

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Chapter 4

Test Techniques

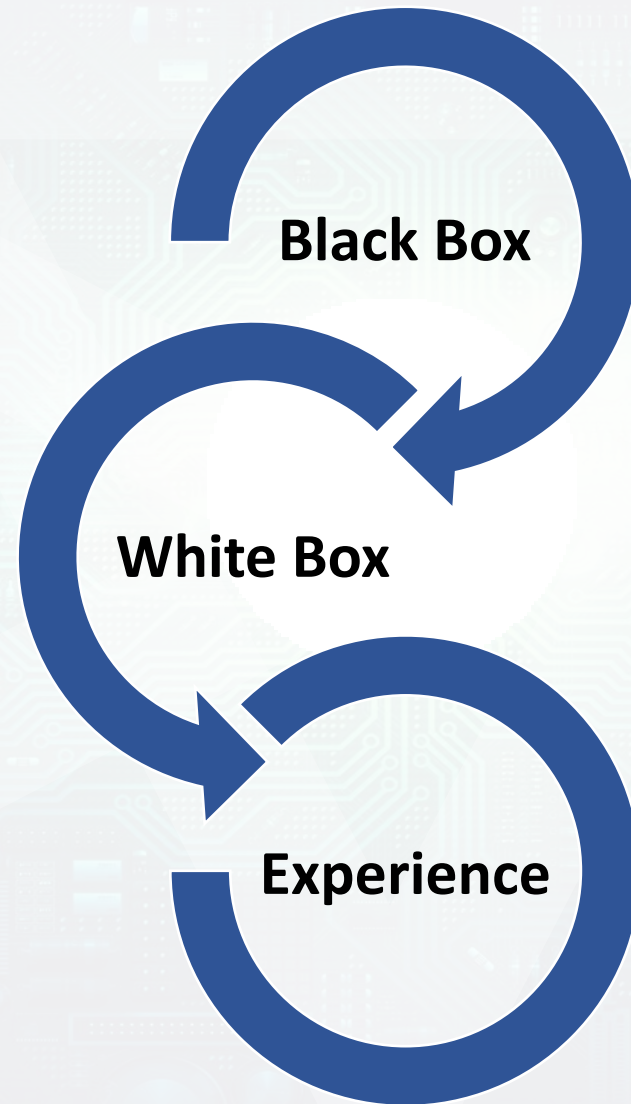
Categories of Test Techniques

Categories of Test Techniques



The purpose of a test technique, is to help in identifying test conditions, test cases, and test data

Test Design Techniques



Test Basis for Test Techniques

| Test Technique | Test Basis |
|------------------|---|
| Black Box | Requirements-Use Cases-User Stories |
| White Box | Architecture analysis-Detailed Design-Internal Structure-Code |
| Experience-based | Knowledge of (Testers-Developers-Users) |

Quiz Time

Quiz Time

- Which one of the following options is categorized as a black-box test technique?
 - A. Techniques based on analysis of the architecture
 - B. Techniques checking that the test object is working according to the technical design
 - C. Techniques based on the expected use of the software
 - D. Techniques based on formal requirements

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 - C. Techniques based on the expected use of the software
 - D. Techniques based on formal requirements**

Quiz Time

- Which of the following test techniques uses the requirements specifications as a test basis?
 - A. Structure-based
 - B. Black-box
 - C. White-box
 - D. Exploratory

Quiz Time

- Which of the following test techniques uses the requirements specifications as a test basis?
 - A. Structure-based
 - B. Black-box**
 - C. White-box
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Quiz Time

- If test cases are derived from looking at the code, what type of test design technique is being used?

- A. Black-box
- B. White-box
- C. Specification-based
- D. Behavior-based

Quiz Time

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- B. White-box**
- C. Specification-based
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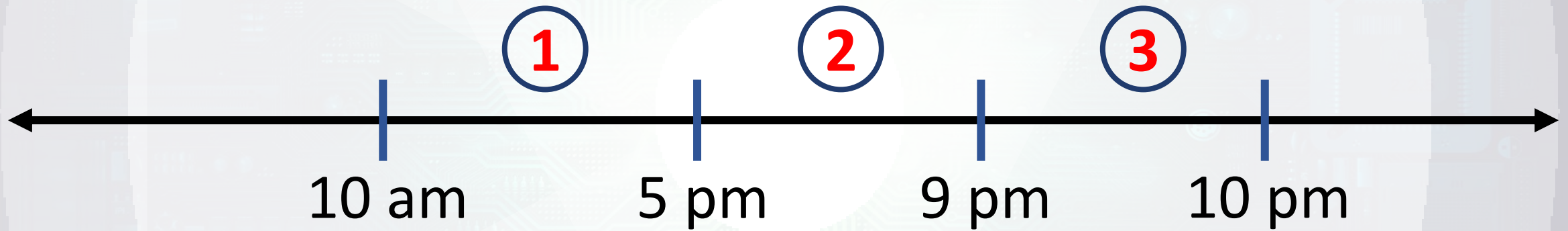
Black-box (Behavioral) Test Techniques

1-Equivalence Partitioning

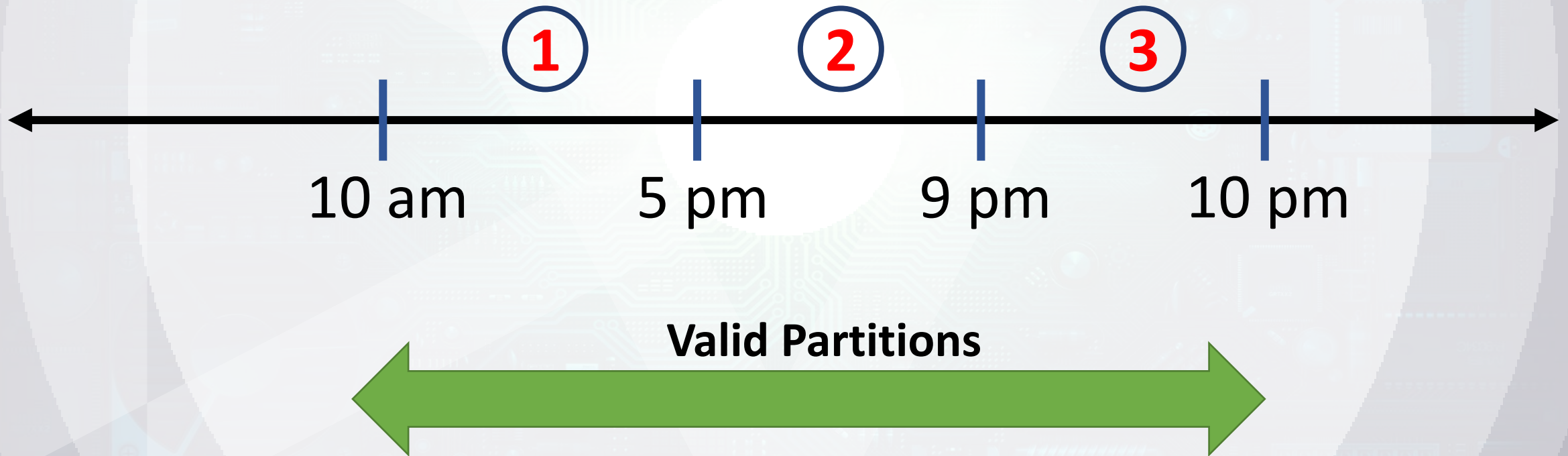
Equivalence Partitioning



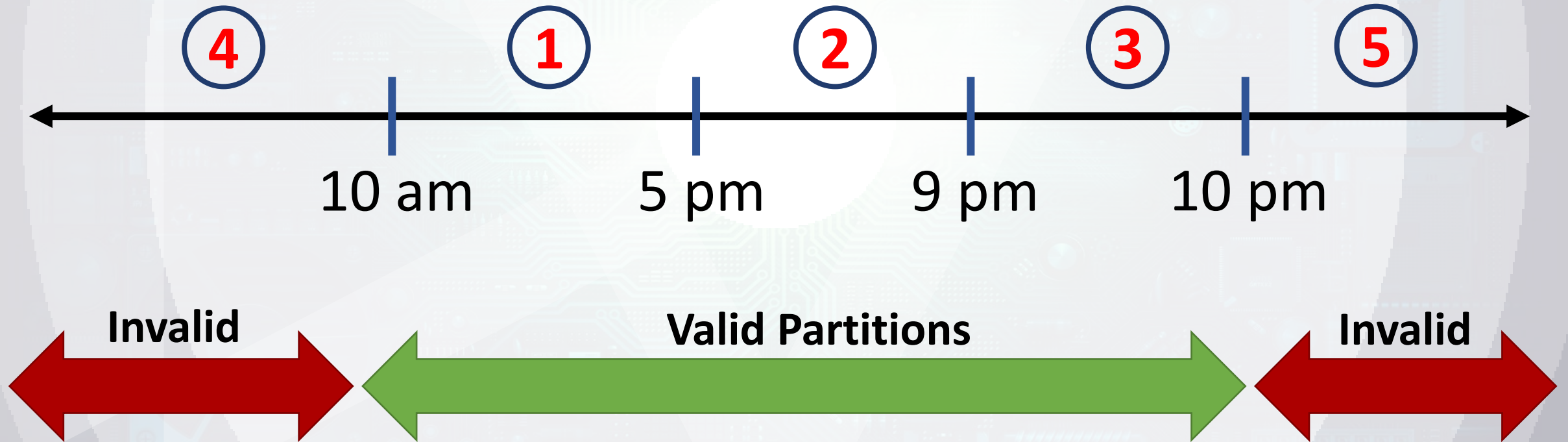
Equivalence Partitioning



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Equivalence Partitioning

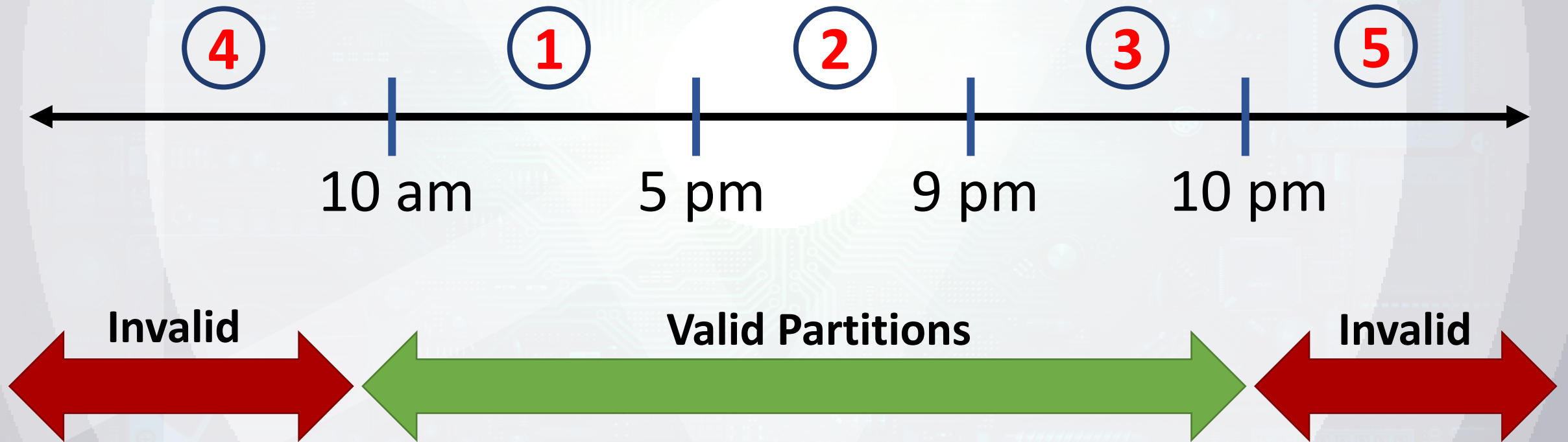
- Partitions are called equivalence classes
- Partition that contains valid values is called a “valid equivalence partition”
- Partition that contains invalid values is called an “invalid equivalence partition”
- Each value must belong to one and only one equivalence partition
- Any partition may be divided into sub partitions if required
- Coverage is measured as the number of equivalence partitions tested by at least one value, divided by the total number of identified equivalence partitions
- When invalid equivalence partitions are used, they should be tested individually

2-Boundary-value Analysis

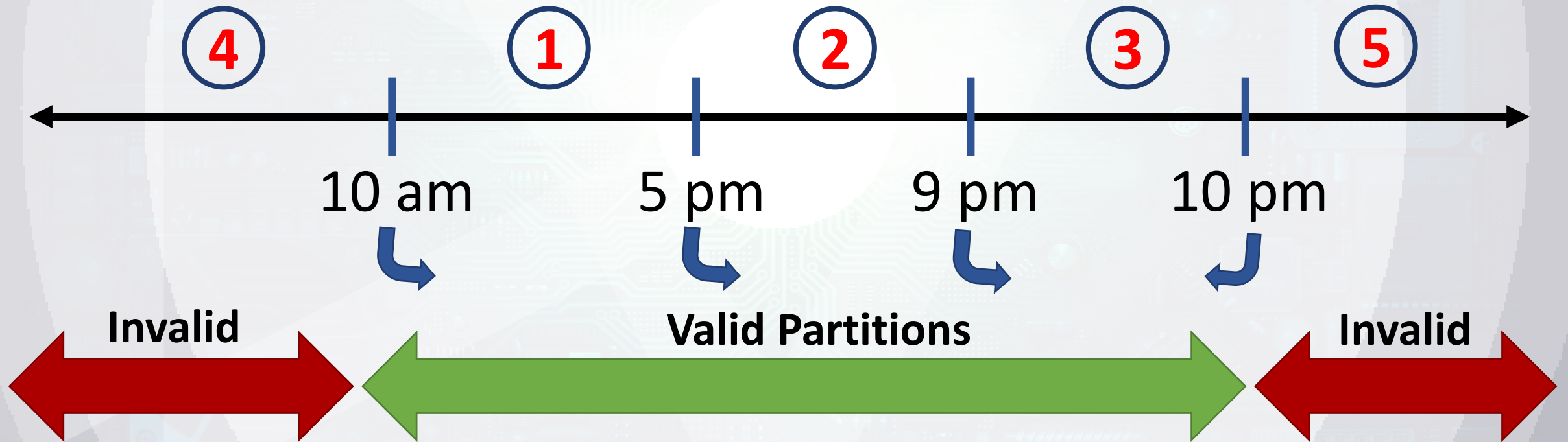
Boundary-Value Analysis



Boundary-Value Analysis



Boundary-Value Analysis



Boundary-Value Analysis

- **Boundary value analysis (BVA) is an extension of equivalence partitioning, but can only be used when the partition is ordered. The minimum and maximum values of a partition are its boundary values.**
- **Some variations of this technique identify three boundary values per boundary : the values before, at, and just over the boundary**
- **Boundary value analysis can be applied at all test levels. This technique is generally used to test requirements that call for a range of numbers**
- **Boundary coverage for a partition is measured as the number of boundary values tested, divided by the total number of identified boundary test values, normally expressed as a percentage**

3-Decision Table Testing

Decision Table Testing

- A Software testing course is created depending on this criteria:
 1. If the trainee is a student, he will get 20 % discount
 2. If the trainee is unemployed, he will get 20 % discount
 3. The trainee can't be both "student & employed" at the same time
 4. If the trainee is a student in (or a graduate from) computer science department, he will be directed to the advanced course group



Decision Table Testing

| Condition | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|-----------|-----|-----|-----|-----|-----|-----|-----|----|
| Graduate | Yes | Yes | Yes | Yes | No | No | No | No |
| Employed | Yes | Yes | No | No | Yes | Yes | No | No |
| CS | Yes | No | Yes | No | Yes | No | Yes | No |

Decision Table Testing

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| CS | Yes | No | Yes | No | Yes | No | Yes | No |
| Actions | | | | | | | | |
| Basics 0 % | | | | | | | | |
| Basics 20 % | | | | | | | | |
| Adv. 0 % | | | | | | | | |
| Adv. 20 % | | | | | | | | |

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Decision Table Testing



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|-------------|-----|-----|------------|-----|-----|-----|-----|----|
| Graduate | Yes | Yes | Don't Care | Yes | No | No | No | No |
| Employed | Yes | Yes | No | No | Yes | Yes | No | No |
| CS | Yes | No | Yes | No | Yes | No | Yes | No |
| Actions | | | | | | | | |
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Decision Table Testing



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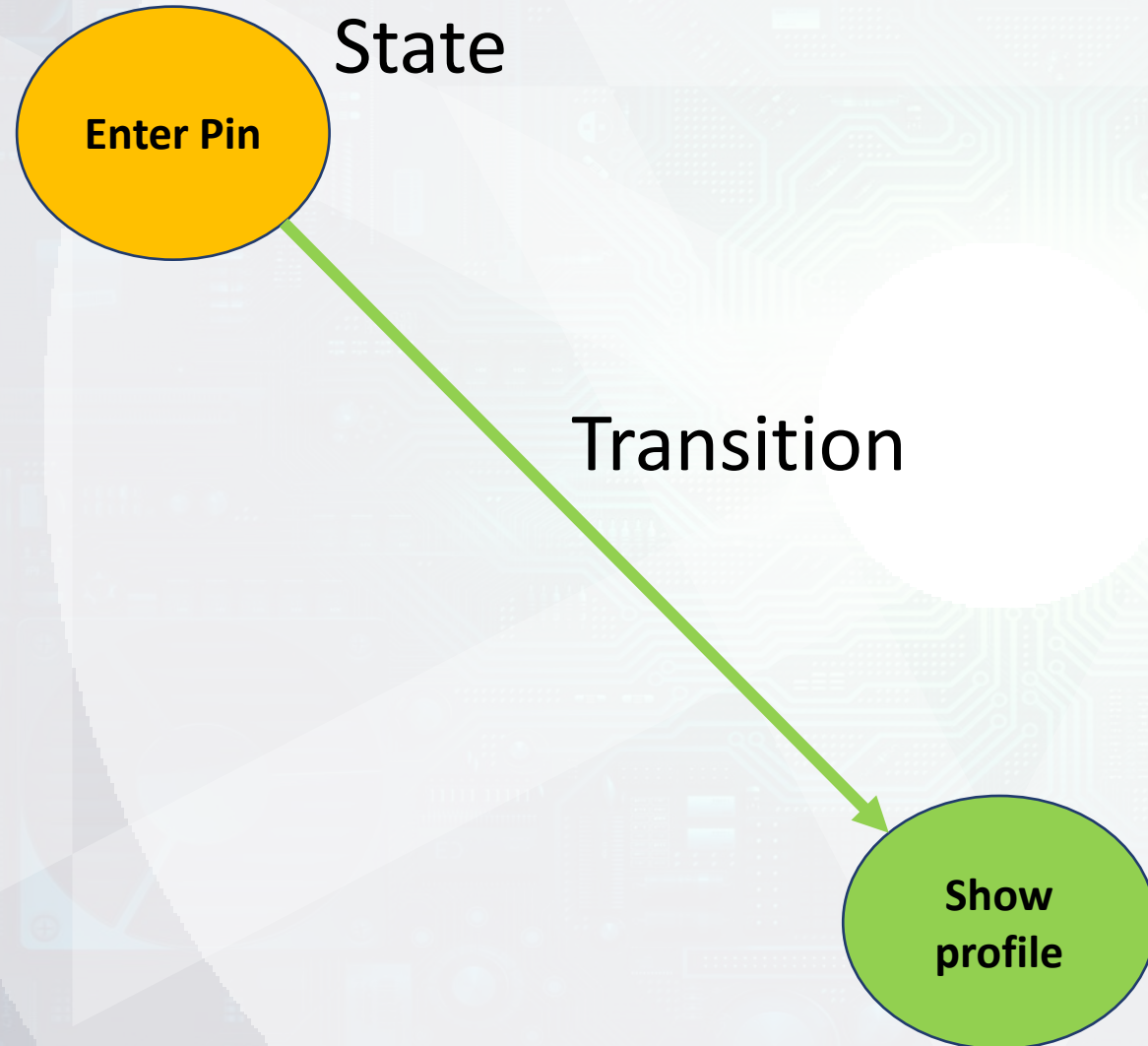
You can apply a trick : Test cases = Number of actions + 1

Decision Table Testing

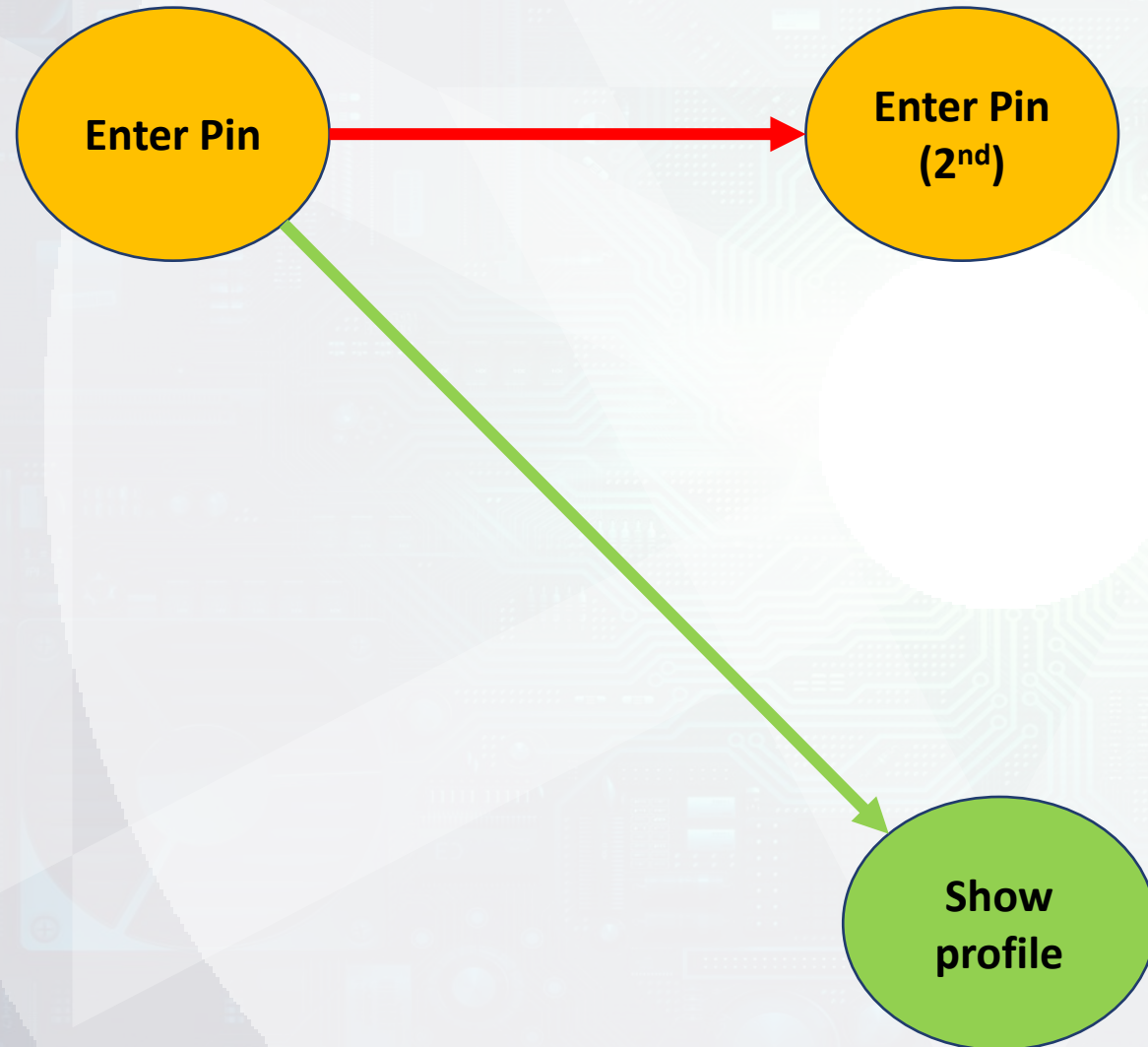
- Each **column** corresponds to a **decision rule** that defines a unique combination of conditions which results in the execution of the actions associated with that rule.
- The values of the conditions and actions are usually shown as **Boolean values (true or false)** or **discrete values** (e.g., red, green, blue), but can also be numbers or ranges of numbers.
- These different types of conditions and actions might be found together in the same table
- The table can be collapsed by deleting columns containing impossible combinations of conditions, columns containing possible but infeasible combinations of conditions, and columns that test combinations of conditions that do not affect the outcome
- The common minimum coverage standard for decision table testing is to have at least one test case per decision rule in the table.
- Coverage is measured as the number of decision rules tested by at least one test case, divided by the total number of decision rules, normally expressed as a percentage

4-State Transition Testing

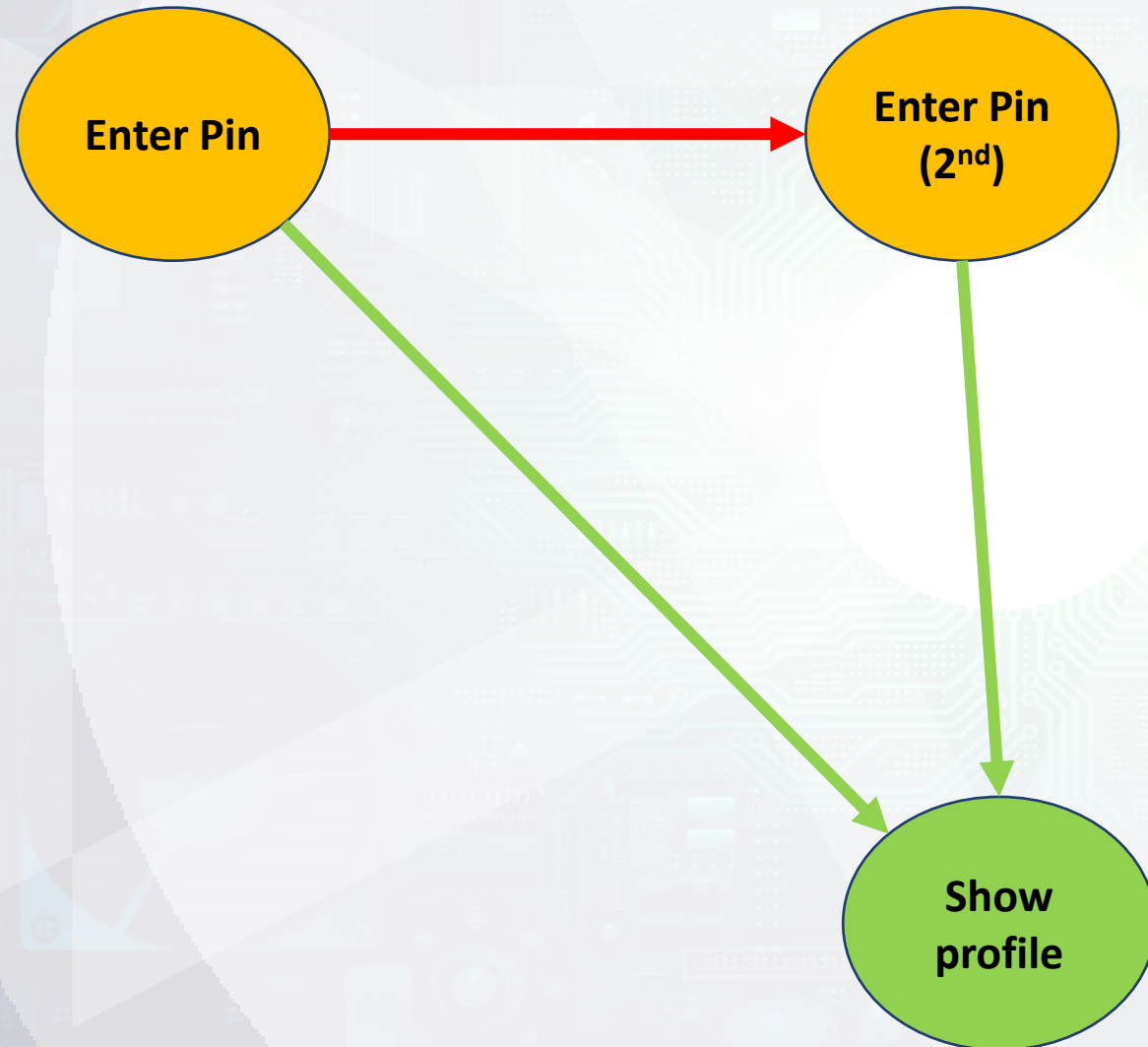
State Transition Testing



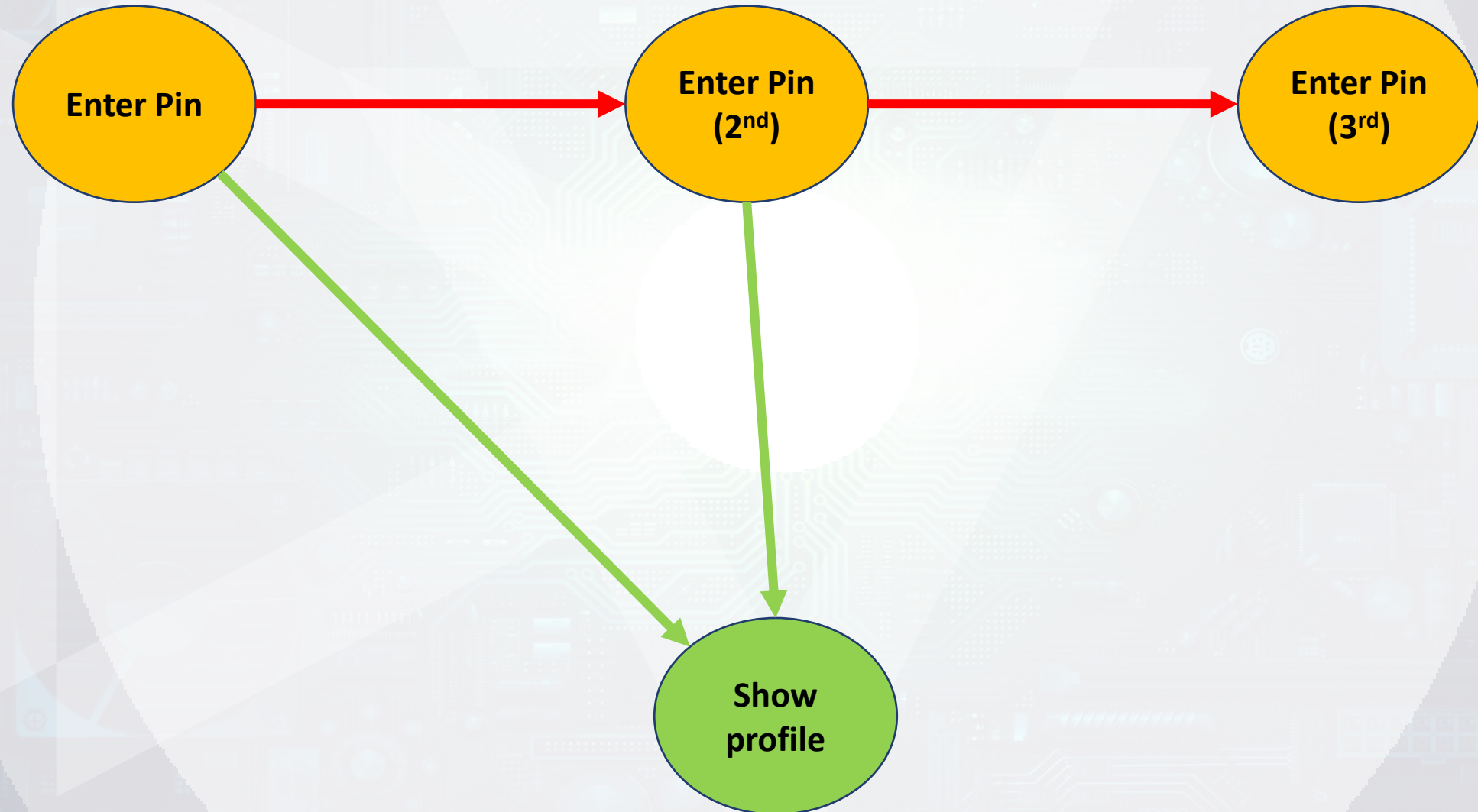
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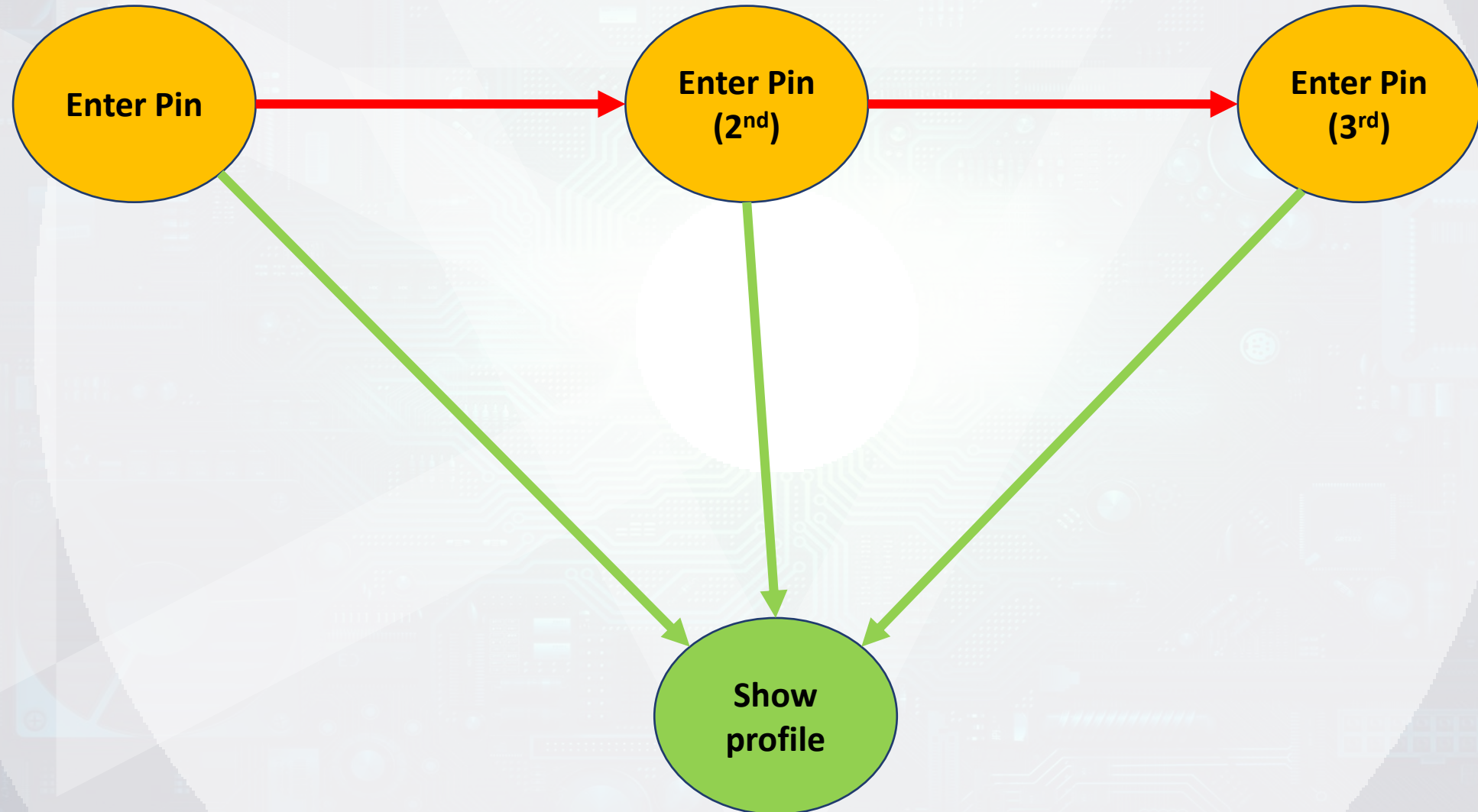
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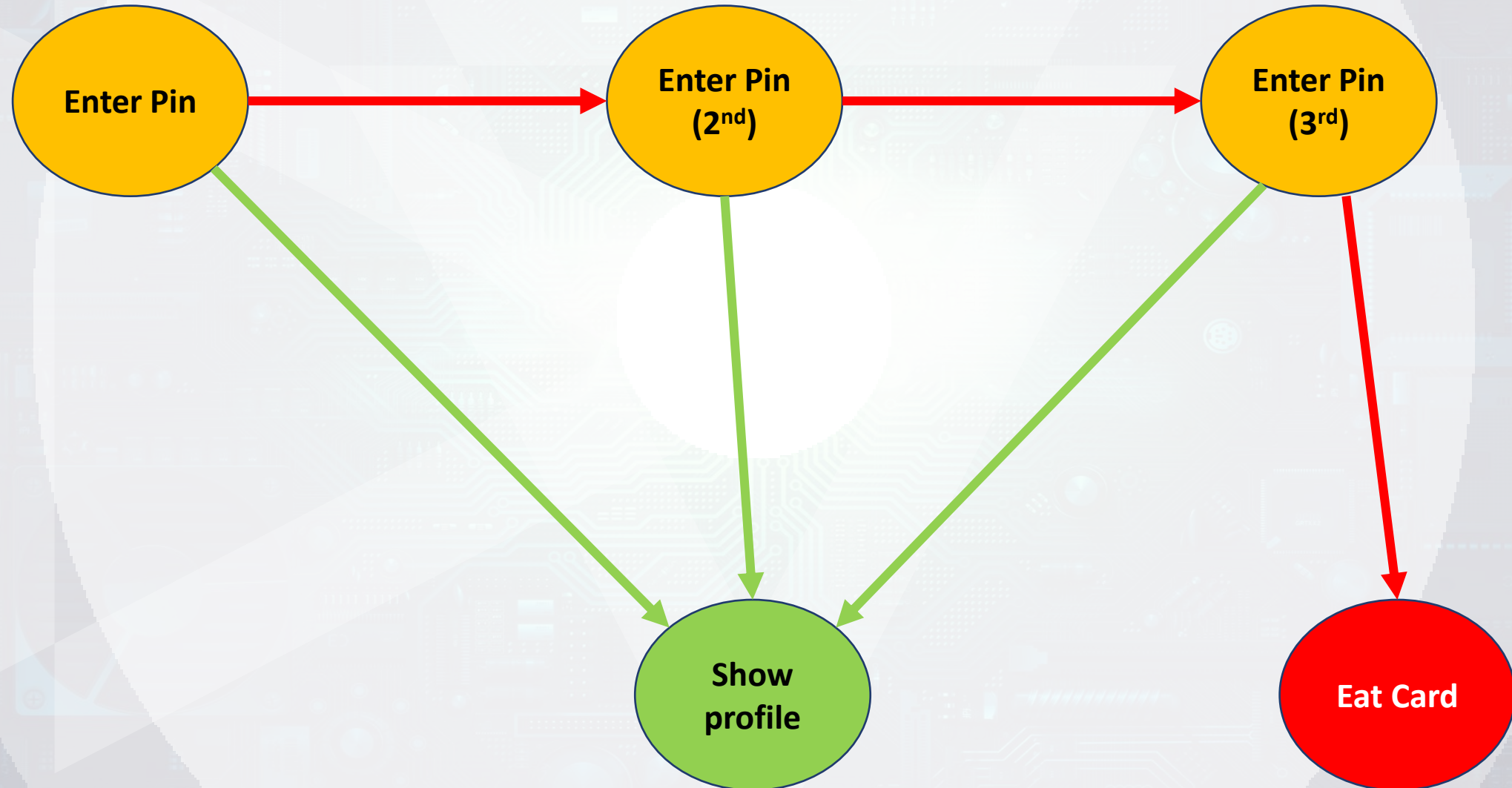
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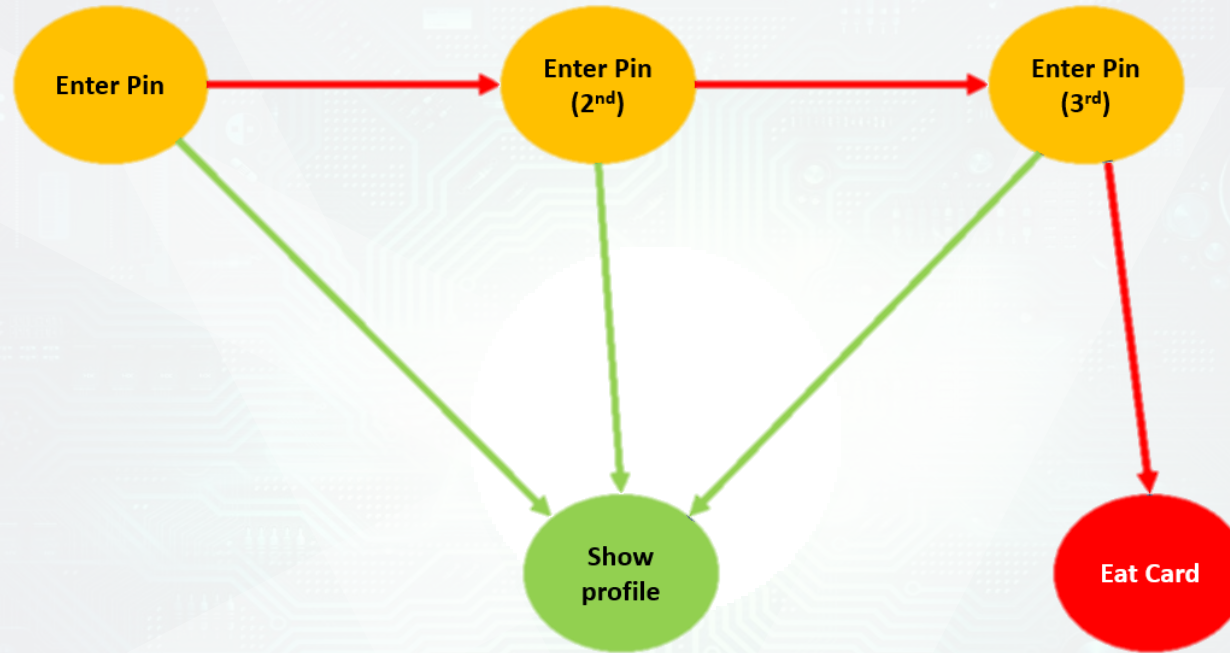
State Transition Testing



State Transition Testing

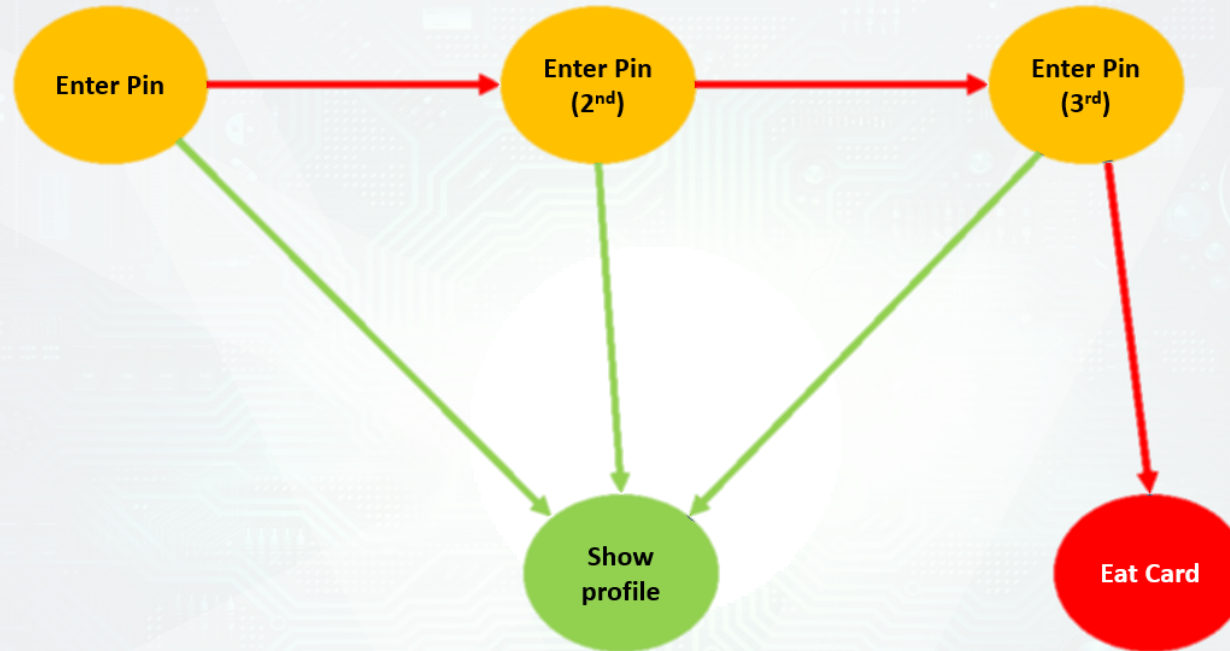


State Transition Testing



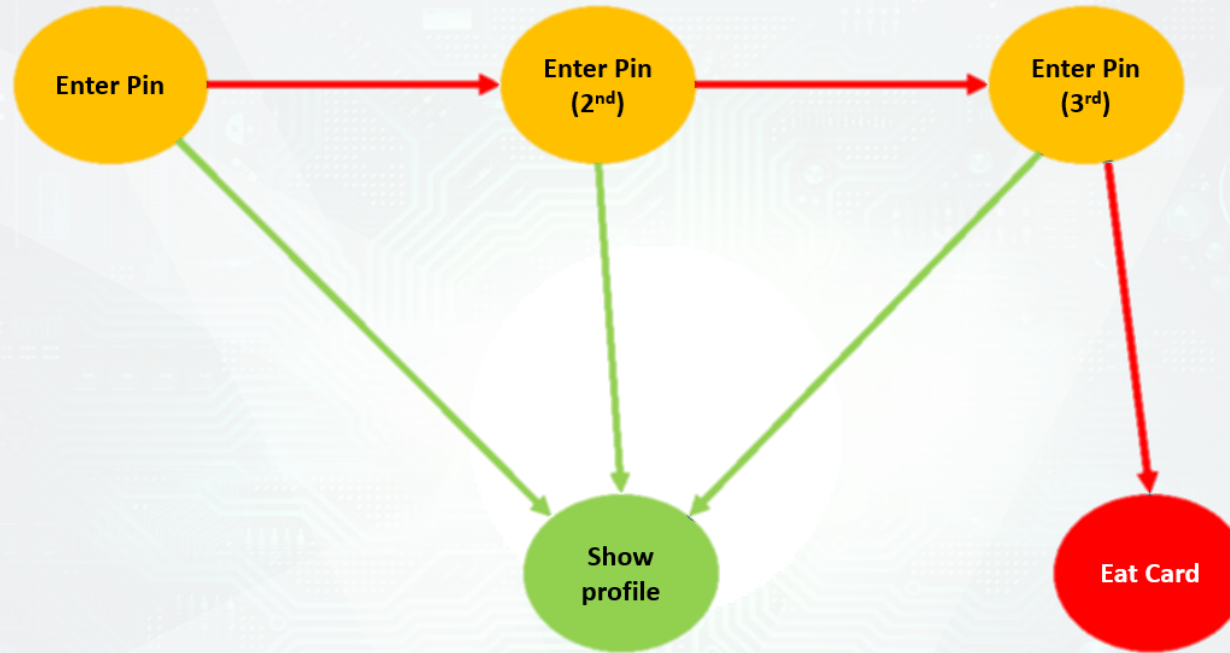
How many Test cases are required to cover all states ?

State Transition Testing



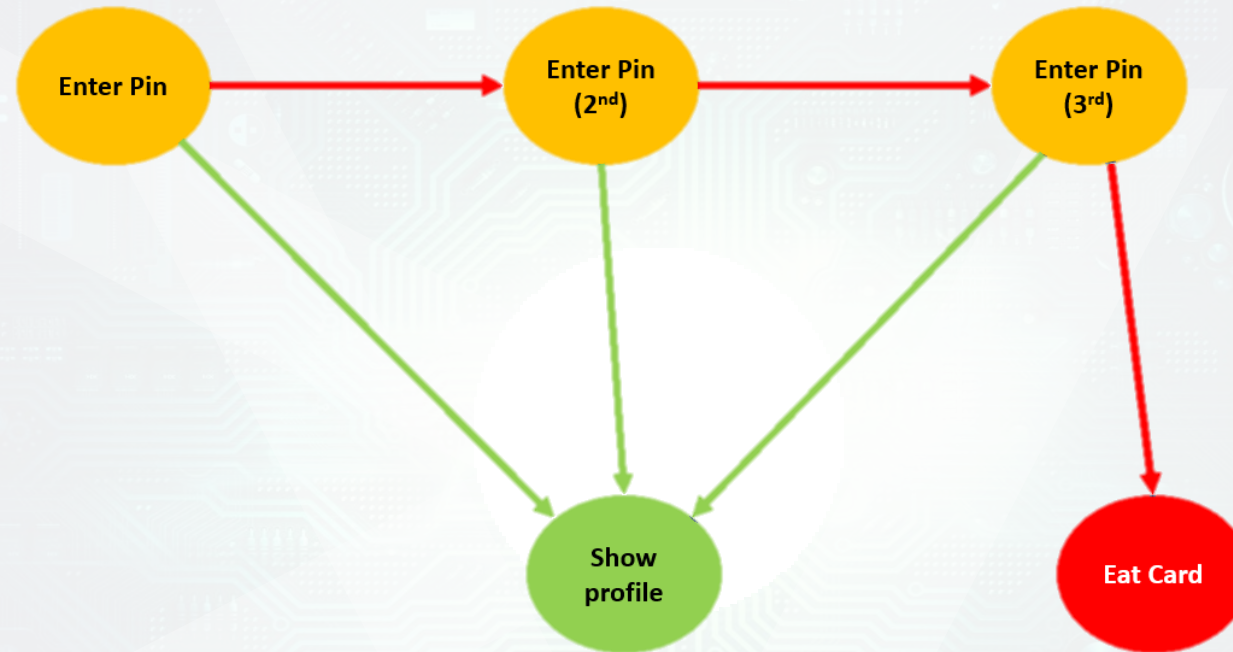
How many Test cases are required to cover all states ? 2

State Transition Testing



How many Test cases are required to cover all transitions?

State Transition Testing



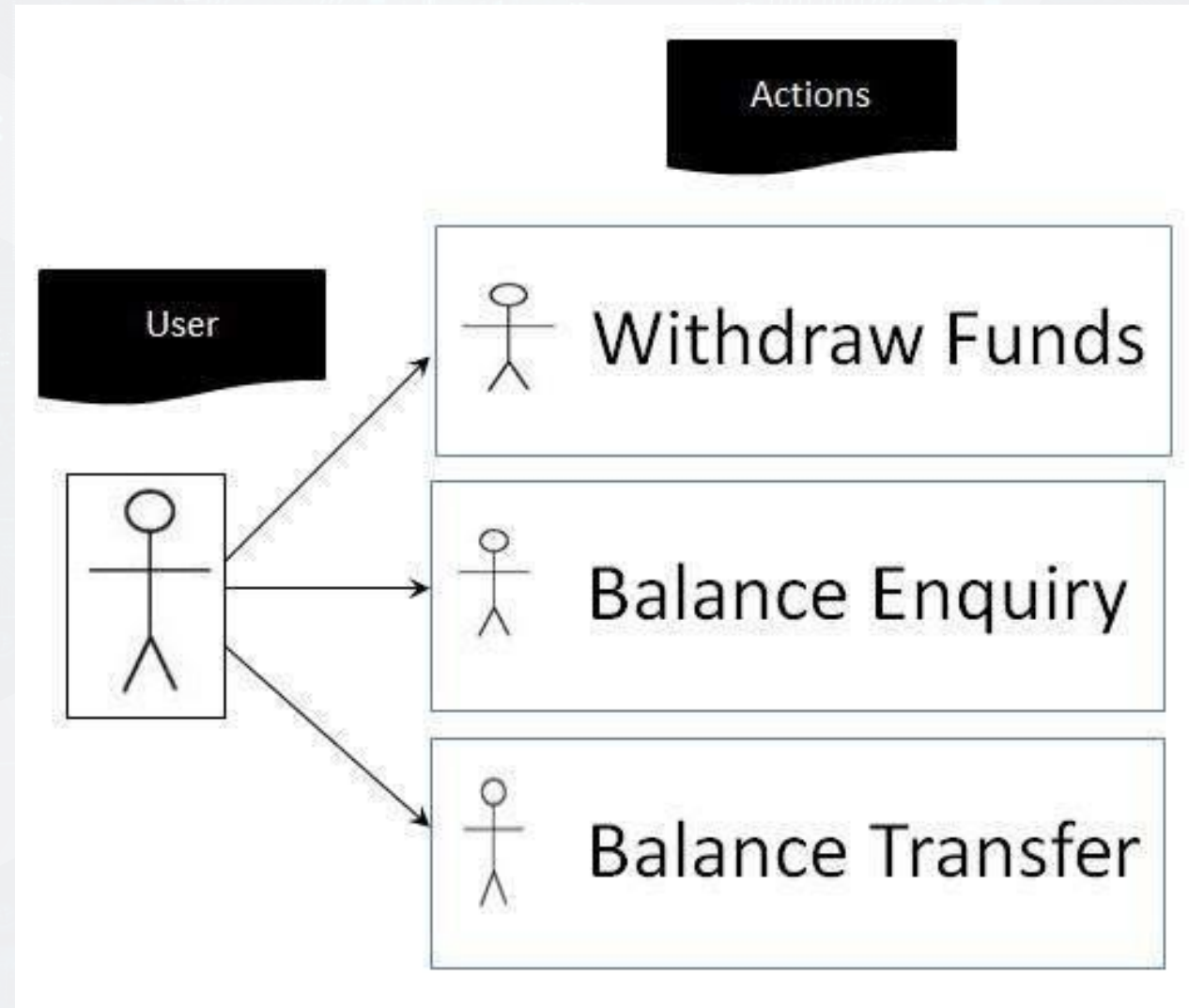
How many Test cases are required to cover all transitions? 4

State Transition Testing

- A state transition diagram shows the possible software states, as well as how the software enters, exits, and transitions between states
- A transition is initiated by an event (e.g., user input of a value into a field). The event results in a transition
- The state change may result in the software taking an action (e.g., outputting a calculation or error message)
- A state transition table shows all valid transitions and potentially invalid transitions between states
- State transition diagrams normally show only the valid transitions and exclude the invalid transitions
- Tests can be designed to cover a typical sequence of states, to exercise all states, to exercise every transition, to exercise specific sequences of transitions, or to test invalid transitions
- Coverage is commonly measured as the number of identified states or transitions tested, divided by the total number of identified states or transitions in the test object, normally expressed as a percentage

5-Use Case Testing

Use Case Testing



Use Case Testing

| Main Success Scenario A: Actor S: System | Step | Description |
|---|------|--|
| | 1 | A: Inserts card |
| | 2 | S: Validates card and asks for PIN |
| | 3 | A: Enters PIN |
| | 4 | S: Validates PIN |
| | 5 | S: Allows access to account |
| Extensions | 2a | Card not valid S: Display message and reject card |
| | 4a | PIN not valid S: Display message and ask for re-try (twice) |
| | 4b | PIN invalid 3 times S: Eat card and Exit |

A Partial Use Case for PIN Entry



Use Case Testing

- Use cases are associated with actors (human users, external hardware, or other components or systems) and subjects (the component or system to which the use case is applied).
- Each use case specifies some behavior that a subject can perform in collaboration with one or more actors
- A use case can be described by interactions and activities, as well as preconditions, postconditions and natural language where appropriate.
- A use case can include possible variations of its basic behavior, including exceptional behavior and error handling
- Tests are designed to exercise the defined behaviors
- Coverage can be measured by the percentage of use case behaviors tested divided by the total number of use case behaviors, normally expressed as a percentage

Quiz Time

Quiz Time

- An employee's bonus is to be calculated. It cannot be negative, but it can be calculated down to zero. The bonus is based on the length of employment.
 - The categories are: less than or equal to 2 years, more than 2 years but less than 5 years, 5 or more years, but less than 10 years, 10 years or longer.
 - What is the minimum number of test cases required to cover all valid equivalence partitions for calculating the bonus?
- A. 3
B. 5
C. 2
D. 4

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- What is the minimum number of test cases required to cover all valid equivalence partitions for calculating the bonus?

- A. 3
- B. 5
- C. 2
- D. 4

Quiz Time

- A speed control and reporting system has the following characteristics:
 - If you drive 50 km/h or less, nothing will happen.
 - If you drive faster than 50 km/h, but 55 km/h or less, you will be warned.
 - If you drive faster than 55 km/h but not more than 60 km/h, you will be fined.
 - If you drive faster than 60 km/h, your driving license will be suspended.
-
- Which would be the most likely set of values (km/h) identified by two-point boundary value analysis?
- A. 0, 49, 50, 54, 59, 60
 - B. 50, 55, 60
 - C. 49, 50, 54, 55, 60, 62
 - D. 50, 51, 55, 56, 60, 61

Quiz Time

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 - C. 49, 50, 54, 55, 60, 62
 - D. 50, 51, 55, 56, 60, 61**

Quiz Time

- A company's employees are paid bonuses if they work more than a year in the company and achieve individually agreed targets.
- The following decision table has been designed to test the logic for paying bonuses:
- Which test cases could be eliminated in the above decision table because the test case wouldn't occur in a real situation?

- A. T1 and T2
- B. T3 and T4
- C. T7 and T8
- D. T5 and T6

| | | T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 |
|------------|-----------------------------|-----|----|-----|-----|-----|-----|-----|-----|
| Conditions | | | | | | | | | |
| Cond1 | Employed more than 1 year ? | Yes | No | Yes | No | Yes | No | Yes | No |
| Cond2 | Agreed Target ? | No | No | Yes | Yes | No | No | Yes | Yes |
| Cond3 | Achieved Target ? | No | No | No | No | Yes | Yes | Yes | Yes |
| Actions | | | | | | | | | |
| | Bonus Payment ? | No | No | No | No | No | No | Yes | No |

Quiz Time

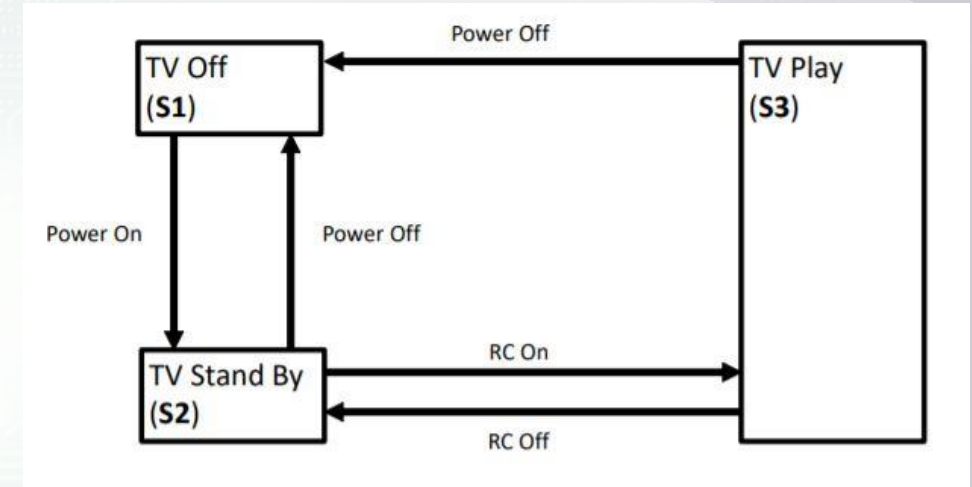
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| Conditions | | | | | | | | | |
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| Cond2 | Agreed Target ? | No | No | Yes | Yes | No | No | Yes | Yes |
| Cond3 | Achieved Target ? | No | No | No | No | Yes | Yes | Yes | Yes |
| Actions | | | | | | | | | |
| | Bonus Payment ? | No | No | No | No | No | No | Yes | No |

Quiz Time

- Which of the following statements about the given state transition diagram and table of test cases is TRUE?
- a. The given test cases can be used to cover both valid and invalid transitions in the state transition diagram
 - b. The given test cases represent all possible valid transitions in the state transition diagram
 - c. The given test cases represent only some of the valid transitions in the state transition diagram.
 - d. The given test cases represent sequential pairs of transitions in the state transition diagram

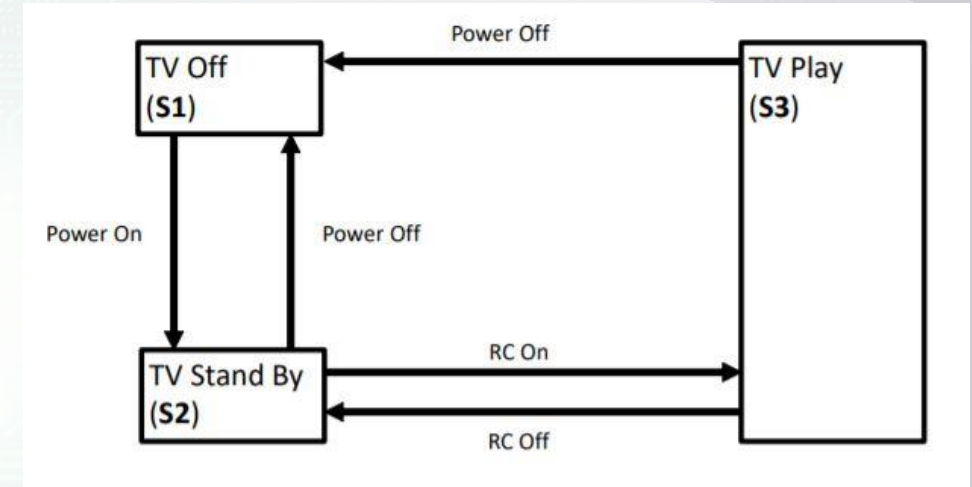


| Test Case | 1 | 2 | 3 | 4 | 5 |
|----------------------|----------|-----------|-------|--------|-----------|
| Start State | S1 | S2 | S2 | S3 | S3 |
| Input | Power On | Power Off | RC On | RC Off | Power Off |
| Expected Final State | S2 | S1 | S3 | S2 | S1 |

Quiz Time

- Which of the following statements about the given state transition diagram and table of test cases is TRUE?

- a. The given test cases can be used to cover both valid and invalid transitions in the state transition diagram
- b. The given test cases represent all possible valid transitions in the state transition diagram**
- c. The given test cases represent only some of the valid transitions in the state transition diagram.
- d. The given test cases represent sequential pairs of transitions in the state transition diagram



| Test Case | 1 | 2 | 3 | 4 | 5 |
|----------------------|----------|-----------|-------|--------|-----------|
| Start State | S1 | S2 | S2 | S3 | S3 |
| Input | Power On | Power Off | RC On | RC Off | Power Off |
| Expected Final State | S2 | S1 | S3 | S2 | S1 |

Quiz Time

- A video application has the following requirement: The application shall allow playing a video on the following display sizes:
 1. 640x480.
 2. 1280x720.
 3. 1600x1200.
 4. 1920x1080.

Which of the following list of test cases is a result of applying the Equivalence Partitioning test technique to test this requirement?

- A. Verify that the application can play a video on a display of size 1920x1080 (1 test)
- B. Verify that the application can play a video on a display of size 640x480 and 1920x1080 (2 tests).
- C. Verify that the application can play a video on each of the display sizes in the requirement (4 tests)
- D. Verify that the application can play a video on any one of the display sizes in the requirement (1 test)

Quiz Time

- A video application has the following requirement: The application shall allow playing a video on the following display sizes:

1. 640x480.
2. 1280x720.
3. 1600x1200.
4. 1920x1080.

Which of the following list of test cases is a result of applying the Equivalence Partitioning test technique to test this requirement?

- A. Verify that the application can play a video on a display of size 1920x1080 (1 test)
- B. Verify that the application can play a video on a display of size 640x480 and 1920x1080 (2 tests).
- C. Verify that the application can play a video on each of the display sizes in the requirement (4 tests)**
- D. Verify that the application can play a video on any one of the display sizes in the requirement (1 test)

Quiz Time

- Which of the following is an extension of equivalence partitioning?
- A. Decision Tables
 - B. Decision testing
 - C. Boundary value analysis
 - D. State transition testing

Quiz Time

- Which of the following is an extension of equivalence partitioning?
 - A. Decision Tables
 - B. Decision testing
 - C. Boundary value analysis**
 - D. State transition testing

Quiz Time

- Which of the following best describes the behaviors defined in a use case that should be covered by tests?
 - A. Positive path and negative path
 - B. Basic, exception and error
 - C. Normal, error, data, and integration
 - D. Control flow, data flow and decision paths

Quiz Time

- Which of the following best describes the behaviors defined in a use case that should be covered by tests?
 - A. Positive path and negative path
 - B. Basic, exception and error**
 - C. Normal, error, data, and integration
 - D. Control flow, data flow and decision paths

Quiz Time

- You are testing a machine that scores exam papers and assigns grades. Based on the score achieved the grades are as follows:

1-49 = F, 50-59 = D-, 60-69 = D, 70-79 = C, 80-89 = B, 90-100=A

If you apply equivalence partitioning, how many test cases will you need to achieve minimum test coverage?

- A. 6
- B. 8
- C. 10
- D. 12

Quiz Time

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D. 12

Quiz Time

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If you apply boundary value analysis, how many test cases will you need to achieve minimum test coverage?

- A. 8
- B. 10
- C. 12
- D. 14

Quiz Time

- You are testing a machine that scores exam papers and assigns grades. Based on the score achieved the grades are as follows:

1-49 = F, 50-59 = D-, 60-69 = D, 70-79 = C, 80-89 = B, 90-100=A

If you apply boundary value analysis, how many test cases will you need to achieve minimum test coverage?

A. 8

B. 10

C. 12

D. 14

Quiz Time

- You have been given the following conditions and results from those condition combinations. Given this information, using the decision table technique, what is the minimum number of test cases you would need to test these conditions?

- A. 7
- B. 13
- C. 15
- D. 18

| Conditions |
|-------------------|
| Valid Cash |
| Valid Credit Card |
| Valid Debit Card |
| Valid Pin |
| Bank accepts |
| Valid selection |
| Item in stock |
| Results: |
| Reject cash |
| Reject card |
| Error message |
| Return cash |
| Refund card |
| Sell item |

Quiz Time

- You have been given the following conditions and results from those condition combinations. Given this information, using the decision table technique, what is the minimum number of test cases you would need to test these conditions?

- A. 7
- B. 13
- C. 15**
- D. 18

| Conditions |
|-------------------|
| Valid Cash |
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| Bank accepts |
| Valid selection |
| Item in stock |
| Results: |
| Reject cash |
| Reject card |
| Error message |
| Return cash |
| Refund card |
| Sell item |

Quiz Time

- You have been given the following requirement:
 - A user must log in to the system with a valid username and password. If they fail to enter the correct combination three times, they will receive an error and will have to wait 10 minutes before trying again. The test terminates when the user successfully logs in.
 - How many test cases are needed to provide 100% state transition coverage?
- A. 1
B. 2
C. 4
D. 5

Quiz Time

- You have been given the following requirement:
 - A user must log in to the system with a valid username and password. If they fail to enter the correct combination three times, they will receive an error and will have to wait 10 minutes before trying again. The test terminates when the user successfully logs in.
 - How many test cases are needed to provide 100% state transition coverage?
- A. 1
B. 2
C. 4
D. 5

Quiz Time

- You are testing a thermostat for a heating/air conditioning system. You have been given the following requirements:
 - When the temperature is below 70 degrees, turn on the heating system
 - When the temperature is above 75 degrees, turn on the air conditioning system
 - When the temperature is between 70 and 75 degrees, inclusive, turn on fan only
- Which of the following is the minimum set of test temperature values to achieve 100% two-value boundary value analysis coverage?

- A. 70,75
- B. 65,72,80
- C. 69,70,75,76
- D. 70,71,74,75,76

Quiz Time

- You are testing a thermostat for a heating/air conditioning system. You have been given the following requirements:
 - When the temperature is below 70 degrees, turn on the heating system
 - When the temperature is above 75 degrees, turn on the air conditioning system
 - When the temperature is between 70 and 75 degrees, inclusive, turn on fan only

Which of the following is the minimum set of test temperature values to achieve 100% two-value boundary value analysis coverage?

- A. 70,75
- B. 65,72,80
- C. 69,70,75,76**
- D. 70,71,74,75,76

Quiz Time

- You are testing a scale system that determines shipping rates for a regional web-based auto parts distributor. You want to group your test conditions to minimize the testing. Identify how many equivalence classes are necessary for the following range. Weights are rounded to the nearest pound

| Weight | 1 to 10 lbs | 11 to 25 lbs. | 26 to 50 lbs. | 51 lbs. and up |
|---------------|-------------|---------------|---------------|----------------|
| Shipping cost | \$ 5.00 | \$ 7.50 | \$ 12.00 | \$ 17.00 |

- a. 8
- b. 6
- c. 5
- d. 4

Quiz Time

- You are testing a scale system that determines shipping rates for a regional web-based auto parts distributor. You want to group your test conditions to minimize the testing. Identify how many equivalence classes are necessary for the following range. Weights are rounded to the nearest pound

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|---------------|-------------|---------------|---------------|----------------|
| Shipping cost | \$ 5.00 | \$ 7.50 | \$ 12.00 | \$ 17.00 |

- a. 8
- b. 6
- c. 5
- d. 4

Quiz Time

- You are testing a scale system that determines shipping rates for a regional web-based auto parts distributor. Due to regulations, shipments cannot exceed 100 lbs. You want to include boundary value analysis as part of your black-box test design.
- How many tests will you need to execute to achieve 100% two-value boundary value analysis?

| Weight | 1 to 10 lbs | 11 to 25 lbs. | 26 to 50 lbs. | 51 lbs. to 100 |
|---------------|-------------|---------------|---------------|----------------|
| Shipping cost | \$ 5.00 | \$ 7.50 | \$ 12.00 | \$ 17.00 |

- a. 4
- b. 8
- c. 10
- d. 12

Quiz Time

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|---------------|-------------|---------------|---------------|----------------|
| Shipping cost | \$ 5.00 | \$ 7.50 | \$ 12.00 | \$ 17.00 |

- a. 4
- b. 8
- c. 10
- d. 12

Quiz Time

- Which of the following is the correct decision table for the following pseudocode for ordering a hamburger ?
- Note : if you add or delete items from the basic burger, you no longer get the basic burger.

| Test # | 1 | 2 | 3 | 4 | 5 | 6 |
|----------------|---|---|---|---|---|---|
| Conditions | | | | | | |
| Add items | Y | Y | N | N | N | N |
| Delete items | N | N | Y | Y | N | N |
| Add fries | Y | N | Y | N | Y | N |
| Results | | | | | | |
| Basic burger | Y | Y | N | N | Y | Y |
| Burger – items | N | N | Y | Y | N | N |
| Added items | Y | Y | N | N | N | N |
| Fries | N | N | Y | N | Y | N |

Table (1)

```
Start;  
Select basic burger  
If customer adds items  
    while items to be added  
        Ask customer which item  
        Add item  
    End while  
End if  
If customer deletes items  
    while items to be deleted  
        Ask customers which item  
        Delete item  
    End while  
End if  
If customer wants fries  
    Add fries to order  
End if  
Complete order  
End
```

Quiz Time

- Which of the following is the correct decision table for the following pseudocode for ordering a hamburger ?
- Note : if you add or delete items from the basic burger, you no longer get the basic burger.

| Test # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---------------|---|---|---|---|---|---|---|---|
| Conditions | | | | | | | | |
| Add items | Y | Y | Y | Y | N | N | N | N |
| Delete items | Y | Y | N | N | Y | Y | N | N |
| Add fries | Y | N | Y | N | Y | N | Y | N |
| Results | | | | | | | | |
| Basic burger | N | N | N | N | N | N | Y | Y |
| Deleted items | Y | Y | N | N | Y | Y | N | N |
| Added items | Y | Y | Y | Y | N | N | N | N |
| Fries | Y | N | Y | N | Y | N | Y | N |

```
Start;  
Select basic burger  
If customer adds items  
    while items to be added  
        Ask customer which item  
        Add item  
    End while  
End if  
If customer deletes items  
    while items to be deleted  
        Ask customers which item  
        Delete item  
    End while  
End if  
If customer wants fries  
    Add fries to order  
End if  
Complete order  
End
```


Quiz Time

- Which of the following is the correct decision table for the following pseudocode for ordering a hamburger ?
- Note : if you add or delete items from the basic burger, you no longer get the basic burger.

| Test # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|----------------|---|---|---|---|---|---|---|---|
| Conditions | | | | | | | | |
| Add items | Y | Y | Y | Y | N | N | N | N |
| Delete items | N | N | N | N | Y | Y | Y | Y |
| Add fries | Y | N | Y | N | Y | N | Y | N |
| Results | | | | | | | | |
| Basic burger | Y | Y | Y | Y | N | N | N | N |
| Burger – items | N | N | N | N | Y | Y | Y | Y |
| Added items | Y | Y | Y | Y | N | N | N | N |
| Fries | Y | N | N | N | Y | N | Y | N |

```
Start;  
Select basic burger  
If customer adds items  
    while items to be added  
        Ask customer which item  
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End if  
If customer deletes items  
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        Ask customers which item  
        Delete item  
    End while  
End if  
If customer wants fries  
    Add fries to order  
End if  
Complete order  
End
```

Quiz Time

- Which of the following is the correct decision table for the following pseudocode for ordering a hamburger ?
- Note : if you add or delete items from the basic burger, you no longer get the basic burger.

| Test # | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|----------------|---|---|---|---|---|---|---|---|
| Conditions | | | | | | | | |
| Add items | Y | Y | Y | Y | N | N | N | N |
| Delete items | Y | Y | N | N | Y | Y | N | N |
| Add fries | Y | N | Y | N | Y | N | Y | N |
| Results | | | | | | | | |
| Basic burger | Y | Y | Y | Y | N | N | Y | Y |
| Burger – items | N | N | N | N | Y | Y | N | N |
| Added items | Y | Y | Y | Y | N | N | N | N |
| Fries | Y | N | N | N | Y | N | Y | N |

```
Start;  
Select basic burger  
If customer adds items  
    while items to be added  
        Ask customer which item  
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End if  
If customer deletes items  
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        Ask customers which item  
        Delete item  
    End while  
End if  
If customer wants fries  
    Add fries to order  
End if  
Complete order  
End
```

Quiz Time

- Which of the following is the correct decision table for the following pseudocode for ordering a hamburger ?
- Note : if you add or delete items from the basic burger, you no longer get the basic burger.

- A. Table 1
- B. Table 2
- C. Table 3
- D. Table 4

```
Start;  
Select basic burger  
If customer adds items  
    while items to be added  
        Ask customer which item  
        Add item  
    End while  
End if  
If customer deletes items  
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        Ask customers which item  
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    End while  
End if  
If customer wants fries  
    Add fries to order  
End if  
Complete order  
End
```


Quiz Time

- Which of the following is the correct decision table for the following pseudocode for ordering a hamburger ?
- Note : if you add or delete items from the basic burger, you no longer get the basic burger.

A. Table 1

B. Table 2

C. Table 3

D. Table 4

```
Start;  
Select basic burger  
If customer adds items  
    while items to be added  
        Ask customer which item  
        Add item  
    End while  
End if  
If customer deletes items  
    while items to be deleted  
        Ask customers which item  
        Delete item  
    End while  
End if  
If customer wants fries  
    Add fries to order  
End if  
Complete order  
End
```

Quiz Time

• You are testing an e-commerce transaction that has the following states and transitions:

1. Login (invalid) > Login
2. Login > Search
3. Search > Search
4. Search > Shopping Cart
5. Shopping Cart > Search
6. Shopping Cart > Checkout
7. Checkout > Search
8. Checkout > Logout

For a state transition diagram, how many transitions should be shown?

- A. 4
- B. 6
- C. 8
- D. 16

Quiz Time

• You are testing an e-commerce transaction that has the following states and transitions:

1. Login (invalid) > Login
2. Login > Search
3. Search > Search
4. Search > Shopping Cart
5. Shopping Cart > Search
6. Shopping Cart > Checkout
7. Checkout > Search
8. Checkout > Logout

For a state transition diagram, how many transitions should be shown?

- A. 4
- B. 6
- C. 8**
- D. 16

Quiz Time

- You are testing a banking application that allows a customer to withdraw 20, 100 or 500 dollars in a single transaction. The values are chosen from a drop-down list and no other values may be entered. How many equivalence partitions need to be tested to achieve 100% equivalence partition coverage?
- A. 1
 - B. 2
 - C. 3
 - D. 4

Quiz Time

- You are testing a banking application that allows a customer to withdraw 20, 100 or 500 dollars in a single transaction. The values are chosen from a drop-down list and no other values may be entered. How many equivalence partitions need to be tested to achieve 100% equivalence partition coverage?

- A. 1
- B. 2
- C. 3
- D. 4**



White-box Test Techniques

Statement Coverage

```
graph TD; A((Statement Coverage)) --> B((Achieve 100 % SC)); B --> C((Measure SC)); C --> A;
```

Statement
Coverage

Achieve
100 % SC

Measure
SC

Quiz Time

- Given the following program fragment:
- What is the minimum number of test cases needed to achieve 100% statement coverage?

- A. 1
- B. 2
- C. 3
- D. 4

```
If x = 3  
Print ("hello")
```


Quiz Time

- Given the following program fragment:
- What is the minimum number of test cases needed to achieve 100% statement coverage?

```
If x = 3  
Print ("hello")
```

- A. 1
- B. 2
- C. 3
- D. 4

Quiz Time

• How many test cases are necessary to achieve 100 % statement coverage

A. 1

B. 4

C. 3

D. 2

```
Print sum (int a, int b) {  
    int result = a + b;  
    if (result > 0)  
        print ("red", result)  
    else if (result < 0)  
        print ("blue", result)  
}
```

Quiz Time

• How many test cases are necessary to achieve 100 % statement coverage

A. 1

B. 4

C. 3

D. 2

```
Print sum (int a, int b) {  
    int result = a + b;  
    if (result > 0)  
        print ("red", result)  
    else if (result < 0)  
        print ("blue", result)  
}
```


Quiz Time

- Given the following program fragment:
- What is the minimum number of test cases needed to achieve 100% statement coverage?

- A. 1
- B. 2
- C. 3
- D. 4

```
If day =Monday
    then statement a
Else
    statement b
End if
```

Quiz Time

- Given the following program fragment:
- What is the minimum number of test cases needed to achieve 100% statement coverage?

- A. 1
- B. 2**
- C. 3
- D. 4

```
If day =Monday
    then statement a
Else
    statement b
End if
```

How to measure statement coverage ?

$$\text{Statement coverage} = \frac{\text{Number of statements covered}}{\text{Total number of statements}}$$

Quiz Time

Quiz Time

- Which one of the following is the BEST description of statement coverage?
 - a. It is a metric which is used to calculate and measure the percentage of test cases that have been executed
 - b. It is a metric, which is used to calculate and measure the percentage of statements in the source code which have been executed
 - c. It is a metric, which is used to calculate and measure the number of statements in the source code which have been executed by test cases that are passed
 - d. It is a metric that give a true/false confirmation if all statements are covered or not

Quiz Time

- Which one of the following is the BEST description of statement coverage?
 - a. It is a metric which is used to calculate and measure the percentage of test cases that have been executed
 - b. It is a metric, which is used to calculate and measure the percentage of statements in the source code which have been executed**
 - c. It is a metric, which is used to calculate and measure the number of statements in the source code which have been executed by test cases that are passed
 - d. It is a metric that give a true/false confirmation if all statements are covered or not

Quiz Time

- How is statement coverage determined?
 - a. Number of test decision points divided by the number of test cases
 - b. Number of decision outcomes tested divided by the total number of executable statements
 - c. Number of possible test case outcomes divided by the total number of function points
 - d. Number of executable statements tested divided by the total number of executable statements

Quiz Time

- How is statement coverage determined?
 - a. Number of test decision points divided by the number of test cases
 - b. Number of decision outcomes tested divided by the total number of executable statements
 - c. Number of possible test case outcomes divided by the total number of function points
 - d. **Number of executable statements tested divided by the total number of executable statements**

Decision Coverage


```
graph TD; A((Decision Coverage)) --> B((Achieve 100 % DC)); A --> C((Measure DC))
```

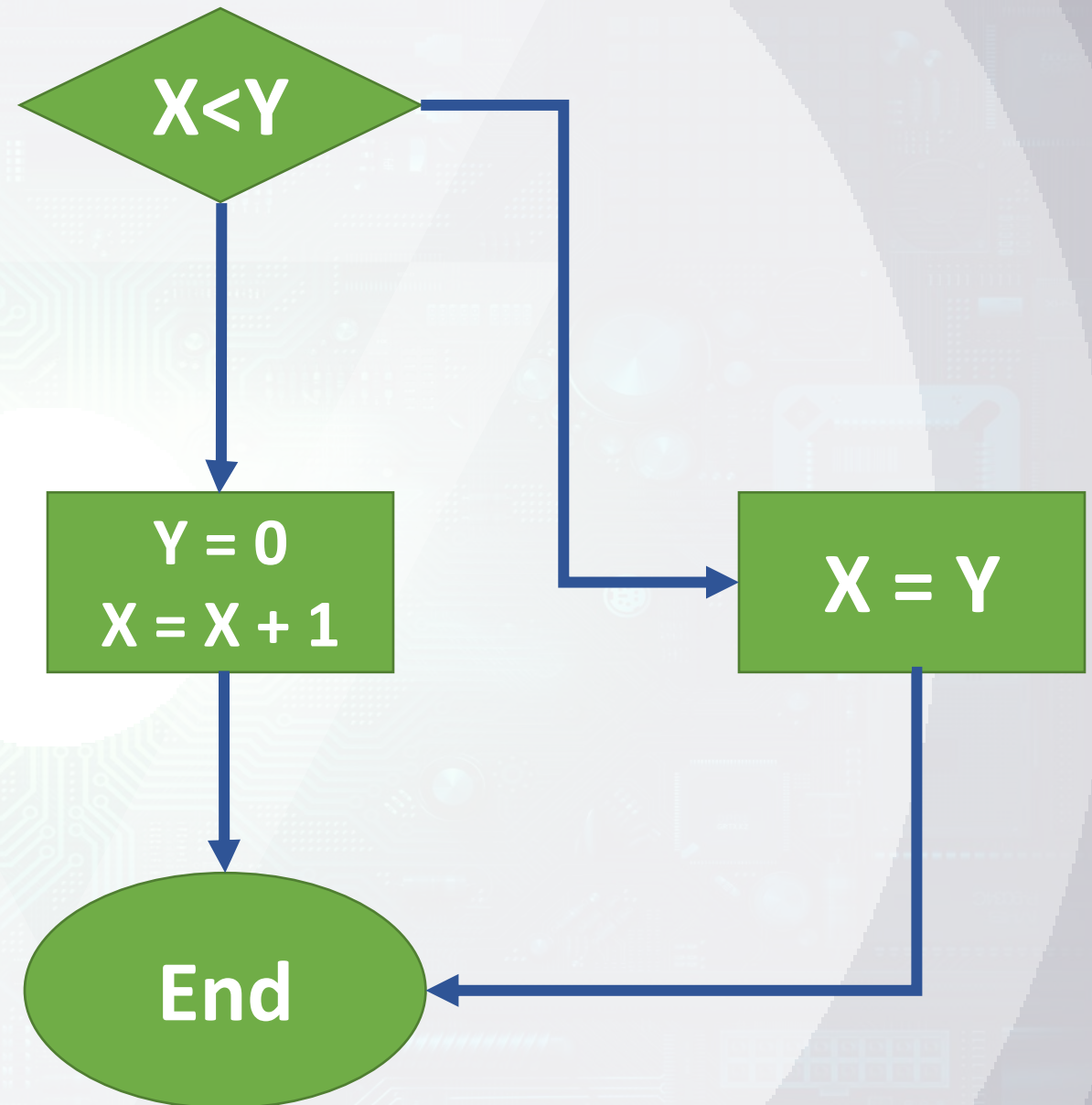
Decision
Coverage

Achieve
100 %
DC

Measure
DC



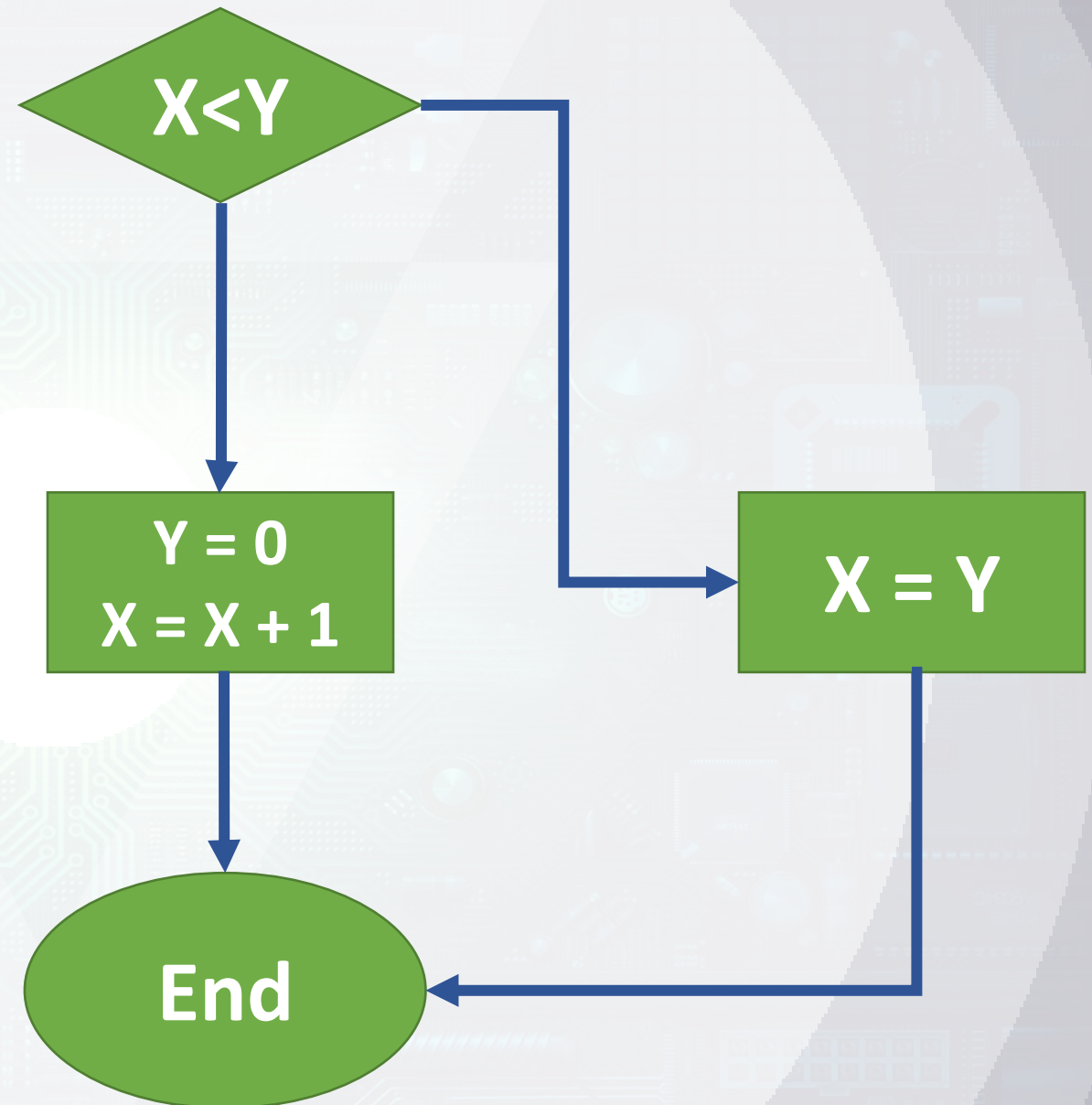
```
If  $X < Y$   
   $Y = 0$ ;  
   $X = X + 1$  ;  
Else  
   $X = Y$  ;
```



How many Test cases are required to achieve 100 % decision coverage ?

```
If  $X < Y$   
   $Y = 0$ ;  
   $X = X + 1$  ;  
Else  
   $X = Y$  ;
```

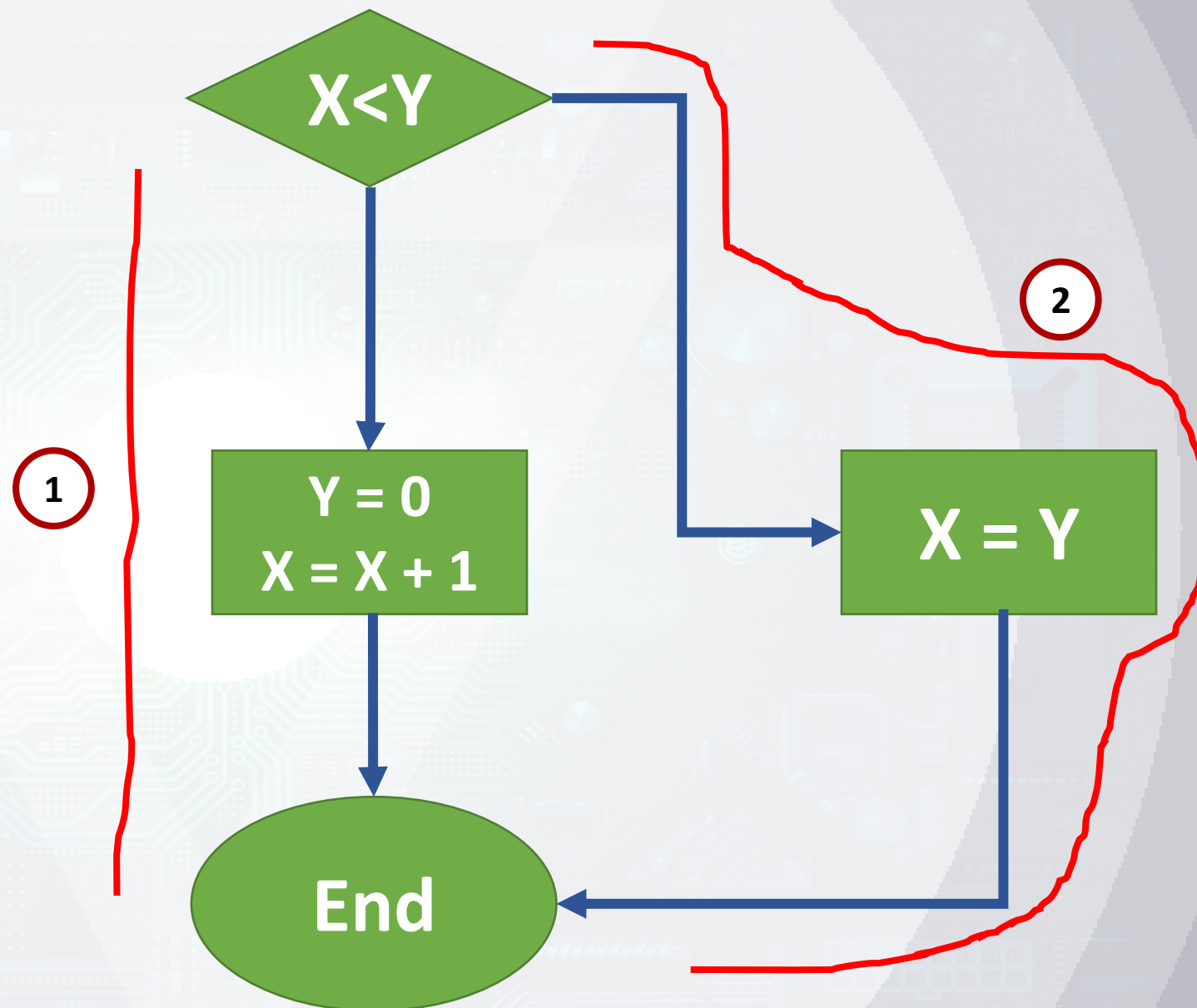
1



How many Test cases are required to achieve 100 % decision coverage ?

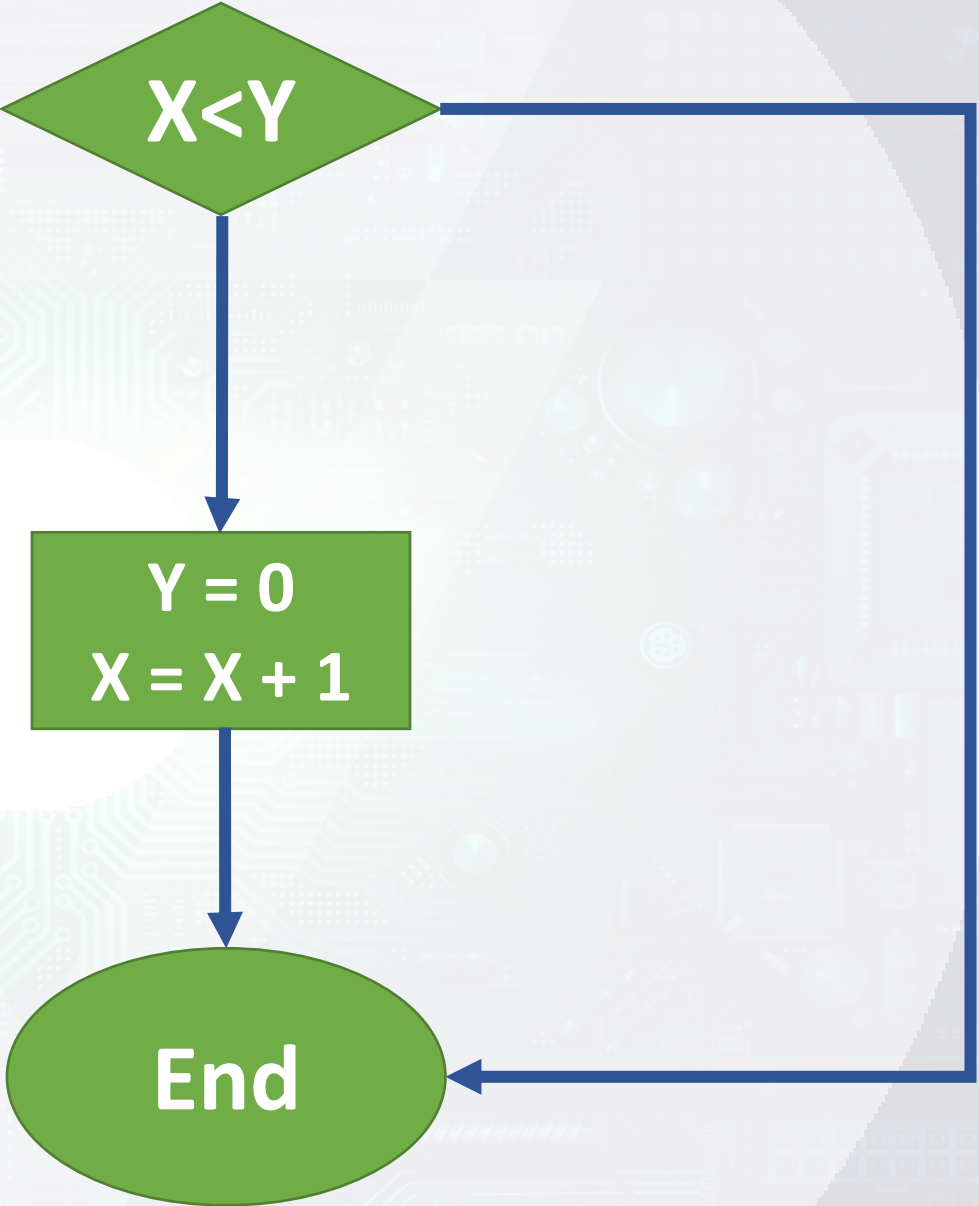

```
If X < Y  
Y = 0;  
X = X + 1 ;  
Else  
X = Y ;
```

How many Test cases are required to achieve 100 % decision coverage ?



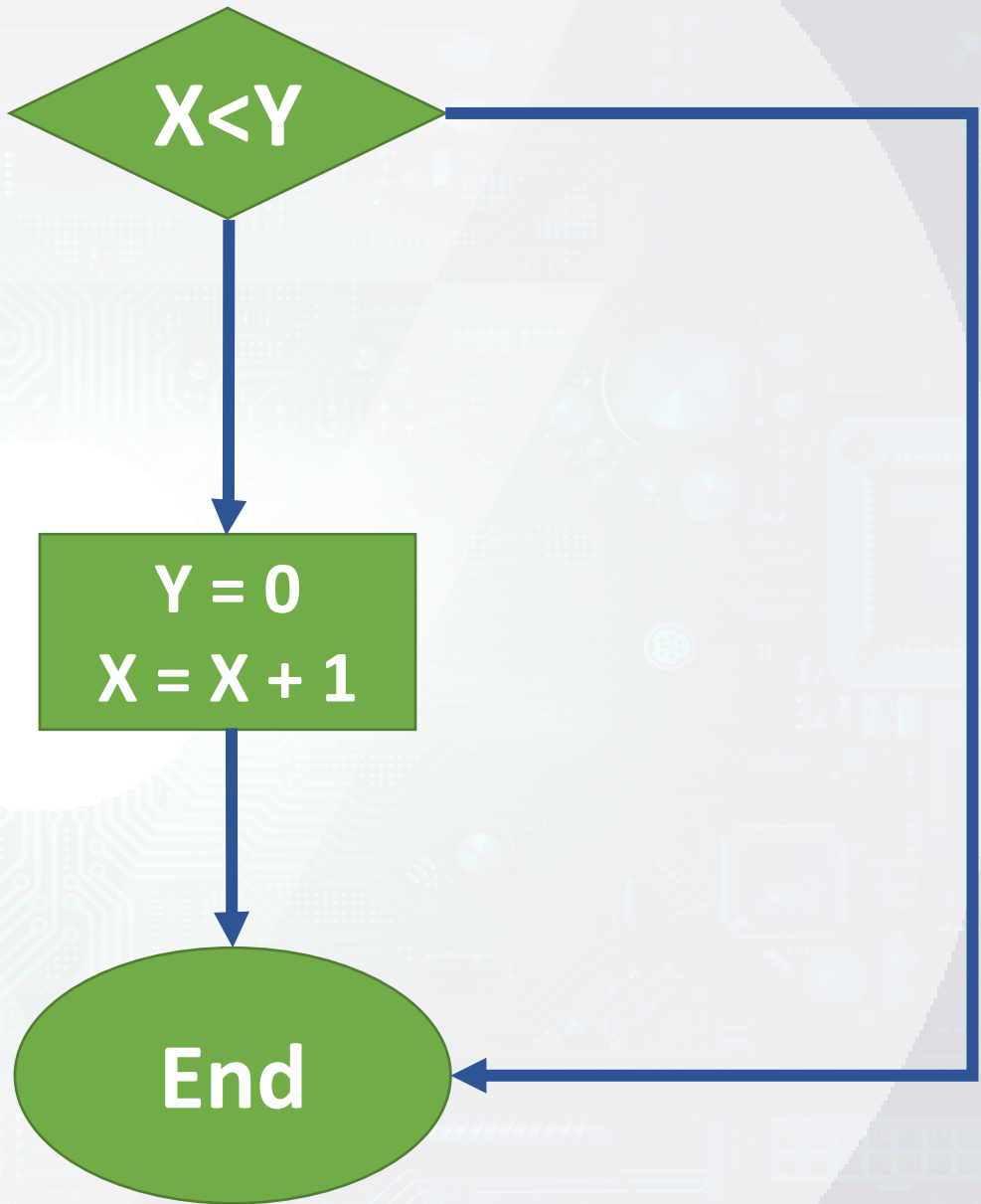
**If $X < Y$
 $Y = 0$;
 $X = X + 1$;**

How many Test cases are required to achieve 100 % decision coverage ?



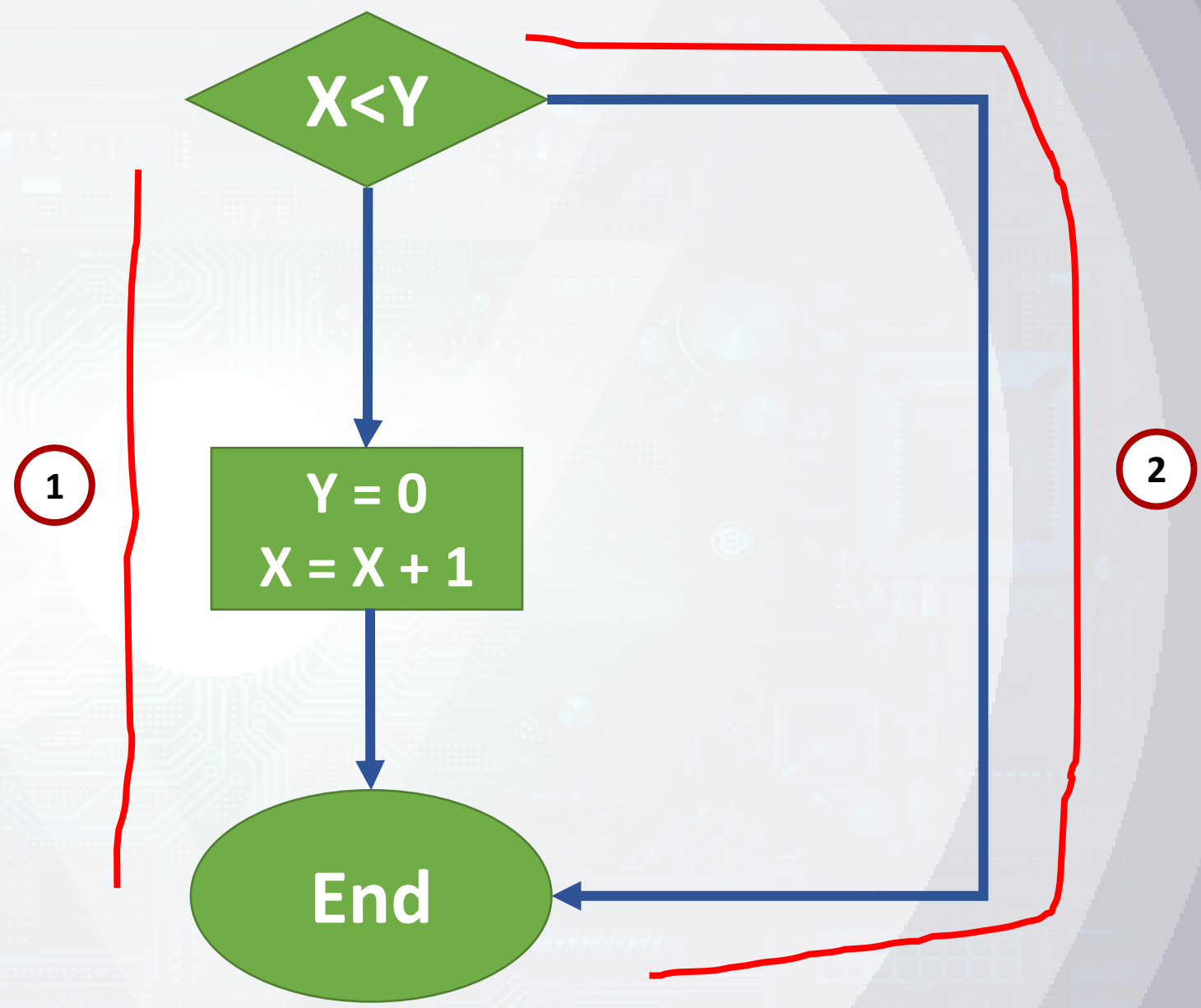
**If $X < Y$
 $Y = 0$;
 $X = X + 1$;**

1



How many Test cases are required to achieve 100 % decision coverage ?

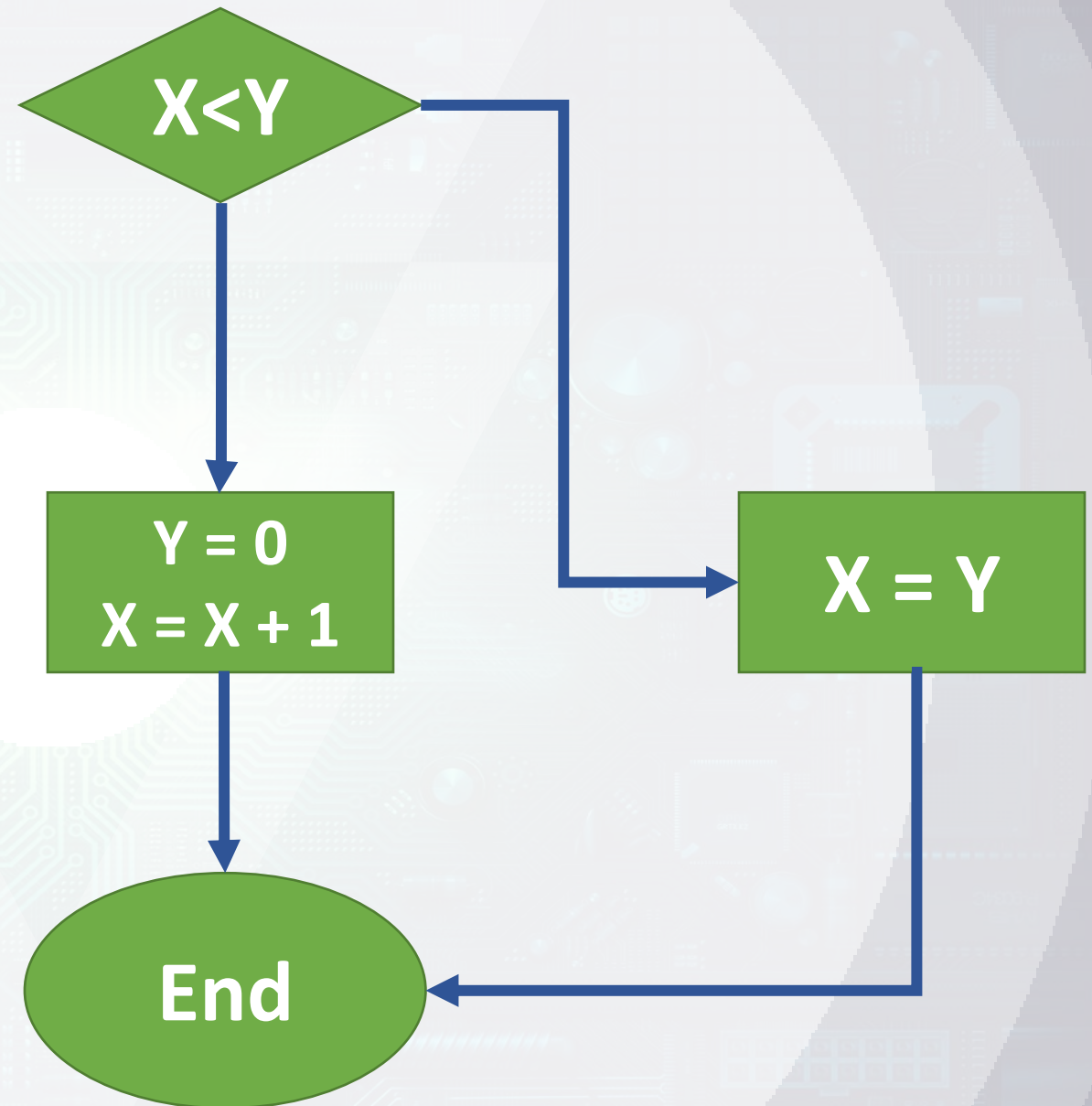
**If $X < Y$
 $Y = 0;$
 $X = X + 1;$**



How many Test cases are required to achieve 100 % decision coverage ?

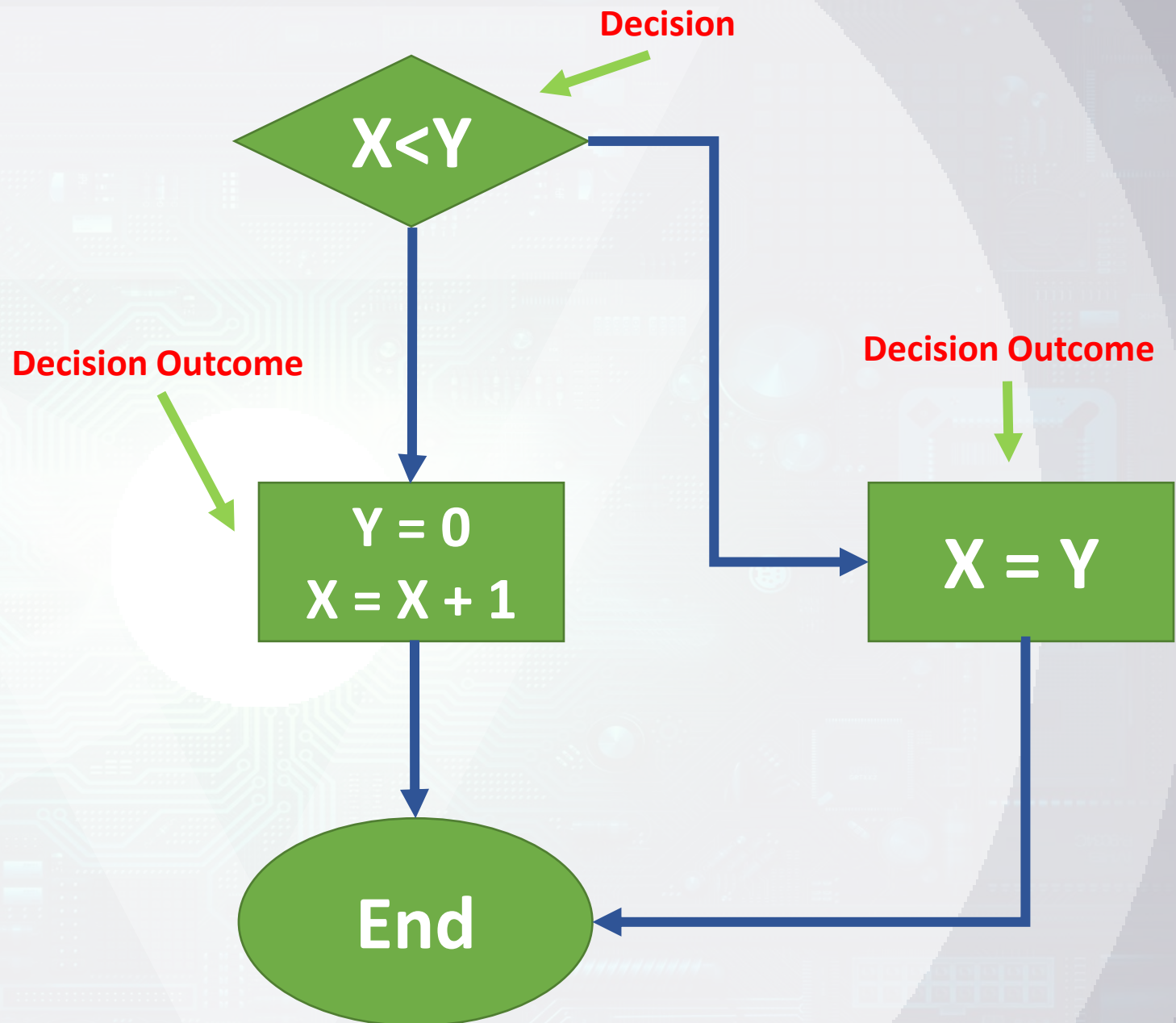
```
If  $X < Y$   
   $Y = 0$ ;  
   $X = X + 1$  ;  
Else  
   $X = Y$  ;
```

What is the difference between a decision and a decision outcome ?



```
If X < Y  
Y = 0;  
X = X + 1 ;  
Else  
X = Y ;
```

What is the difference between a decision and a decision outcome ?



How to measure decision coverage ?

$$\textit{Decision coverage} = \frac{\textit{Number of Decision Outcomes Covered}}{\textit{Total number of Decision Outcomes}}$$

Quiz Time

Quiz Time

- The following statement refers to decision coverage: “When the code contains only a single ‘if’ statement and no loops or CASE statements, any single test case we run will result in 50% decision coverage.”
- Which of the following sentences is correct?
 - A. The sentence is true. Any single test case provides 100% statement coverage and therefore 50% decision coverage
 - B. The sentence is true. Any single test case would cause the outcome of the “if” statement to be either true or false
 - C. The sentence is false. A single test case can only guarantee 25% decision coverage in this case
 - D. The sentence is false. The statement is too broad. It may be correct or not, depending on the tested software

Quiz Time

- The following statement refers to decision coverage: “When the code contains only a single ‘if’ statement and no loops or CASE statements, any single test case we run will result in 50% decision coverage.”
- Which of the following sentences is correct?
 - A. The sentence is true. Any single test case provides 100% statement coverage and therefore 50% decision coverage
 - B. The sentence is true. Any single test case would cause the outcome of the “if” statement to be either true or false**
 - C. The sentence is false. A single test case can only guarantee 25% decision coverage in this case
 - D. The sentence is false. The statement is too broad. It may be correct or not, depending on the tested software

Quiz Time

- Which TWO of the following statements about the relationship between statement coverage and decision coverage are true?
 - A. Decision coverage is stronger than statement coverage.
 - B. Statement coverage is stronger than decision coverage.
 - C. 100% statement coverage guarantees 100% decision coverage
 - D. 100% decision coverage guarantees 100% statement coverage
 - E. Decision coverage can never reach 100%.

Quiz Time

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 - B. Statement coverage is stronger than decision coverage.
 - C. 100% statement coverage guarantees 100% decision coverage
 - D. 100% decision coverage guarantees 100% statement coverage**
 - E. Decision coverage can never reach 100%.

Quiz Time

- If you are testing a module of code, how do you determine the level of decision coverage you have achieved?
- A. By taking the number of decisions you have tested and dividing that by the total number of executable statements in the module
 - B. By taking the number of decisions you have tested and dividing that by the total number of decisions in the module
 - C. By taking the number of decisions you have tested and dividing that by the total lines of code in the module
 - D. By taking the number of decision outcomes you have tested and dividing that by the total number of decision outcomes in the module

Quiz Time

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- A. By taking the number of decisions you have tested and dividing that by the total number of executable statements in the module
 - B. By taking the number of decisions you have tested and dividing that by the total number of decisions in the module
 - C. By taking the number of decisions you have tested and dividing that by the total lines of code in the module
 - D. By taking the number of decision outcomes you have tested and dividing that by the total number of decision outcomes in the module**

Quiz Time

- If you have a section of code that has one simple IF statement, how many tests will be needed to achieve 100% decision coverage?
- A. 1
 - B. 2
 - C. 5
 - D. Unknown with this information

Quiz Time

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 - B. 2**
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Experience-based Test Techniques

Experience-based Test Techniques

- When applying experience-based test techniques, the test cases are derived from the **tester's skill and intuition, and their experience** with similar applications and technologies.
- These techniques can be helpful in identifying tests that were not easily identified by other more systematic techniques.



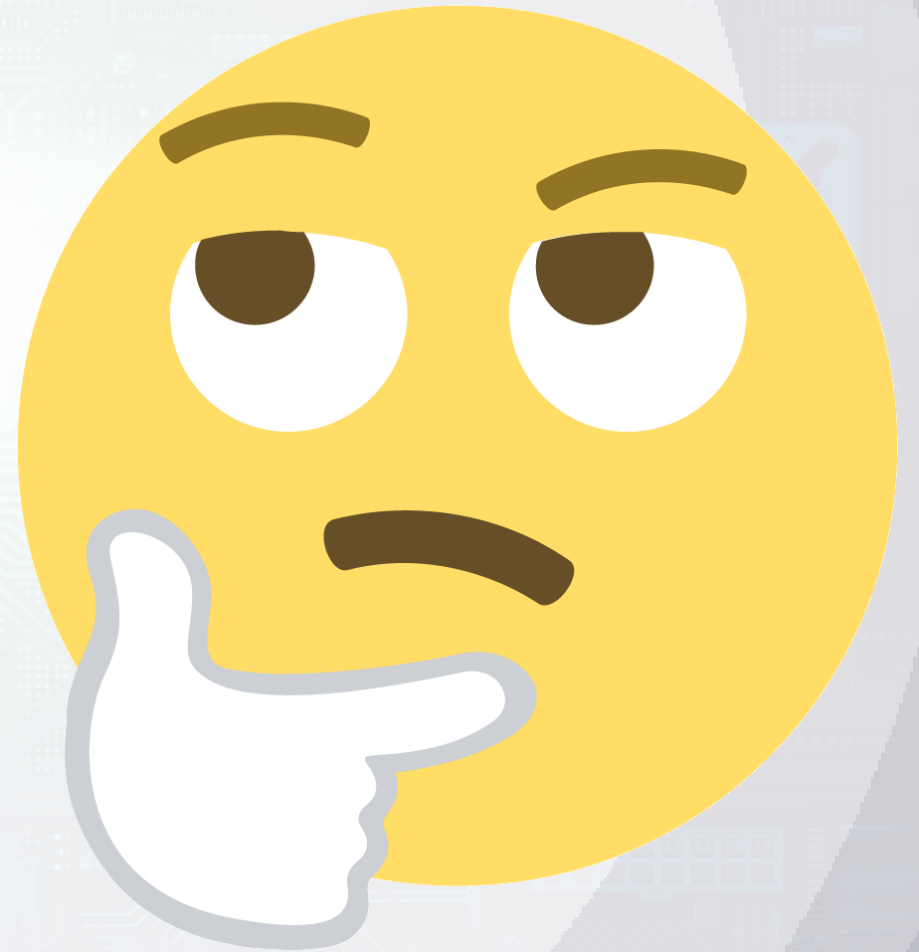
Experience-based Test Techniques

- Depending on the tester's approach and experience, these techniques may achieve widely varying degrees of coverage and effectiveness.
- Coverage can be difficult to assess and may not be measurable with these techniques.



Error Guessing

- Error guessing is a technique used to anticipate the occurrence of mistakes, defects, and failures, based on the tester's knowledge, including:
 - How the application has worked in the past
 - What types of mistakes the developers tend to make
 - Failures that have occurred in other applications



Error Guessing

- A methodical approach to the error guessing technique is to **create a list of possible mistakes, defects, and failures, and design tests that will expose those failures** and the defects that caused them.
- These mistake, defect, failure lists can be built based on experience, defect and failure data, or from common knowledge about why software fails.



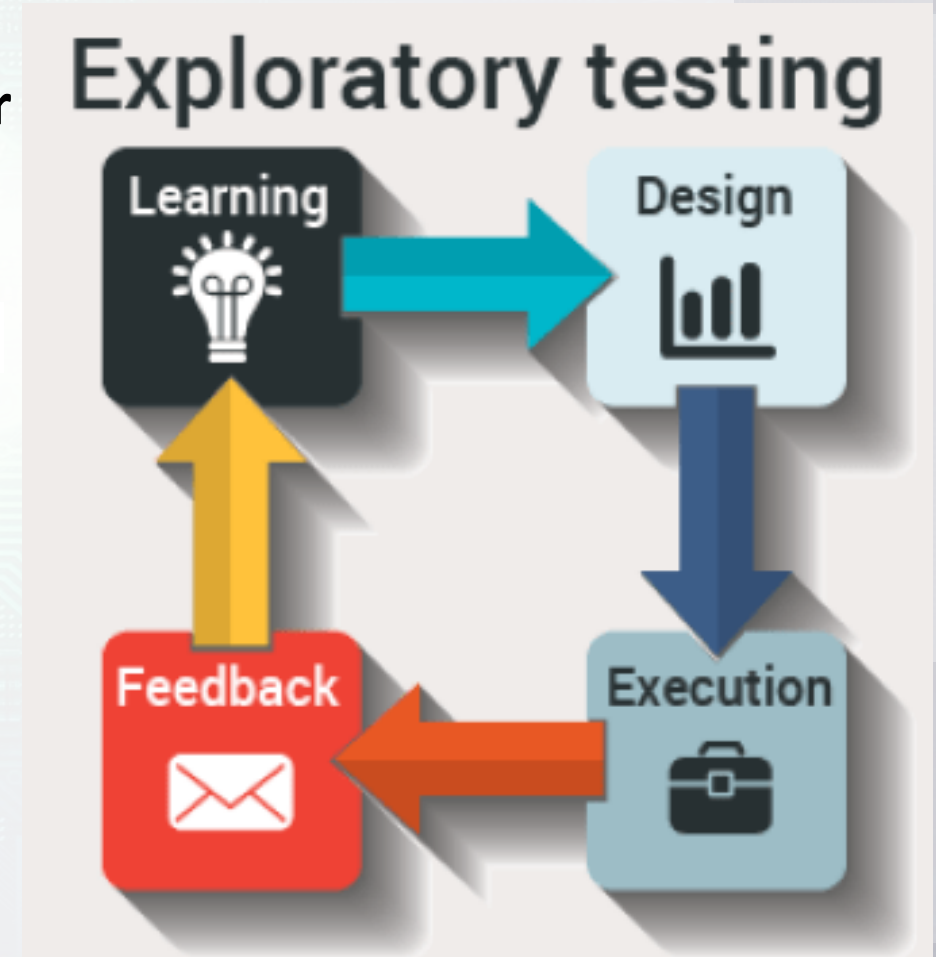
Exploratory Testing

- In exploratory testing, **informal tests are designed, executed, logged, and evaluated dynamically during test execution.**
- The test results are used to learn more about the component or system, and to create tests for the areas that may need more testing.
- Exploratory testing is sometimes conducted using **session-based testing** to structure the activity.



Exploratory Testing

- In session-based testing, exploratory testing is conducted within a defined time-box, and the tester uses a **test charter** containing test objectives to guide the testing.
- Exploratory testing is most useful when there are **few or inadequate specifications or significant time pressure** on testing.



Exploratory Testing

- Exploratory testing is also useful to complement other more formal testing techniques.
- Exploratory testing is strongly associated with reactive test strategies.
- Exploratory testing can incorporate the use of other black-box, white-box, and experience-based techniques.



Checklist-based Testing

- In checklist-based testing, testers design, implement, and execute tests to cover test conditions found in a checklist.
- As part of analysis, testers create a new checklist or expand an existing checklist, but testers may also use an existing checklist without modification.
- Such checklists can be built based on experience, knowledge about what is important for the user, or an understanding of why and how software fails.



Checklist-based Testing

- Checklists can be created to support various test types, including functional and non-functional testing.
- In the absence of detailed test cases, checklist-based testing can provide guidelines and a degree of consistency.
- As these are high-level lists, some variability in the actual testing is likely to occur, resulting in potentially greater coverage but less repeatability.



Quiz Time

Quiz Time

- Which of the following situations is NOT suited for using exploratory testing?
 - A. When there is time pressure, and/or the requirements are incomplete or inapplicable
 - B. When the system is developed and tested incrementally.
 - C. When only new and inexperienced testers are available
 - D. When the main part of the application can be tested only at the customer's site.

Quiz Time

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 - C. When only new and inexperienced testers are available**
 - D. When the main part of the application can be tested only at the customer's site.

Quiz Time

- Which of the following is a good reason to use experience-based testing?
 - A. You can find defects that might be missed by more formal techniques
 - B. You can test for defects that only experienced users would encounter
 - C. You can target the developer's efforts to the areas that users will be more likely to use
 - D. It is supported by strong tools and can be automated

Quiz Time

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Quiz Time

- If you are using error guessing to target your testing, which type of testing are you doing?
 - A. Specification-based
 - B. Structure-based
 - C. Experience-based
 - D. Reference-based

Quiz Time

- If you are using error guessing to target your testing, which type of testing are you doing?
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Quiz Time

- What is error guessing?
- A. A testing technique used to guess where a developer is likely to have made a mistake
- B. A technique used for assessing defect metrics
- C. A development technique to verify that all error paths have been coded
- D. A planning technique used to anticipate likely schedule variances due to faults

Quiz Time

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Quiz Time

- When exploratory testing is conducted using time-boxing and test charters, what is it called?
- A. Schedule-based testing
 - B. Session-based testing
 - C. Risk-based testing
 - D. Formal chartering

Quiz Time

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Chapter 4 In the Exam

| Remember (1 Question) | Understand (5 Questions) | Apply (5 Questions) |
|--|---|--|
| <ul style="list-style-type: none">• Definition of Keywords in Chapter 4 | <ul style="list-style-type: none">• Choosing Test technique• Use Case Testing• Statement Coverage• Decision Coverage• Error Guessing• Exploratory Testing• Checklist-based Testing | <ul style="list-style-type: none">• Equivalence Partitioning• Boundary-value Analysis• Decision Table Testing• State Transition Testing |