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Test Techniques in Software Testing

- Test techniques are strategies or methods used to design test cases and determine whether a software application behaves as expected.
- They help ensure that different aspects of the software are tested comprehensively.
- The 3 main examples are:

1. Black Box Testing
2. White Box Testing
3. Experience- Based Testing

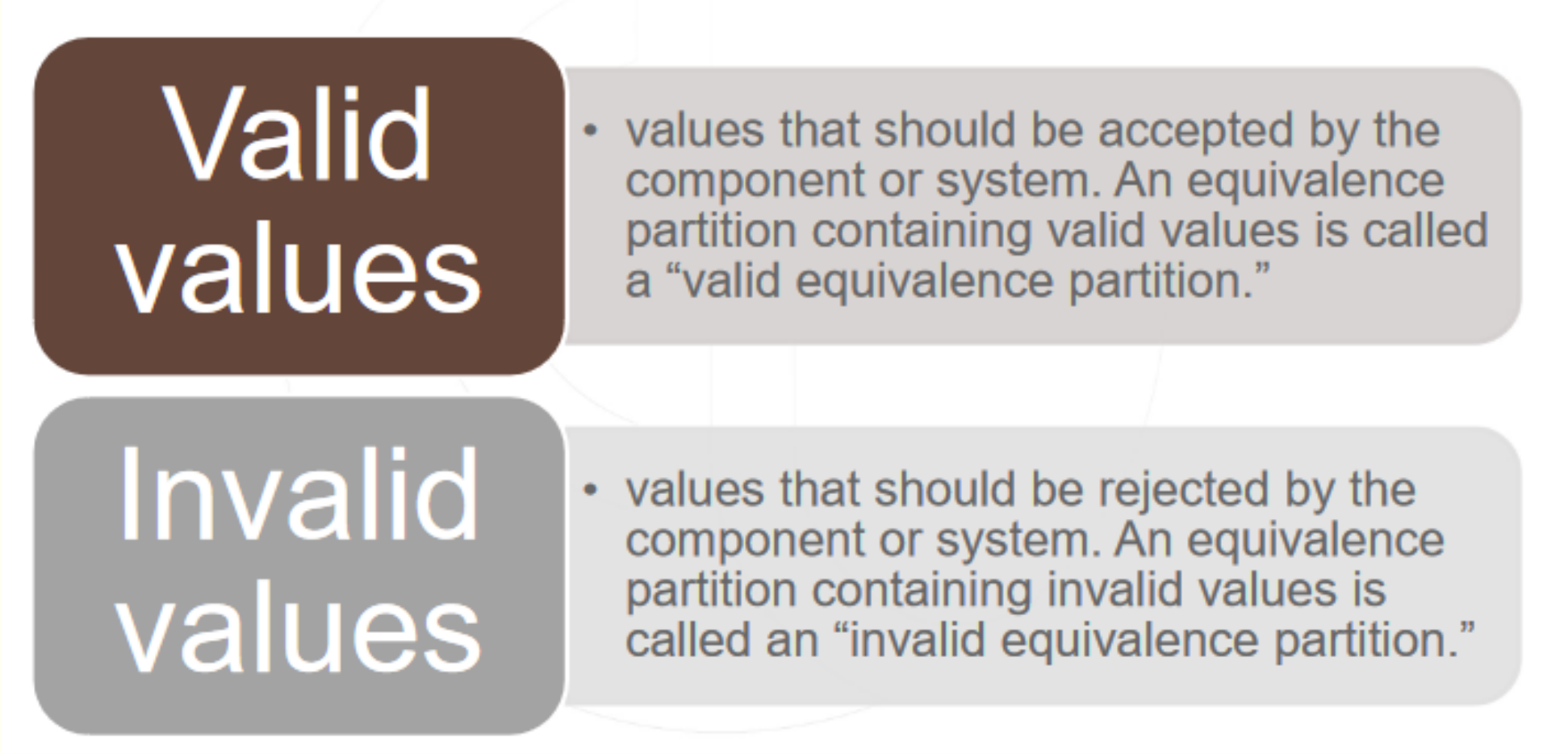
Black Box Testing (behavioral or behavior-based technique)

- Black Box Testing focus on the input-output behavior of the software without knowing its internal code structure.
- Based on an analysis of the appropriate test basis (e.g., formal requirements documents, specifications, use cases, user stories, or business processes).

Equivalence Partitioning

- Equivalence partitioning divides data into partitions (also known as equivalence classes) in such a way that all the members of a given partition are expected to be processed in the same way (see Kaner 2013 and Jorgensen 2014).
- The goal is to reduce the number of test cases while maintaining adequate test coverage.

Valid and Invalid Partitions



Note

- When invalid equivalence partitions are used in test cases, they should be tested individually, i.e., not combined with other invalid equivalence partitions, to ensure that failures are not masked.
- To achieve 100% coverage with this technique, test cases must cover all identified partitions (including invalid partitions) by using a minimum of one value from each partition.
- Coverage is measured as the number of equivalence partitions tested by at least one value, divided by the total number of identified equivalence partitions, normally expressed as a percentage.

Steps to conduct Equivalence Partitioning

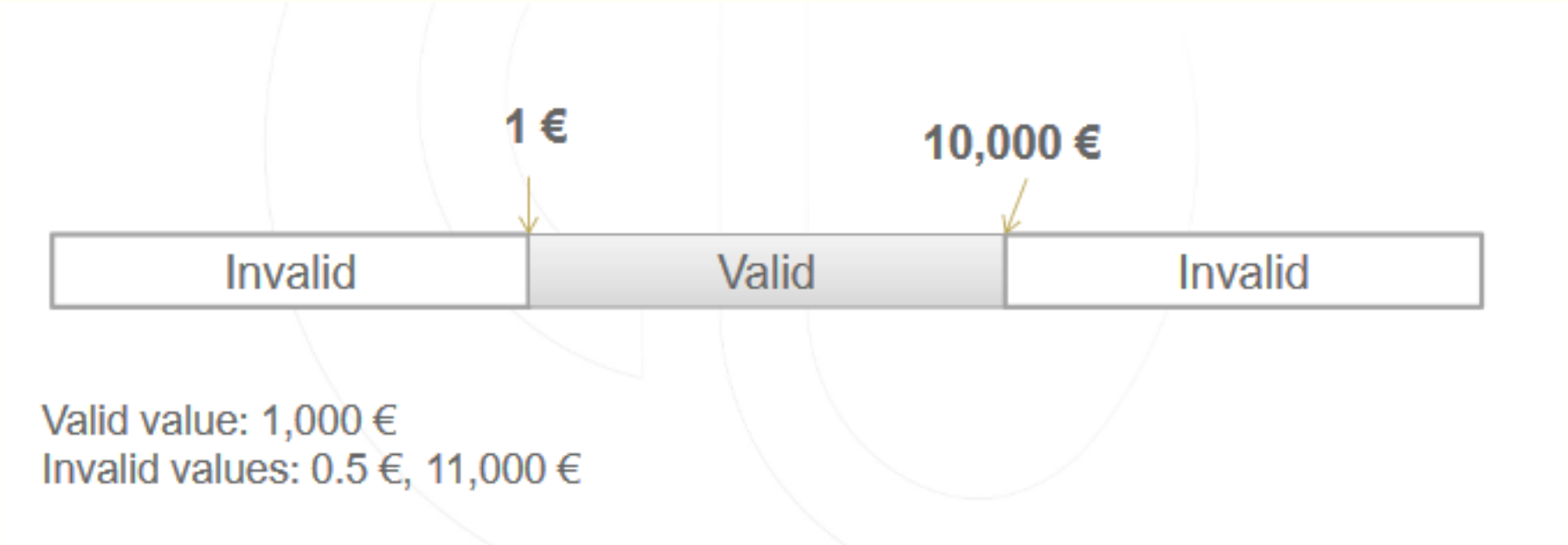
1. Identify different classes or partitions of input data.
2. Select representative values from each partition.
3. Design test cases using these representative values.
4. Execute the test cases and observe the behavior of the system.

Example 1

- Consider a software application that accepts age as input.
- Equivalence partitioning might divide the input range into three partitions: below 18 (for minors), between 18 and 65 (for adults), and above 65 (for seniors).
- Test cases would then be designed to cover a value from each partition.
- Still not 100 % coverage- WHY?

Example 2

- The system allows transfers between 1Euro and 10,000 Euro.



Question 1

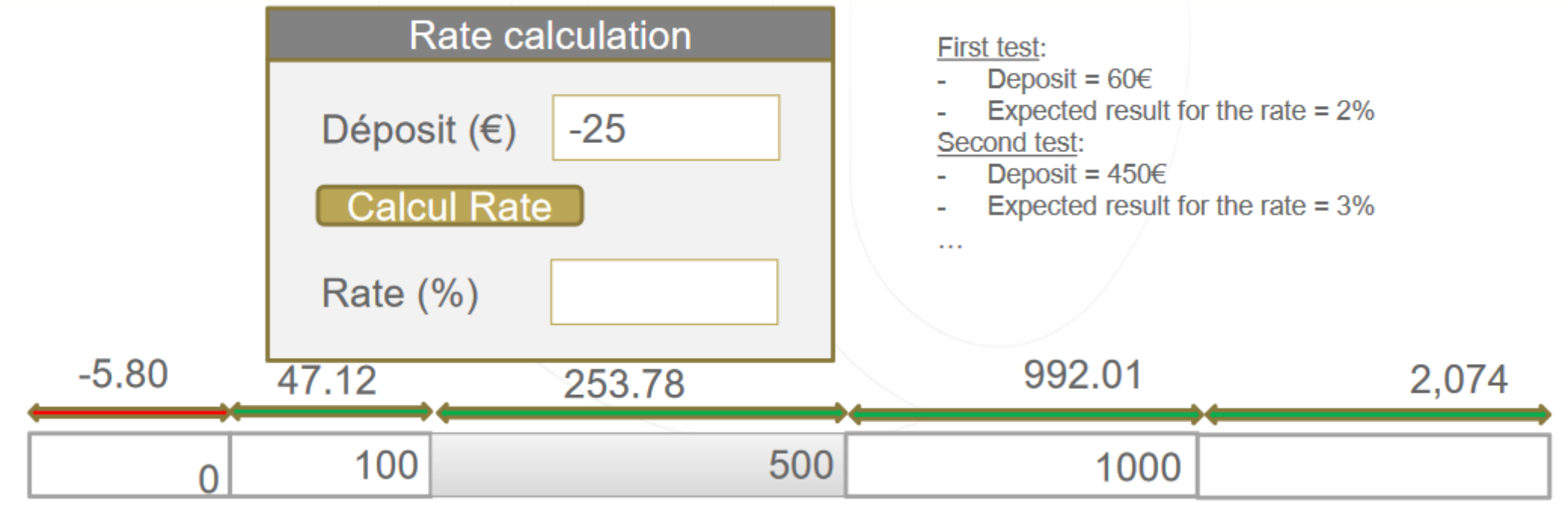
Exercise

Let us consider the interest generated on a bank account. The interest rate varies depending on the deposit. Regarding positive account balance values the rate is 2% up to and including 100.00€, 3% up to and including 500.00€, 5% up to and including 1,000.00€ and 7% for values beyond 1,000.00€.
Which is the smallest set of values that covers all **equivalence partitions**?

- a. -1.56€, 89.84€, 120.64€, 432.78€, 741.69€ and 3,694.72€
- b. 0.00€, 100.00€, 500€ and 1000.00€
- c. -55.74€, 147.87€, 508.13€ and 6,543.87€
- d. -5.80€, 47.12€, 253.78€, 992.01€ and 2,074.32€

Answer

- ANS: D


Rate calculation
Déposit (€)
-25
Calcul Rate
Rate (%)
First test:
- Deposit = 60€
- Expected result for the rate = 2%
Second test:
- Deposit = 450€
- Expected result for the rate = 3%
…
-5.80
47.12
253.78
992.01
2,074
0
100
500
1000

Question 2

Exercise

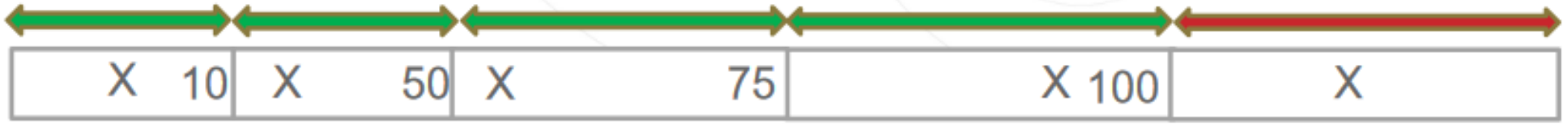
Postage for a letter up to 10g is 25 cents, up to 50g it is 35 cents along with a surcharge of 10 cents on any additional 25g up to 100g.
Which set of input values will be chosen to cover the equivalence partitions (in grammes)?

- a. 8, 42, 82, 102
- b. 4, 15, 65, 92, 159
- c. 10, 50, 75, 100
- d. 5, 20, 40, 60, 80

Answer

- ANS: B

- a. 8, 42, 82, 102
- **b**. 4, 15, 65, 92, 159
- c. 10, 50, 75, 100
- d. 5, 20, 40, 60, 80



Boundary Value Analysis

- Boundary value analysis (BVA) is an extension of equivalence partitioning, but can only be used when the partition is ordered, consisting of numeric or sequential data.
- The minimum and maximum values (or first and last values) of a partition are its boundary values (Beizer 1990).
- The main aim is to support the detection of defects related to the use of boundary such as a misuse of <, >, >=

Boundary Value Analysis- Two Types

- There are two approaches for determining boundary values.
- Example: a recording unit accepts numbers from 10 to 500.

1. Approach “2 Values”

- The boundary limit value and the adjacent one outside the partition.
- e.g.: 9.99, 10.00, 500.00; 500.01

2. Approach “3 values”

- The boundary limit value and the adjacent ones outside and inside the partition.
- e.g.: 9.99, 10.00, 10.01, 499.99, 500.00; 500.01

Steps to conduct Boundary Value Analysis (BVA)

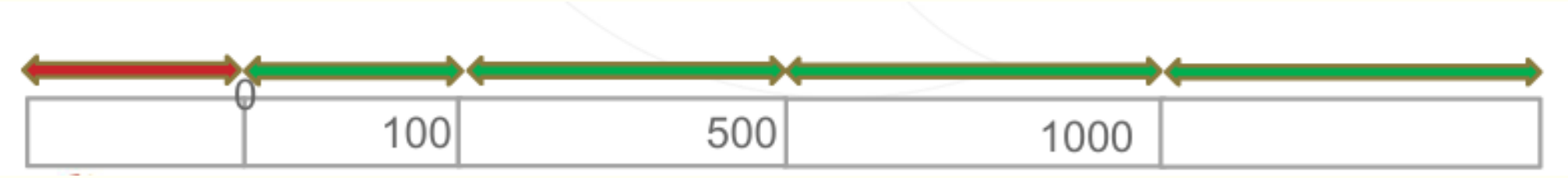
- Identify the boundaries between partitions.
- Select test cases that test values at, just below, and just above each boundary (Approach 2 or Approach 3)
- Execute the test cases and observe the system's behavior.

Example 1

- Let us take the same issue, but this time look for all entry values that need to be selected for the analysis of boundary values (Approach 2). Regarding positive account balance values the rate is 2% up to and including 100.00€, 3% up to and including 500.00€, 5% up to and including 1,000.00€ and 7% for values beyond 1,000.00€. ·
- a. 0.00€, 100.00€, 500€ and 1,000.00€
- b. -1.00€, 1.00€, 99.00€, 101.00€, 499.00€, 501.00€, 999.00€ and 1,001.00€
- c. -0.01€, 0.00€, 100.00€, 100.01€, 500.00€, 500.01€, 1,000.00€ and 1,000.01€
- d. 0.00€, 100.00€, 100.01€, 500.00€, 500.01€ and 1,000.00€

Answer

- ANS: C



Decision Table Testing

- Useful if the application of certain rules depends on logical conditions.
- It involves creating a decision table that enumerates all possible combinations of conditions and the corresponding actions.

Steps to conduct a Decision Table Testing

- Identify the conditions and actions.
- Create a decision table that lists all possible combinations of conditions and the corresponding actions.
- Design test cases to cover each combination of conditions.
- Execute the test cases and compare the actual results with expected results.

Example

- A rental car office would like to introduce certain criteria to rent out cars to their prospective customers.
- Only customers over 23 years and without any points on their driving license may get a rental car.
- In addition, if this office provides a car for professional purposes, the customer needs to pay a surcharge.

Solution

Conditions								
Age > 23 years	F	F	F	F	T	T	T	T
Full points	F	F	T	T	F	F	T	T
Professional use	F	T	F	T	F	T	F	T
Actions								
Entitled to rental car	F	F	F	F	F	F	T	T
Surcharge	F	F	F	F	F	F	F	T

Example 2

- A banking application provides different interest rates based on the type of account and the balance amount. The conditions and actions are as follows:
- Conditions:

1. Account Type: Savings, Checking
2. Balance Amount: Less than $1,000, $1,000 to $10,000, More than $10,000

- Actions:
- Interest Rate for Savings Account: 1% if less than $1,000, 1.5% if $1,000 to $10,000, 2% if more than $10,000.
- Interest Rate for Checking Account: 0.5% if less than $1,000, 1% if $1,000 to $10,000, 1.25% if more than $10,000

Decision Table

- Capturing all possible combinations:

Account Type	Balance Amount	Interest Rate
Savings	Less than $1,000	1%
Savings	$1,000 to $10,000	1.5%
Savings	More than $10,000	2%
Checking	Less than $1,000	0.5%
Checking	$1,000 to $10,000	1%
Checking	More than $10,000	1.25%

Questions & Answers