Information

UNIVERSITY OF OSLO

The Faculty of Mathematics and Natural Sciences

Written examination IN3240/IN4240
2024 SPRING
Duration: 4 June at 09:00 - 13:00
Permitted aids: None.

It is important that you read this front page before you start. If you need to use the zoom function exam set you can hold down ctrl and click + or - on the numerical keyboard.

The task consists of four parts.

You can write in both English and Norwegian.

Part 1 - Multiple choice exercises

- 7 multiple choice questions
- 7 matching/pairing questions
- Maximum score for Part 1: 25 points.

Part 2 - Specification-Based Techniques

Three cases:

- EP/ BVA: 10 points.
- Decision tables: 10 points.
- State transition: 10 points.
- Maximum score for Part 2: 30 points.

Part 3 - Short questions

- 5 text tasks to be answered briefly and accurately.
- Maximum score for Part 3: 25 points.

Part 4 - Essay

Maximum score for Part 4: 20 points.

Drawings

In this assignment, you shall supply the exercises in part 2 (Decition tables and/or State transition) with digital handwriting using the sketch sheets you will be given. It is possible to use several sheets per task. See instructions on how to fill in the sketch sheets in the link below the assignment overview.

If some tasks are unclear, you can make your own assumptions. If so, explain them.

1 Part 1 - Multiple choice

What is the purpose of confirmation testing?

Select one alternative:

- To confirm that no unintended defects have been introduced as a result of changes made.
- To confirm that a defect has been fixed correctly
- To confirm that the detailed logic of a component conforms to its specification.
- To confirm the user's confidence that the system will meet their business needs.

Maximum marks: 1

2 Part 1 - Multiple choice

Impact analysis helps to decide ...

- ... how many more test cases need to written.
- ... different tools to perform regression testing .
- ... how much regression testing should be done.
- ... exit criteria.

Maximum marks: 1

3 Part 1 - Multiple choice

Which of the following best describes integration testing?

- Testing performed to expose faults in the interfaces and in the interaction between integrated components.
- Integration of automated software test suites with the product.
- Testing to verify that a component is ready for integration.
- Testing to verify that test environment can be integrated with product.

Maximum marks: 1

4 Part 1 - Matching/Pairing

The specification-based (black-box) test techniques can be used in several of the areas below. However, you must match them so that all the techniques are applied in the most suitable area.

	Use case testing	State transition testing	EP and BVA*	Decision table
Testing an admission system for higher education based on several admission criteria.	○	○	○	○
Validation of user stories.	○	○	○	○
Testing a banking application that calculates the interest on a savings account.	○	○	○	○
Testing the functionality of an ATM.	○	○	○	○

** EP and BVA: Equivalence partitioning and boundary value analysis*

Maximum marks: 2

5 Part 1 - Multiple choice

During an early period of test execution, a defect is located, fixed and confirmed as fixed by re-testing. However, it is seen again later during a subsequent test execution.

The cause is most likely lack of one of the following aspects? Which?

Select one alternative:

- Configuration control
- Regression testing
- Test documentation management
- Traceability

Maximum marks: 1

6 Part 1- Matching / pairing

Determine which test strategy is used in each of the cases.

Please match the values:

	Consultative	Methodical	Dynamic and heuristic	Analytical	Model based
The tests are based on the systematic use of a predefined set of test conditions.					
The test is based on the tester experience and skills					
The tests are based on a state transition diagram of the product.					
The tests are designed and prioritized based on risk level.					
The tests are based on the views of business experts.					

Maximum marks: 2

7 Part 1 - Matching/pairing

Which of the following tools are primarily used by developers, and which are primarily used by other people involved in testing?

	Others	Developerts
Static analysis tools	○	○
Test management tools	○	○
Modelling tools	○	○
Performance testing tools	○	○
Dynamic analysis tools	○	○

Maximum marks: 2

8 Part 1 - Matching/Pairing

ISTQB distinguishes between the terms test type and test level.
Determine what is a test type and what is a test level.

Please match the values:

	Test type	Test level
Non-functional testing	○	○
Functional testing	○	○
Integration testing	○	○
Acceptance testing	○	○
Testing related to changes	○	○
Unit testing	○	○
System testing	○	○
Structure based testing	○	○

Maximum marks: 4

9 Part 1 - Matching/pairing

Match the following processes with their corresponding activities:

	Establish the scope and objectives of the testing	Group tests into scripts	Transform the test objectives into test conditions	Communicate the test results to the stakeholders
Test reporting	○	○	○	○
Test analysis	○	○	○	○
Test implementation	○	○	○	○
Test planning	○	○	○	○

Maximum marks: 2

10 Part 1 Multiple choice

Complete the following sentence:

A regression test ...

- ○ ... will always be automated.
- ○ ... is only run once.
- ○ ... will check changes areas of the software to see if the have been affected.
- ○ ... will check unchanged areas of the software to see if they have been affected.

Maximum marks: 1

11 Part 1 - Multiple choice

Complete the sentence so that it gives the most precise definition of beta testing.

Beta testing is ...

Select one alternative:

- ○ ... performed by end users at the software developer's site.
- ○ ... useful to test software developed for a specific customer or user.
- ○ ... performed by an independent test team.
- ○ ... performed by end users at their own site.

Maximum marks: 1

12 Part 1 - Matching/pairing

Which of the following are benefits, and which are risks of using tools to support testing?

	Risk	Benefit
Ease the access to information about tests or testing	○	○
Underestimating the effort required to maintain the test assets generated by the tool	○	○
Greater consistency and repeatability	○	○
Overreliance on the tool	○	○
Repetitive work is reduced	○	○
Unrealistic expectations	○	○
Objective assessment	○	○

Maximum marks: 3

13 Part 1 - Multiple choice

Which of the following statements best describes White-box testing techniques?

Select one alternative:

- A sequence of test cases in executive order, and any associated actions that may be required to set up the initial preconditions and any wrap-up activities post executions.
- A procedure for deriving and/or selecting test cases based on an analysis of the specifications, either functional or non-functional, of a component or system without reference to its internal structure.
- A procedure for deriving and/or selecting test cases based on an analysis of the internal structure of a component or a system.
- A procedure for deriving and/or selecting test cases based on testers' experience, knowledge and intuition.

Maximum marks: 1

14 Part 1 - Matching/Pairing

Determine which test activities are primarily performed by the tester and which are primarily performed by the test leader.

Please match the values:

	Test leder	Tester
Collect test results and report on test progression	○	○
Analyze, review and assess user requirements	○	○
Decide what should be automated and to what degree	○	○
Design test cases	○	○
Evaluate the test results against the exit criteria	○	○
Coordinatie the test strategy and plan with project managers	○	○
Obtain and prepare test data	○	○

Maximum marks: 3

15

Part 2 - EP / BVA

Imagine that you are going to test a program, where the input values are integers from the interval 1 - 20 (both limits included). To facilitate the test work, we shall divide the input values into smaller subsets.

a) What are the two conditions (regardless of the program to be tested) that must be met for the subsets of input values to constitute an equivalence partitioning?

b) Below you see two proposals for equivalence partitioning:

Proposal 1:

- Two valid equivalence partitions:
  - 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
  - 11, 12, 13, 14, 15, 16, 17, 18, 19, 20
- Two invalid equivalence partitions:
  - Integers less than 1
  - Integers greater than 20

Proposal 2:

- Two valid equivalence partitions:
  - The odd numbers 1, 3, 5, 7, 9, 11, 13, 15, 17, 19
  - The even numbers 2, 4, 6, 8, 10, 12, 14, 16, 18, 20
- One invalid equivalence partitions:
  - Integer outside the range 1 - 20 (i.e. numbers less than 1 and greater than 20).

Justify whether the conditions you stated under point a) are met for the two different proposals for equivalence partitioning.

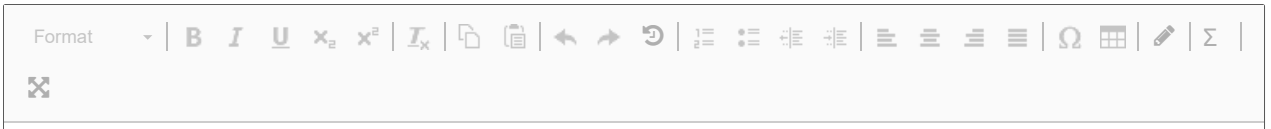
c) Even if a set of input values can be divided into equivalence partitions, it is not certain that we can use them as a test design technique on the program we are going to test.
What condition must the *program* meet in order for us to be able to use a concrete equivalence partitioning as a test design technique?

d) Assume the program fulfills the condition from point c) to be able to use the equivalence partitioning given in Proposal 1 (see point b). Which test values would you select to get the best possible equivalence partitioning coverage with the fewest possible test values?

e) Equivalence partitioning is often used in conjunction with *boundary value analysis*. Boundary value analysis cannot, however, be applied to all types of equivalence partitionings. Which necessary, but not always sufficient, condition must be met for the equivalence partitions to contain boundary values?

f) Enter any boundary values for one or both of the proposals for equivalence partitioning described in point b).

Fill in your answer here



Words: 0

Maximum marks: 10

16

Part 2 - Decision tables

NB! In this task, you can answer both in the word processor and possibly with sketches/drawings. In that case, use the sketch paper that has been handed out to you in the exam room. See instructions under the taskbar.

Several positions as associate professor in information technology are to be announced at a university in Norway.

In the announcement text, the following requirements for the applicant have been set:

- The applicant must have a PhD within the relevant subject area.
- The applicant must be able to document pedagogical competence at university level.
- The applicant must have language skills in Norwegian, equivalent to level B2 (the so-called Bergen test).

In order to streamline the processing of applicants, a computer program will be used to filter out the qualified applicants, as well as applicants who are qualified based on given conditions. Both those qualified and those who are conditionally qualified will then be called for an interview.

- Applicants who meet all three requirements are qualified.
- Applicants who cannot document pedagogical competence at the university level, but who meet the other two requirements, are qualified provided that they pass a course in university pedagogy within two years.
- Applicants who cannot document sufficient Norwegian skills, but who meet the other two requirements, are qualified provided that they pass the Bergen test (level B2) within two years.
- Applicants who do not fall under any of the points above are not qualified and should be rejected immediately.

In connection with the development and testing of the computer program that will process the applications automatically, you are to use decision tables to select use cases to be run during the system testing of the program.

a) Draw a decision table that shows all possible combinations of requirement fulfillment in the application. The decision table should include an action part that shows the outcome of the application, based on the points above.

b) Reduce the number of rules in the decision table as much as possible without losing information. Explain how you made the reduction.

c) Consider the following three different use cases:

- Applicant with a PhD within the relevant subject area, documented pedagogical competence, and sufficient language skills.
- Applicant with a PhD within the relevant subject area, but without documented pedagogical competence, and who also lacks sufficient Norwegian skills.
- Applicant with documented pedagogical competence, and sufficient Norwegian skills, but with a PhD outside the relevant subject area.

Do we need more use cases to achieve full decision table coverage? If yes, specify the use case(s) and the rule(s) in the decision table they represent.

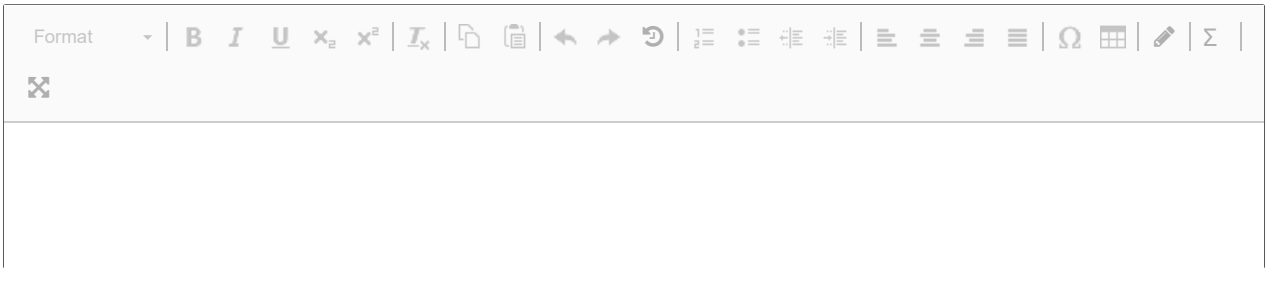
d) It turns out that the number of applicants for the positions is very high. To reduce the number to be called in for an interview, the department is considering adding an additional requirement:

- Only applicants with a minimum of two years of teaching experience at the university level will be considered.

How many possible different combinations of requirements fulfillment do we get in the decision table now (*before* any rule reductions)?

e) Decision tables are considered a test design tool. However, they are suitable for more than designing use cases. Where in the software life cycle are decision tables a good tool to ensure the foundation on which the program is to be built, and what is this form of testing called?

Fill in your answer here



Words: 0

Maximum marks: 10

17

Part 3 - State transition

Note that in this task you shall answer both in the text editor and with sketches/drawings. Use the sketching paper handed to you in the exam room. See instructions on filling out the sketch sheets in the link below the task bar.

In the second compulsory assignment, you were testing av ticket machine.



The interaction between the user and the ticket machine module was described as follows.
(For practical reasons, the interaction is somewhat simplified in relation to the compulsory assignment.)

State 1: Start window.
The traveler can choose one of two options:

a. *Buy a ticket or a travel card. The system goes to state 2.*
b. *Recharge an existing travel card. The system goes to state 3.*

State 2: Window for choosing the type of ticket or travel card.
The traveler can choose one of two options:

a. *Travel card. The system goes to state 5.*
b. *30-days ticket. The system goes to state 6.*

State 3: Window for reading a travel card.
The traveler holds the travel card in front of the card reader so that the card is read. If the system is recognizing the card, the system goes to state 5. If the system does not recognize it or the card, for any reason, is not valid, the system goes to state 4.

State 4. Window for displaying an error message.
The system displays the error message "Unknown card" on the screen.
After a few seconds, the system returns to the start screen, state 1.

State 5: Window for making deposits to the travel card.
The traveler enters the amount he/she wants to deposit to the card.
The system goes to state 6.

State 6. Confirmation window.
Information about what is purchased and what is payable is displayed on the screen. The traveler can choose one of two options:

a. The traveler confirms the purchase, by pressing the confirm button. The system goes then to state 7.
b. Cancel: The traveler cancels the transaction by pushing the cancel button. The system then returns to the start screen, state 1.

State 7. Payment window.
The following message is displayed on the screen:
"Insert you credit card".

a) Draw a state transition diagram that cover all the states and transitions.

b) Consider following use case:

" The traveler chooses to recharge an existing travel card. The system recognizes the card, and the traveler chooses to deposit 100 NOK, and then confirms the purchase."

Write down the path through the state transition diagram representing the use case.
What is the state coverage and transition coverage for this test case?

c) Is there a path through the state transition diagram that provides 100% state coverage? If there are multiple paths of different lengths that all provide 100% state coverage, choose the shortest.

d) What is the transition coverage of your path in point c).

e) How many use cases do we need to achieve 100% transition coverage?
Write down the relevant path(s) through the state transition diagram that represents the use case(s).

f) If a use case has 100% transition coverage, is it then possible to determine what the state coverage is? Justify your answer.

Fill in your answer here

Format

Words: 0

Maximum marks: 10

18 # Part 3 - Short question

One of the seven testing principles is called *Defect clustering*.
What does this principle tell us, and how should it affect the testing activities?

Fill in your answer here

Format

Words: 0

Maximum marks: 4

19 **Part 3 - Short question**

What other testing principles do we have, according to ISTQB?

Fill in your answer here

Format

Words: 0

Maximum marks: 6

20 Part 3 - Short questions

One of the guest lectures dealt with TDD.

a) What does the acronym TDD stand for?

b) What is the main principle behind TDD?

c) TDD is an iterative process.
Name and explain the various phases in the process.

d) TDD is preferably used at one of the four test levels. Which?

Fill in your answer here

Format

Words: 0

Maximum marks: 6

21

Part 3 - Short question

a) Explain the following terms:

- Regression testing
- Confirmation testing

b) What is the name of the test type that both regression testing and confirmation testing belong to?

Fill in your answer here

Format

Words: 0

Maximum marks: 5

22 # Part 3 - Short question

a) What two factors are involved in the calculation of risk?

b) How are risk values used...

1. ... in the planning phase?
2. ... during the dynamic testing?

Fill in your answer here

Format

Words: 0

Maximum marks: 4

23 # Part 4 - Essay

Within Continuous Integration, Delivery & Deployment it is common for testers and developers to work side by side in the same team (cf. the guest lecture on 24 April)

Discuss advantages and disadvantages of this practice from different perspectives, such as

- Test independence
- Test levels
- Roles
  - developer
  - tester
  - test leader
- Psychological aspects
- Different mindsets
- ...

Fill in your answer here

Format

Words: 0

Maximum marks: 20