated in the test plan of "finding as many defects as possible during testing" might be more closely met by redirecting the test effort according to which test principle?

A. Importance of early testing.
B. The absence-of-errors fallacy.
C. Impossibility of exhaustive testing.
D. Defect clustering.

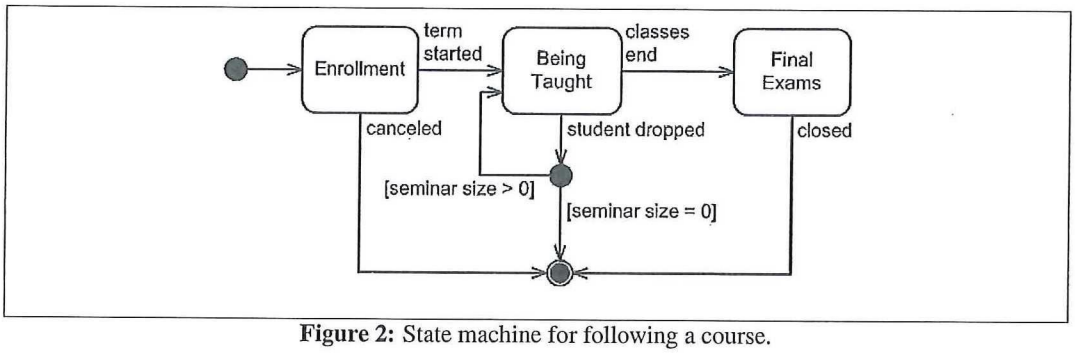


Figure 2: State machine for following a course.

Question 15. The typical way to using a mocking framework (such as Mockito) when testing a class *C* is:

A. To mock selected methods in *C*.
B. To mock selected interfaces implemented by *C*.
C. To mock selected subclasses of *C*.
D. To mock selected classes *C* depends on.

Question 16. Consider the following two statements about the boundary testing one-by-one strategy.

1. While testing one boundary, you should use X in points for the remaining boundaries.
2. If we want to test four boundary conditions, we would have to write Y test cases minimally.

What should X and Y be?

A. X = varying, Y = four.
B. X = the same, Y = eight.
C. X = varying, Y = eight.
D. X = the same, Y = four.

Question 17. What statement about static analysis is true?

A. When properly performed, static analysis makes functional testing redundant.
B. Compiling is not a form of static analysis.
C. With static analysis, defects can be found that are difficult to find with dynamic testing.
D. Static analysis finds all faults.

Question 18. Consider the state machine in Figure 2. How many test cases are needed to achieve all roundtrip path coverage?

A. 3.
B. 4.
C. 5.
D. 7.

Question 19. According to the ISTQB, "...the best testing technique is..."

A. Model-based testing.
B. Exploratory testing.
C. Acceptance testing.
D. No single testing technique.

Question 20. Which of the following is the most important difference between the metrics-based approach and the expert-based approach to test estimation?

A. The expert-based approach takes longer than the metrics-based approach.
B. The metrics-based approach is more accurate than the expert-based approach.
C. The metrics-based approach uses calculations from historical data while the expert-based approach relies on team wisdom.
D. The metrics-based approach can be used to verify an estimate created using the expert-based approach, but not vice versa.

Question 21. Is it possible to write a program that can check any other Java program and warns if it prints the string "Stop Censorship Now"?

A. Yes, this is trivial, just search for the requested string.
B. No, this cannot be done as it would require solving the halting problem.
C. Yes, but this would require a powerful symbolic execution engine.
D. Yes, this can be done, because even if the string would be encrypted, the program would also have to contain the encryption keys.

Question 22. What is a test condition?

A. A specific state of the software, e.g., before a test can be run.
B. An input, expected outcome, precondition and postcondition.
C. Something that can be tested.
D. The steps to be taken to get the system to a given point.

Question 23. Which of the following is an accurate description of the relation between a fault and a failure?

A. A fault is caused by a failure.
B. A fault must lead to a failure.
C. A failure is caused by a fault.
D. A failure must lead to a fault.

Question 24. The best use of code coverage is as:

A. A tool to help managers assess developers' testing ability.
B. A tool to assist in reviewing code changes.
C. A metric that ensures a minimum level of testing for the entire code base.
D. A tool to show your supervisor that you have tested all functionality properly.

Question 25. Which of the following statements concerning *modern code reviews* is true?

A. Successful code reviews lead to software changes.
B. Most code changes resulting from code reviews fix defects spotted during review.
C. Most code changes resulting from code reviews improve maintainability.
D. Most code changes resulting from code review improve functionality.

Question 26. To test the method in Figure 3, what would be the best use of mock objects?

A. The use of mocks is not helpful in this case.
B. Mock PictureReader to improve observability, and mock HandlerListener to improve controllability.
C. Mock both PictureReader and HandlerListener to improve controllability as well as observability.
D. Mock PictureReader to improve controllability, and mock HandlerListener to improve observability.

```
public class PictureHandler {
        private PictureReader myReader;
        private HandlerListener myListener;
        ...
        /**
         * Try to read a given picture, retrying it at most n times.
         * Inform the listener if the picture was read successfully.
         * @param name Name of the picture to be read.
         * @param n Number of read attempts to be made.
         */
        public void readRepeatedly(String name, int n) {
                int i = 0;
                Picture pict = null;

                while (i <= n && pict == null) {
                        i++;
                        pict = myReader.readPicture(name);
                }

                if (pict != null) {
                        myListener.pictureSuccessfullyRead();
                }
        }
        ...
}
```

Figure 3: A Picture Manipulation Method

Control flow for flight check in.
If you are flying with an economy ticket, there is a possibility that you may get upgraded to business class, especially if you hould a gold card in the airline's frequent flyer program.
If you don't hold a gold card, there is a possibility that will get 'bumped' off the flight if it is full and you check in late.

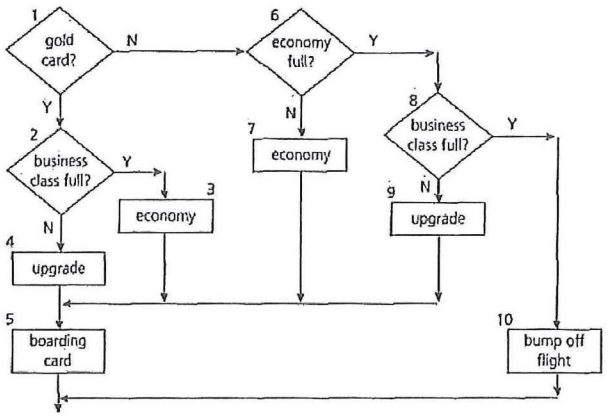


Figure 4: Control flow diagram for flight check-in.

Question 27. Consider the following exit criteria which might be found in a test plan:

I No known customer-critical defects.
II All interfaces between components tested.
III 80% code coverage of all units.
IV All specified requirements satisfied.
V System functionality matches behavior of old systems for all business rules.

Which of the following statements is true about whether these *exit* criteria belong in an acceptance test plan?

A. All statements belong in an acceptance test plan.
B. Oly statements I, IV, and V belong in an acceptance test plan.
C. Only statement I belongs in an acceptance test plan.
D. Only statements I, II, and III belong in an acceptance test plan.

Question 28. For the control flow graph shown Figure 4, three tests have been run:

1. Gold card holder who gets upgraded to business class.
2. Non-gold card holder who stays in economy.
3. A person who is bumped from the flight.

Assume each box in the control flow diagram corresponds to a statement. What is the statement coverage of these three tests? (See also Question 7).

A. 60%.
B. 90%.
C. 70%.
D. 80%.

Question 29. What is exploratory testing?

A. Concurrent test design, test execution, test logging, and learning.
B. The testing carried out by a chartered engineer.
C. The process of anticipating or guessing where defects might occur.
D. A systematic approach to identifying specific equivalent classes of input.

Question 30. Which of the following is an advantage of independent testing?

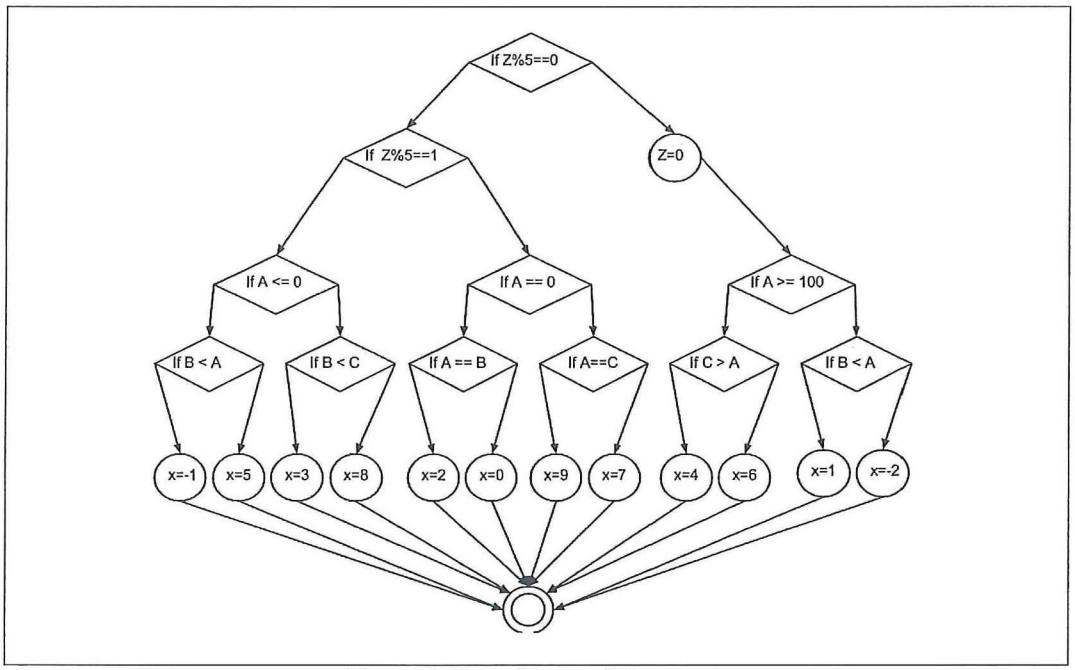


Figure 5: Example control flow graph

A. Independent testers don't have to spend time communicating with the project team.
B. Programmers can stop worrying about the quality of their work and focus on producing more code.
C. The others on a project can pressure the independent testers to accelerate testing at the end of the schedule.
D. Independent testers sometimes question the assumptions behind requirements, designs and implementations.

Question 31. One of the following statements about code analysis tools such as Checkstyle is *not* correct. Which one is it?

A. For test code different Checkstyle rules may apply than for production code.
B. Automated Checkstyle analysis should be conducted *before* a manual code review.
C. Checkstyle rule preferences may differ per team, and should be set on a per project basis.
D. Whenever Checkstyle warns about a code fragment, the code should be adjusted to fix this.

Question 32. During test execution, the test manager describes the following situation to the project team: *"90% of the test cases have been run. 20% of the test cases have identified defects. 127 defects have been found. 112 defects have been fixed and have passed confirmation testing. Of the remaining 15 defects, project management has decided that they do not need to be fixed prior to release."*

Which of the following is the most reasonable interpretation of this test status report?

A. The remaining 10% of test cases should be run prior to release.
B. The system is now ready for release with no further testing or development effort.
C. The remaining 15 defects should be confirmation tested prior to release.
D. The programmers should focus their attention on fixing the remaining known defects prior to release.

Question 33. Consider the control flow graph in Figure 5. What is its cyclomatic complexity?

A. 14.
B. 11.
C. 12.
D. 6.

Question 34. The key reason to adopt a continuous integration server (such as DevHub as used in the labwork) is:

A. To ensure that the system can be built and executed in a clean environment using only source code that is under revision control.
B. To build up a history of build successes and failures over time.
C. To make it easy to share code among team members.
D. To relieve the individual developers from the need to execute test cases themselves.

Question 35. In the study of JUnit's coverage, what was *not* a category of commonly uncovered code?

A. The code is unreachable (dead) by design.
B. The code is too complex to test.
C. The code contains bad weather behavior that is unlikely to happen.
D. The code is too simple to test.

Question 36. An attacker is trying to hack into a system by collecting input data from a log file, changing the data a little and using it as input for the system once again. This type of fuzzing is called:

A. Protocol fuzzing.
B. Random fuzzing.
C. Mutation based fuzzing.
D. State-based protocol fuzzing.

Question 37. A probe sent to Mars was able to receive new instructions during the mission. The memory in which new instructions could be stored began to run out. One engineer decided to send an instruction that would erase the landing modules (because the probe was never going to have to land again) to free up a large amount of memory space. Unfortunately, the communication with earth was disconnected as soon as the code was executed: The landing module contained instructions to point the antenna in the right direction to enable communication with earth.

How could this problem have been avoided?

A. By correctly maintaining diagonal traceability.
B. By correctly maintaining vertical tracability
C. None of the other answers is correct.
D. By correctly maintaining horizontal traceability.

Question 38. Static code analysis typically identifies all but one of the following problems. Which is it?

A. Uninitialized variables.
B. Unreachable code.
C. Faults in the requirements.
D. Too few comments.

Question 39. Oracles can be strong (verifying concrete values) or weak (partial oracles, conducting a reasonableness check or self check) verifying generic properties. Automated test input generation techniques (such as fuzzing or crawling) typically:

A. Make use of strong oracles, as this gives most confidence.
B. Make use of strong oracles, as this leads tó the best test results at the least cost.
C. Make use of weak oracles, as this permits testing many different inputs at low cost.
D. Make use of weak oracles, as this helps to avoid false alarms.

Question 40. Which of the following statements is true in a class hierarchy that is compliant with the Liskov Substitution Principle?

A. A superclass can be more defensive than its subclasses.
B. A superclass invariant need not hold in its subclasses.
C. A subclass must meet the invariant of its superclass.
D. Subclasses can be more demanding than their superclass.