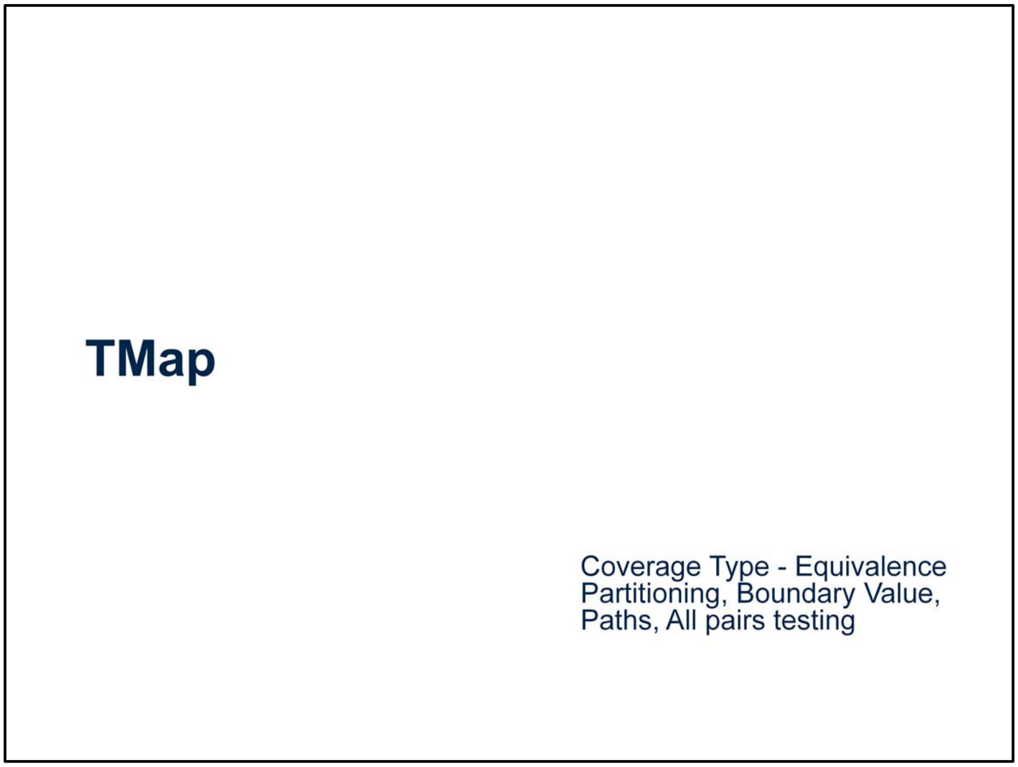
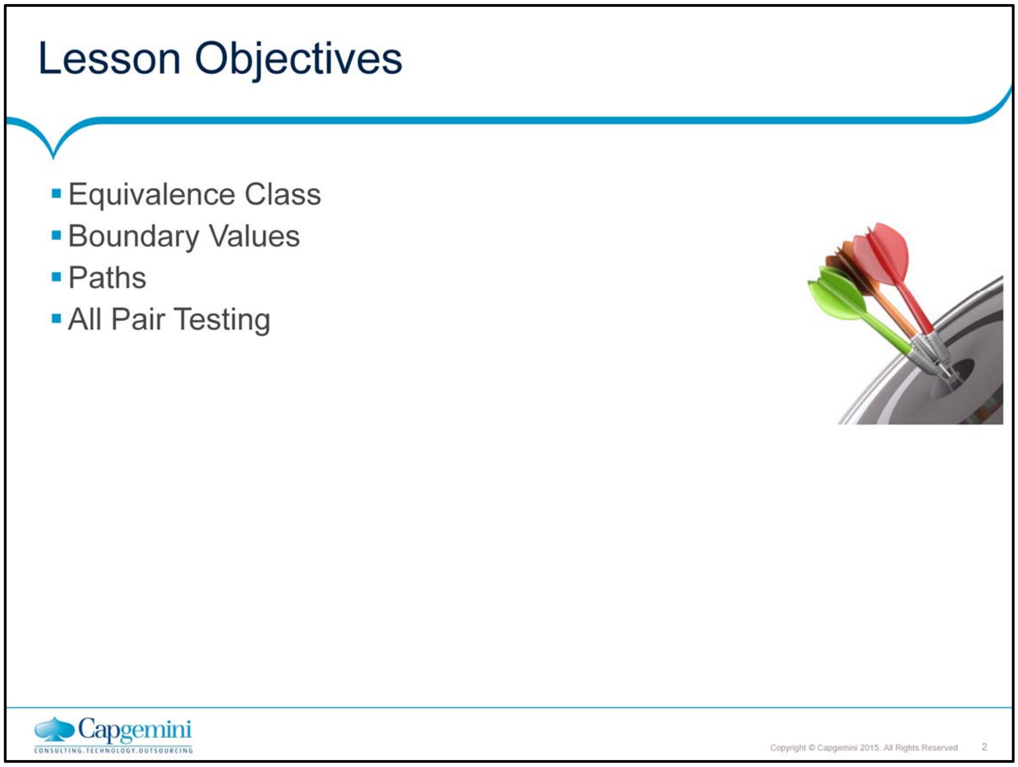


TMap

Coverage Type - Equivalence Partitioning, Boundary Value, Paths, All pairs testing



Lesson Objectives

- Equivalence Class
- Boundary Values
- Paths
- All Pair Testing

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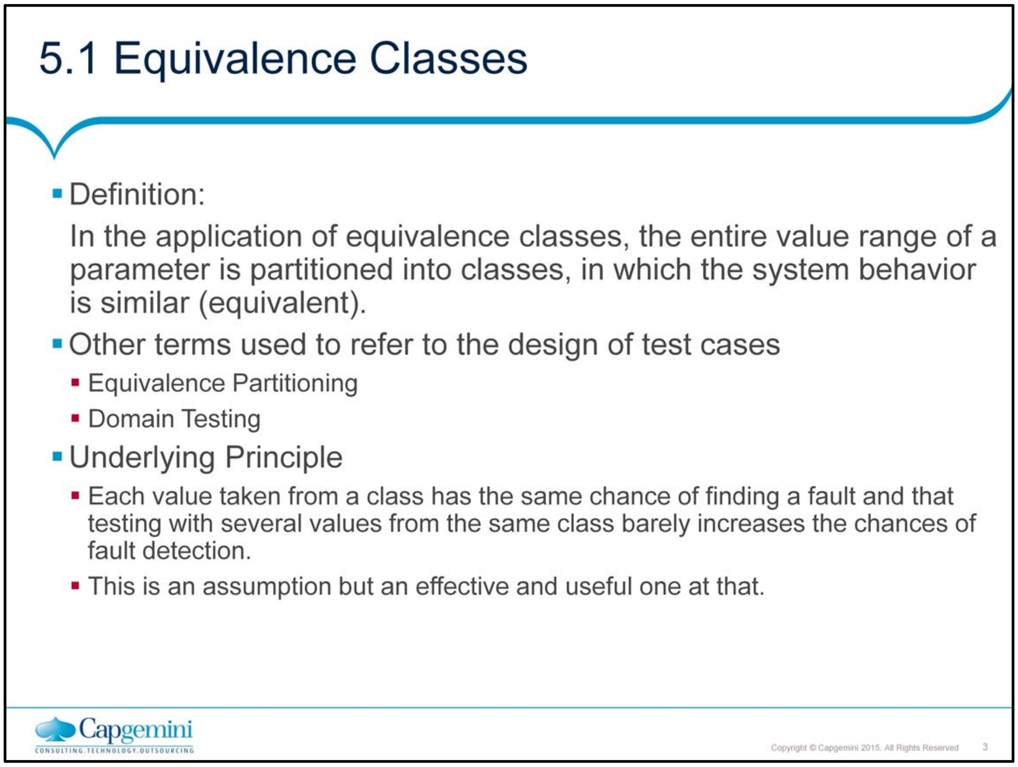

5.1 Equivalence Classes

- Definition:

  In the application of equivalence classes, the entire value range of a parameter is partitioned into classes, in which the system behavior is similar (equivalent).

- Other terms used to refer to the design of test cases
  - Equivalence Partitioning
  - Domain Testing
- Underlying Principle
  - Each value taken from a class has the same chance of finding a fault and that testing with several values from the same class barely increases the chances of fault detection.
  - This is an assumption but an effective and useful one at that.

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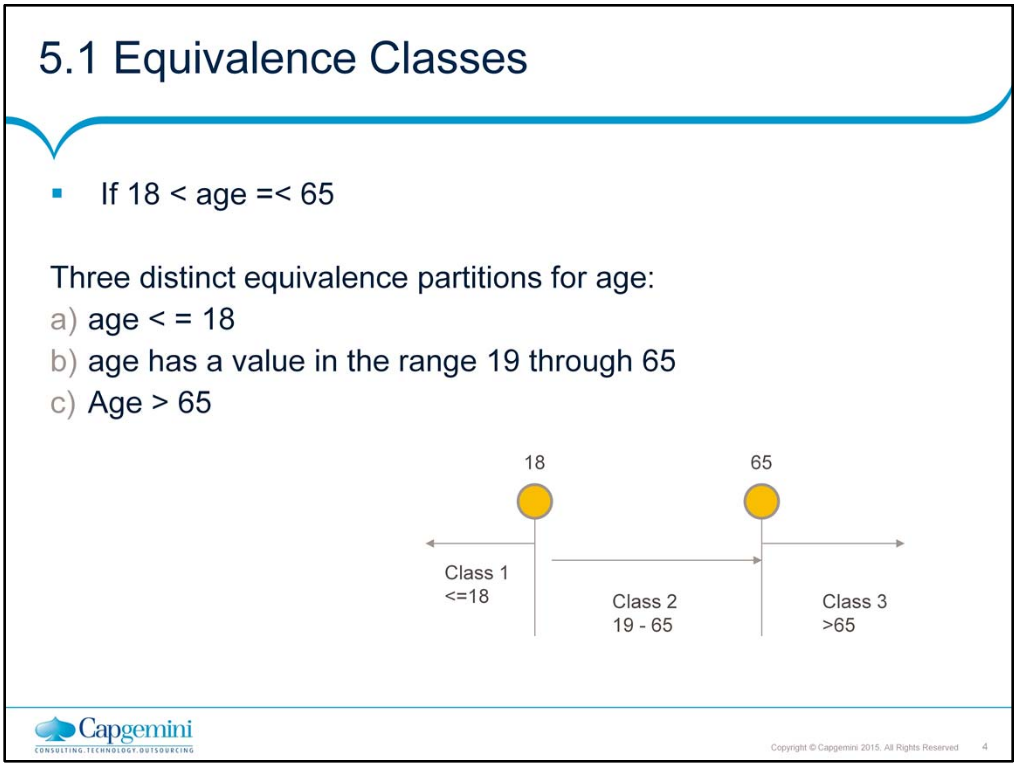

5.1 Equivalence Classes

- If 18 < age =< 65

Three distinct equivalence partitions for age:

a) age < = 18

b) age has a value in the range 19 through 65

c) Age > 65

18

65

Class 1
<=18

Class 2
19 - 65

Class 3
>65

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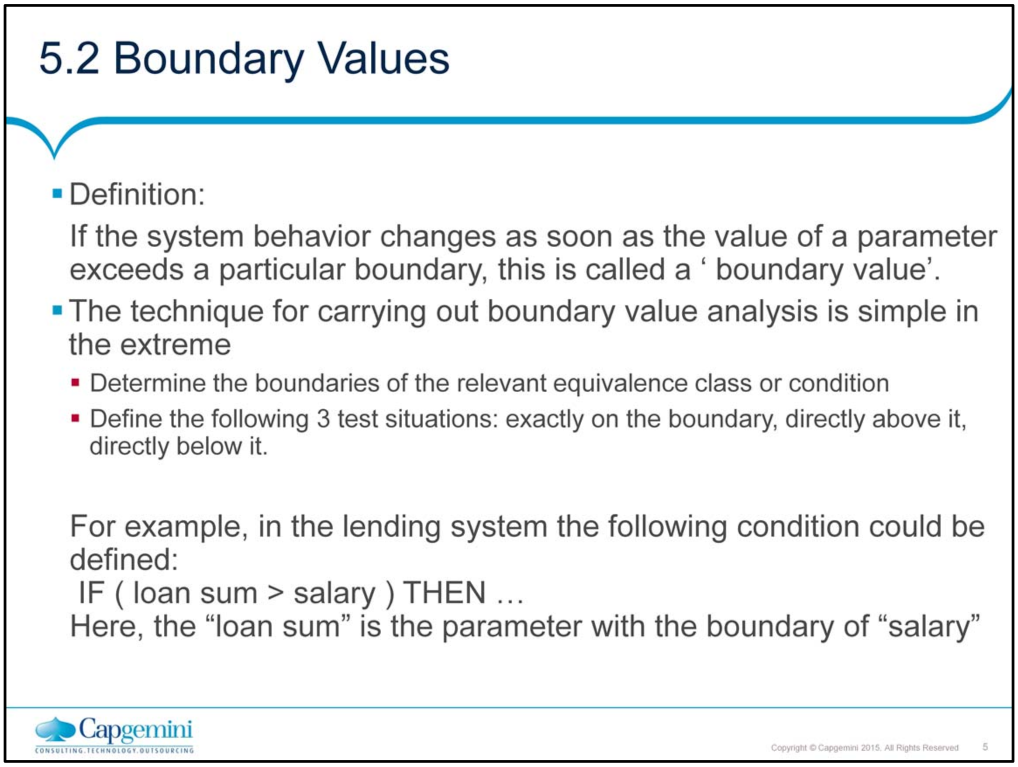

5.2 Boundary Values

- Definition:

  If the system behavior changes as soon as the value of a parameter exceeds a particular boundary, this is called a ‘ boundary value’.
- The technique for carrying out boundary value analysis is simple in the extreme
  - Determine the boundaries of the relevant equivalence class or condition
  - Define the following 3 test situations: exactly on the boundary, directly above it, directly below it.

For example, in the lending system the following condition could be defined:
IF (loan sum > salary) THEN …
Here, the “loan sum” is the parameter with the boundary of “salary”

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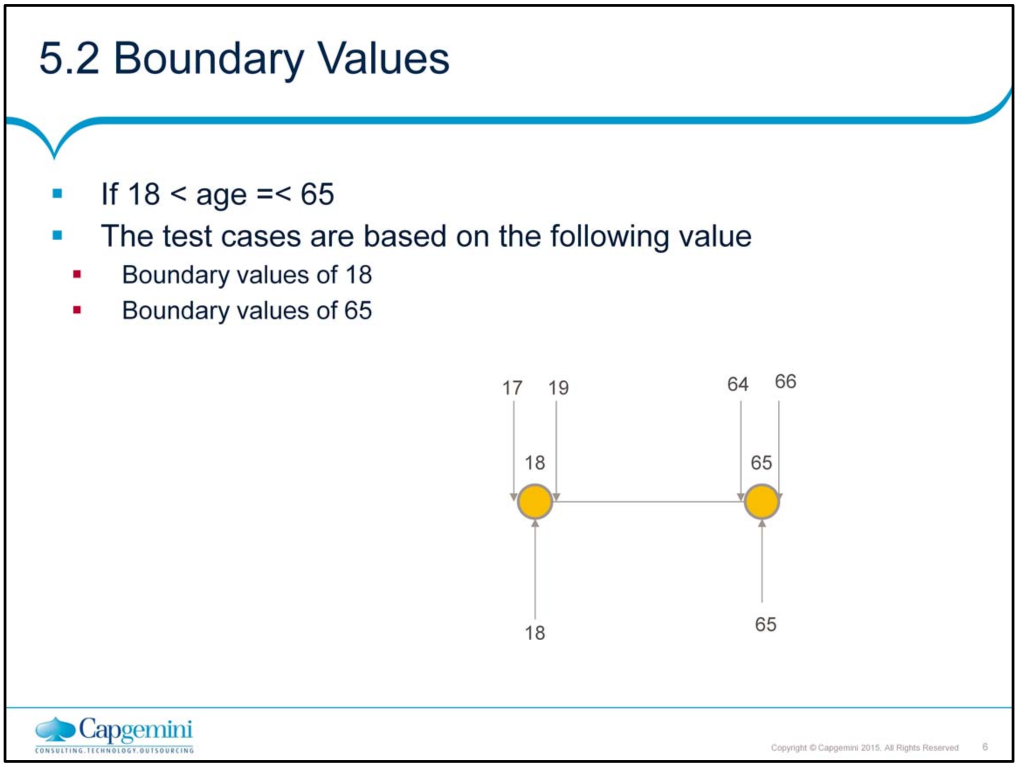
Boundary value analysis is best used when combined with the equivalence class
Note: Boundary value cannot be applied on all equivalence classes ex: Gender



5.2 Boundary Values

- If 18 < age =< 65
- The test cases are based on the following value
  - Boundary values of 18
  - Boundary values of 65

17
19
64
66
18
65
18
65
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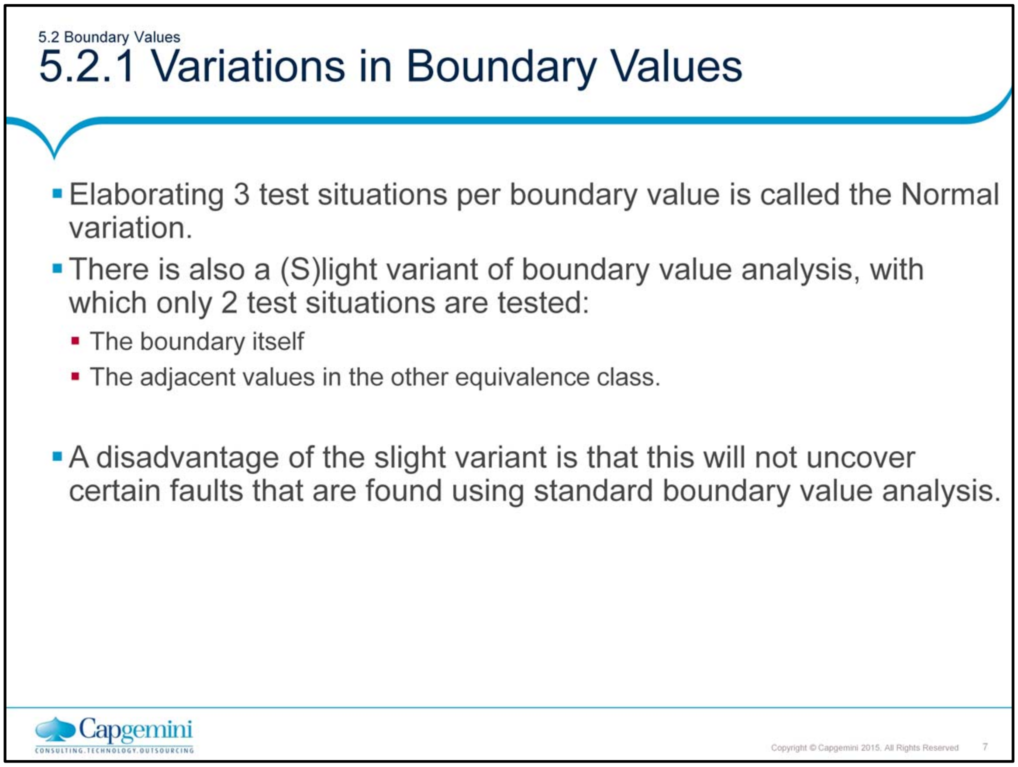
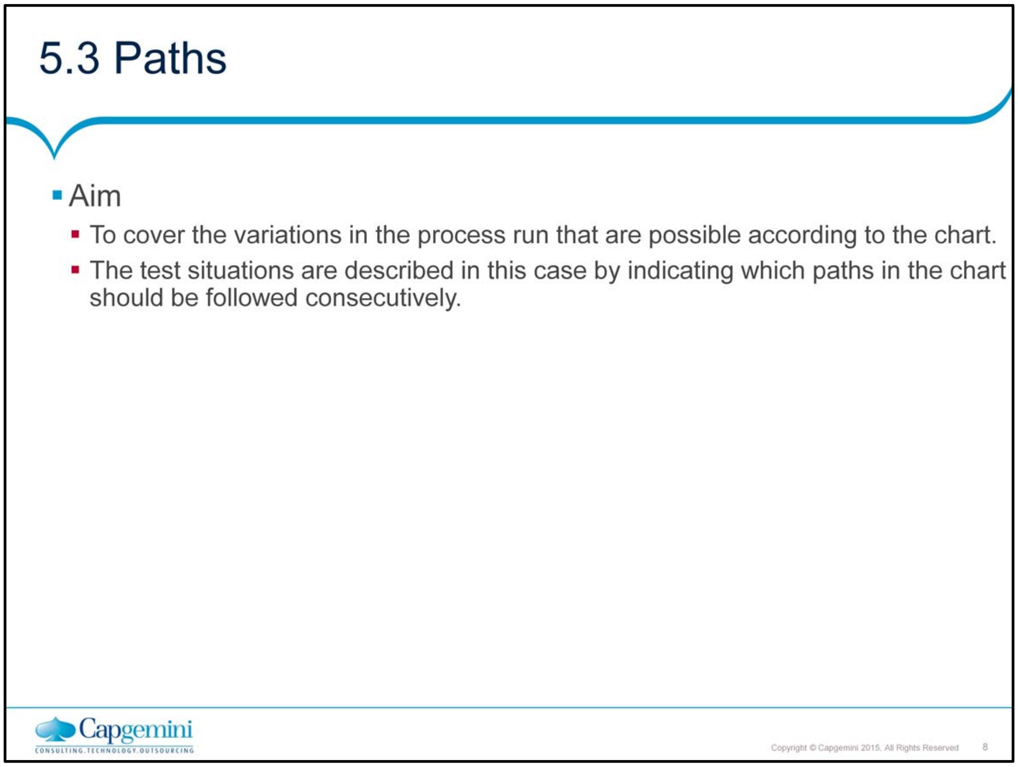


5.2 Boundary Values

5.2.1 Variations in Boundary Values

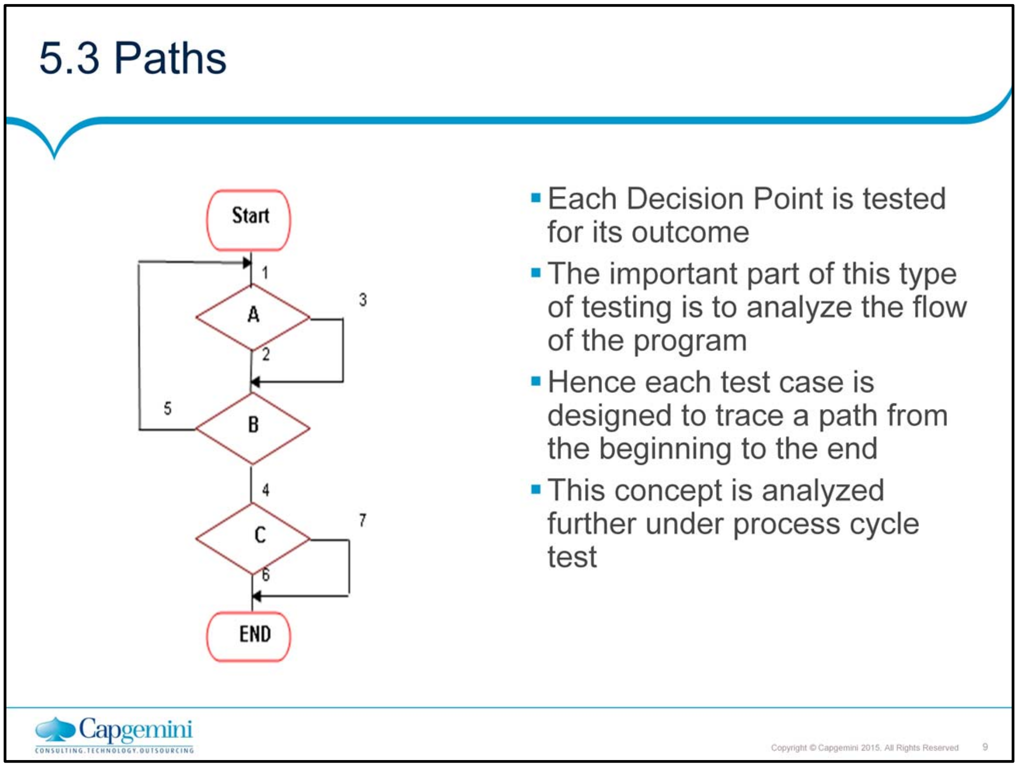
- Elaborating 3 test situations per boundary value is called the Normal variation.
- There is also a (S)light variant of boundary value analysis, with which only 2 test situations are tested:
  - The boundary itself
  - The adjacent values in the other equivalence class.
- A disadvantage of the slight variant is that this will not uncover certain faults that are found using standard boundary value analysis.



5.3 Paths

- Aim
  - To cover the variations in the process run that are possible according to the chart.
  - The test situations are described in this case by indicating which paths in the chart should be followed consecutively.

Remember that such charts with decision points and paths do not necessarily have to be about the functionality of the system.
Security processes or work procedures in business processes can also be described with such charts, which makes the basic technique described here applicable to other test types.



5.3 Paths

- Each Decision Point is tested for its outcome
- The important part of this type of testing is to analyze the flow of the program
- Hence each test case is designed to trace a path from the beginning to the end
- This concept is analyzed further under process cycle test

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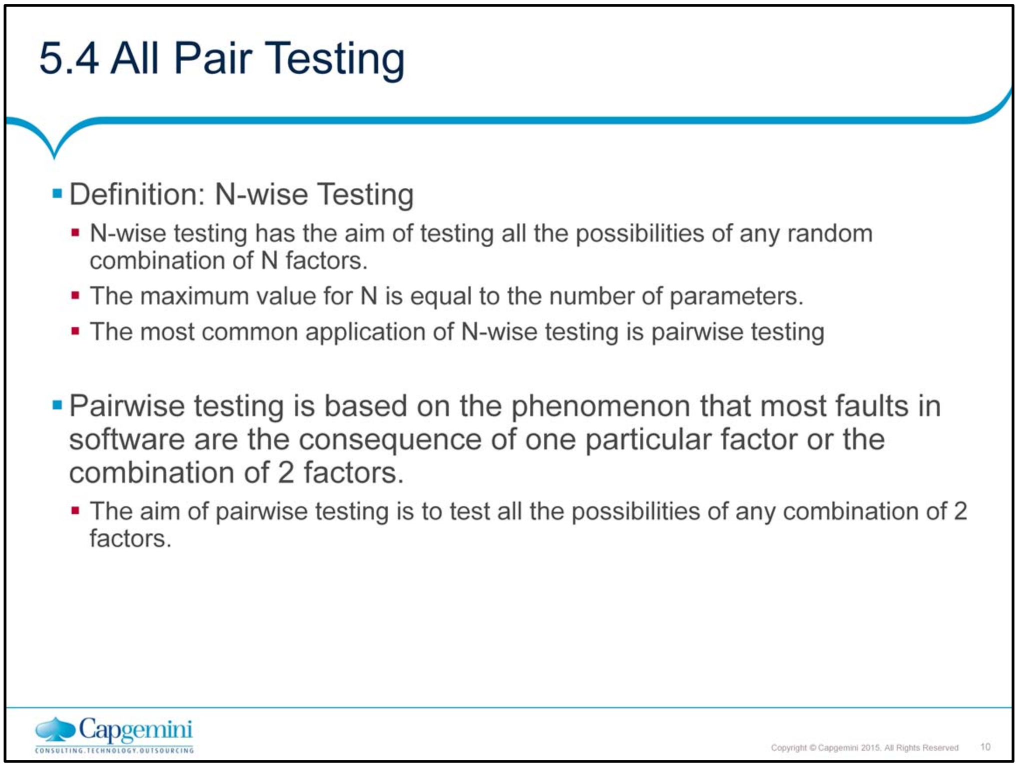
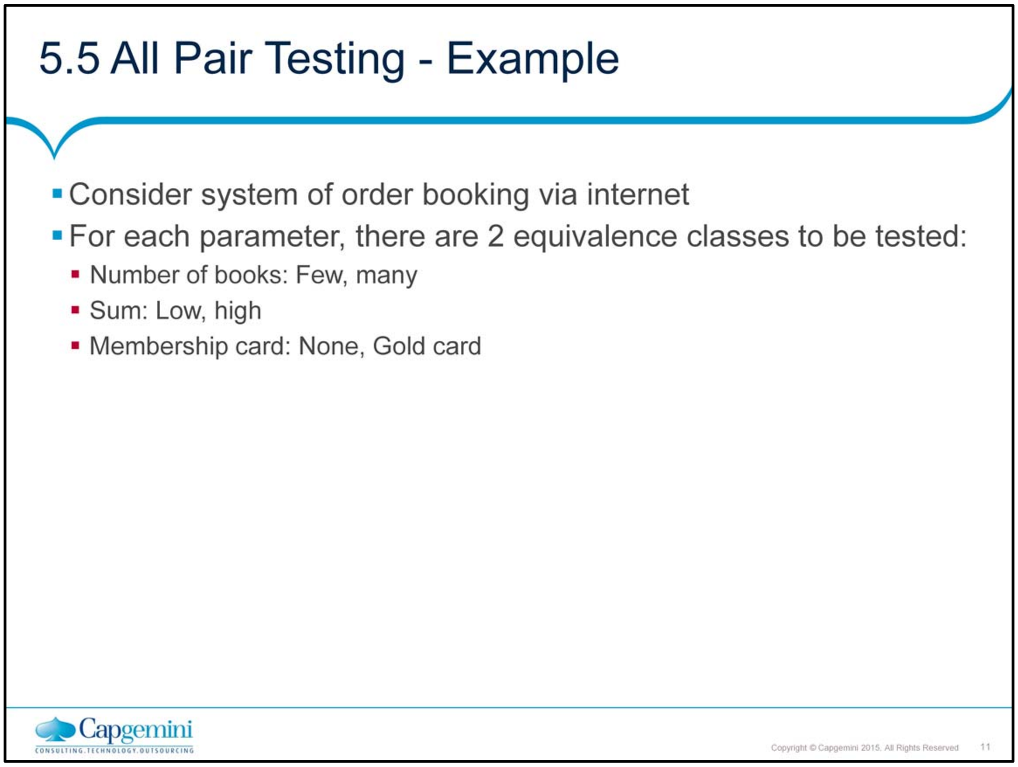


5.4 All Pair Testing

- Definition: N-wise Testing
  - N-wise testing has the aim of testing all the possibilities of any random combination of N factors.
  - The maximum value for N is equal to the number of parameters.
  - The most common application of N-wise testing is pairwise testing
- Pairwise testing is based on the phenomenon that most faults in software are the consequence of one particular factor or the combination of 2 factors.
  - The aim of pairwise testing is to test all the possibilities of any combination of 2 factors.

In practice, a value of 4 or higher is seldom applied in N-wise Testing.
Instead of testing all the possible combinations of all the factors, it is very effective if every combination of 2 factors is tested.



5.5 All Pair Testing - Example

- Consider system of order booking via internet
- For each parameter, there are 2 equivalence classes to be tested:
  - Number of books: Few, many
  - Sum: Low, high
  - Membership card: None, Gold card

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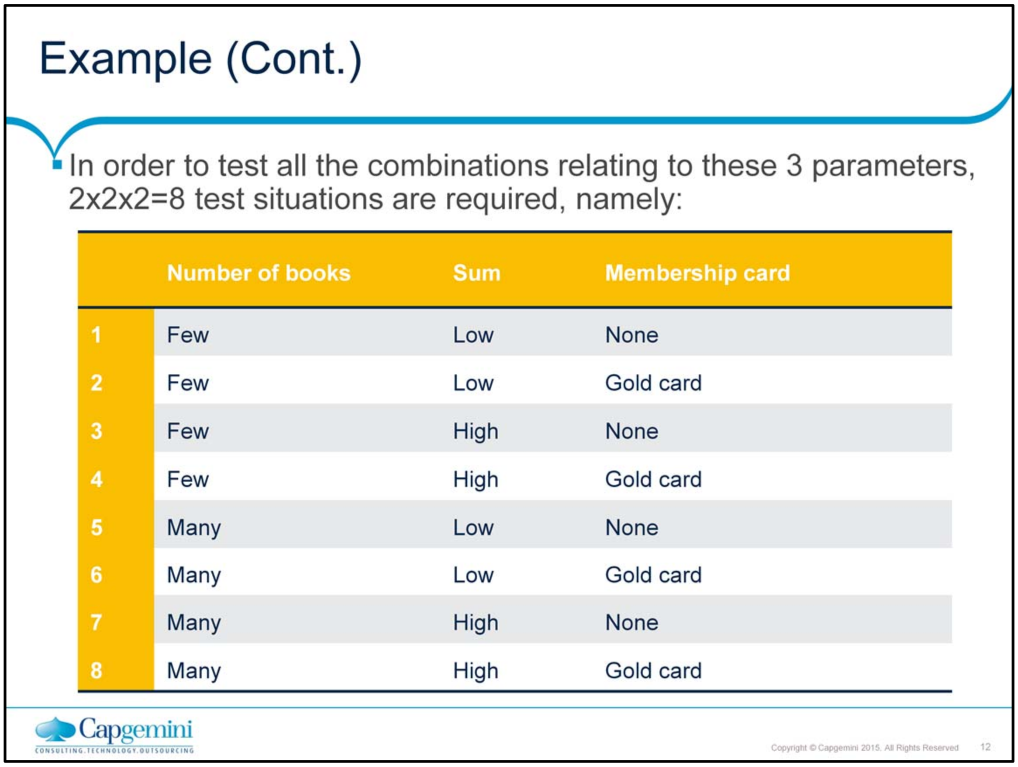
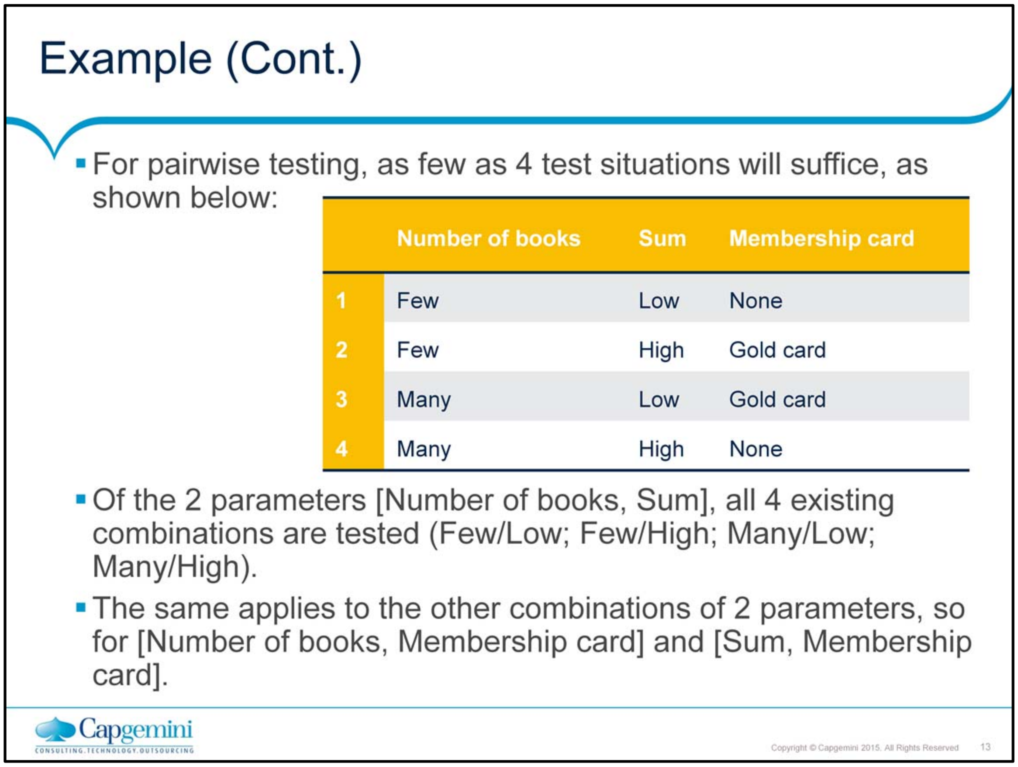


Example (Cont.)

- In order to test all the combinations relating to these 3 parameters, 2x2x2=8 test situations are required, namely:

	Number of books	Sum	Membership card
1	Few	Low	None
2	Few	Low	Gold card
3	Few	High	None
4	Few	High	Gold card
5	Many	Low	None
6	Many	Low	Gold card
7	Many	High	None
8	Many	High	Gold card



Example (Cont.)

- For pairwise testing, as few as 4 test situations will suffice, as shown below:

	Number of books	Sum	Membership card
1	Few	Low	None
2	Few	High	Gold card
3	Many	Low	Gold card
4	Many	High	None

- Of the 2 parameters [Number of books, Sum], all 4 existing combinations are tested (Few/Low; Few/High; Many/Low; Many/High).
- The same applies to the other combinations of 2 parameters, so for [Number of books, Membership card] and [Sum, Membership card].

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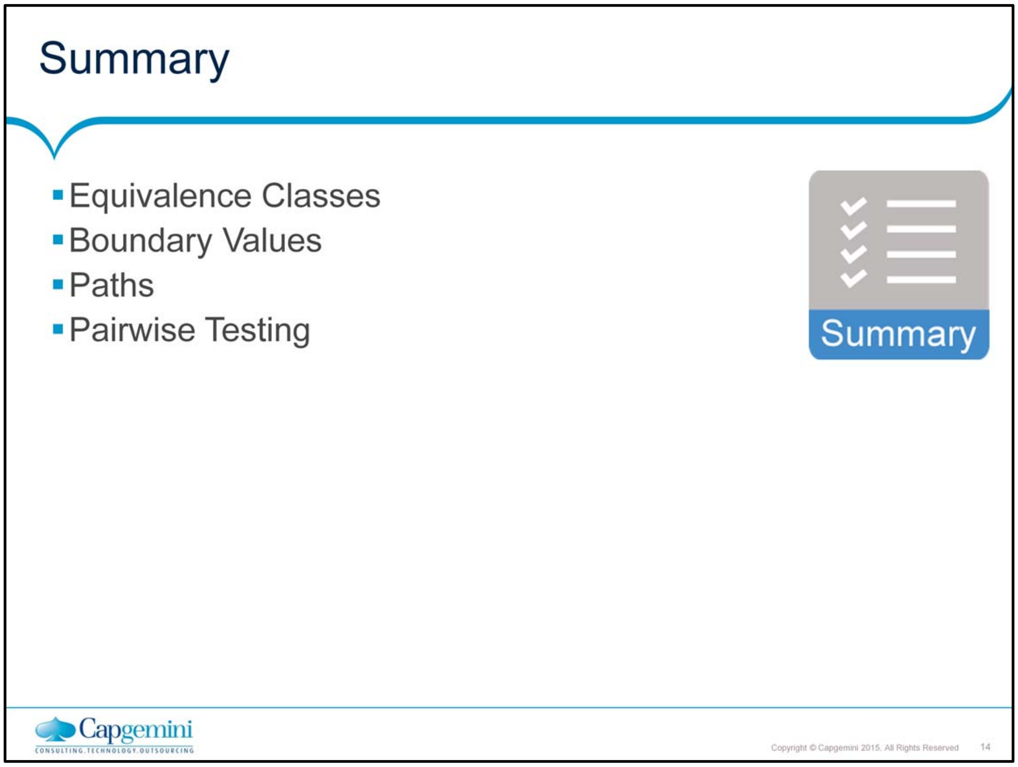

Summary

- Equivalence Classes
- Boundary Values
- Paths
- Pairwise Testing

Summary

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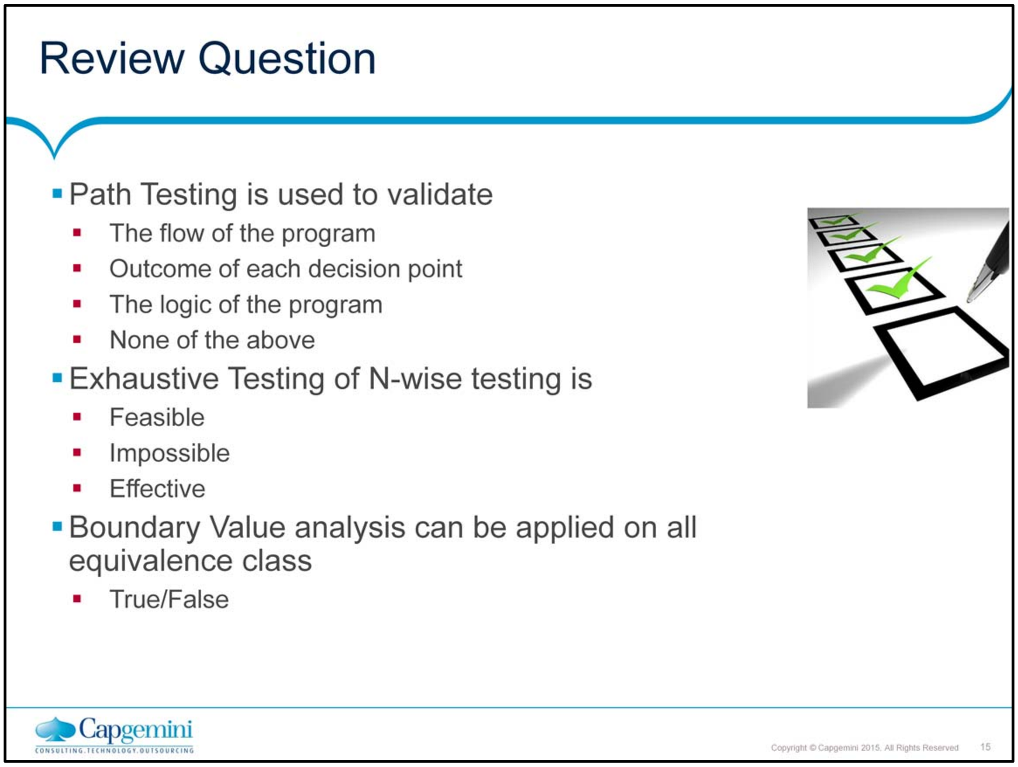
Add the notes here.



Review Question

- Path Testing is used to validate
  - The flow of the program
  - Outcome of each decision point
  - The logic of the program
  - None of the above
- Exhaustive Testing of N-wise testing is
  - Feasible
  - Impossible
  - Effective
- Boundary Value analysis can be applied on all equivalence class
  - True/False

Add the notes here.