Unit 3 Notes

Learning Objectives

- Apply combinatorial test coverage to assess test quality
- Apply design of experiments to develop tests
- Understand mutation testing
- Understand fuzz testing
- Define metamorphic testing
- Apply defect-based testing techniques
- Describe the role of exploratory testing

Combinatorial Testing Techniques

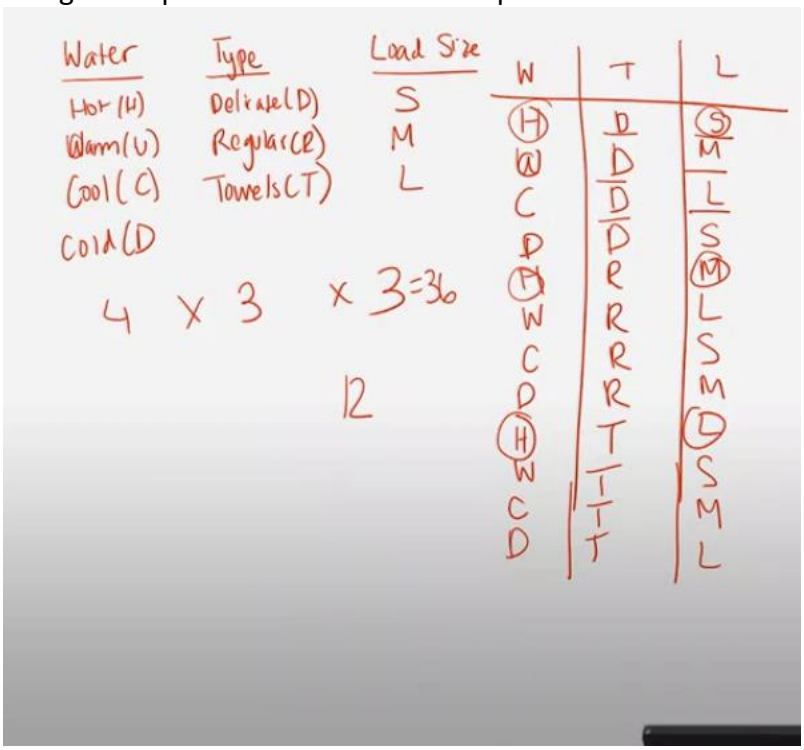
Combinatorial Coverage as an Aspect of Test Quality

- See slides

Design of Experiments

- See slides

Design of Experiments: Problem Example **



Combinatorial Testing Techniques Problem Example

- Combinatorial coverage looks at parameter values being individually tested.
    - False. Combinatorial coverage looks at how combinations of parameter values are tested together.

2. Assume we are testing a function with 3 variables:

   Variable A: has values 0 and 1

   Variable B: has values 0 and 1

   Variable C: has values 0 and 1

   What is the total 2-way variable value configuration coverage achieved by the following tests:

   A=0; B=0; C=0

   A=0; B=1; C=1

   A=1, B=1, C=0

   - (●) 9/12
   - ( ) 7/12
   - ( ) 10/12
   - ( ) 8/12

   ✓ **Correct**
   Possible combinations: A=0 B=0; A=0 C=0; B=0 C=0; A=0 B=1; A=0 C=1; B=1 C=1; A=1 B=1; A=1 C=0; B=1 C=0

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- What is the goal of design of experiments?
  - Minimize the number of tests we need to run. We are testing pairs of values for each input to minimize the number of tests.
- True or False. Design of experiments pairwise combination involves systematically testing all combinations of inputs.
  - False. Only pairs of values for each input are tested together, not all combinations of values of inputs.
- Given 3 inputs: P1 with values V1 and V2; P2 with values V3, V4, and V5 and P3 with values V6 and V7, what are the correct tests for a pairwise combination design of experiments?

◉

V3	V1	V6
V3	V2	V7
V4	V1	V7
V4	V2	V6
V5	V1	V6
V5	V2	V7

○

V3	V1	V6
V3	V2	V7
V4	V1	V7
V4	V2	V6

✓ **Correct**
This table tests every combination of pairs of values.

○

Using Combinatorial Testing to Reduce Software Rework: Review of Reading

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Combinatorial Coverage as an Aspect of Test Quality: Review of Reading

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Mutation Testing

Mutation Testing

- See slides

Mutation Testing: Knowledge check

- What is NOT an example of a mutation?

2. What is NOT an example of a mutation?

○ Modifying Boolean expressions

○ Modifying variables

◉ Renaming a class and anywhere that the class is called or found

○ Modifying arithmetic operations

✓ **Correct**
If a class is renamed everywhere, that would not introduce an error (mutant) in the program.

○

Mutation Testing: Review of Reading

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Fuzz Testing

Fuzz Testing

- See slides

Fuzz Testing Knowledge Check

- True or False? Fuzz testing consists of random, invalid or unexpected inputs that are created automatically.
    - Fuzz testing is an approach to testing where invalid, random or unexpected inputs are automatically generated.
- True or False? Fuzz testing looks only for undesirable behavior or crashes.
    - Fuzz testing is not looking at specific inputs or outputs, but is instead looking for an error or a wrong behavior.

Metamorphic Testing

Metamorphic Testing

- See slides

Metamorphic Testing Knowledge Check

- True or False? Metamorphic testing makes the assumption that if there is a program with input x that results in output y, and there is a change to input x, that same change is not reflected in output y.
    - False. Metamorphic testing makes the assumption that when changes are made to an input, it is possible to predict changes on the output.
- Without using a calculator, what would be the expected output of this example using metamorphic testing for the third test case?:
    - (◉) 7.2
    - ( ) 14.4
    - ( ) 3.6
    - ( ) 28.8

    ✓ **Correct**

    When the values are incremented by 5, the standard deviation was 7.2 In the third test, the values are incremented by 5.

Defect Based Testing

Defect Based Testing

- See slides

Defect Based Testing Knowledge Check

- True or False? Defect based testing can only be applied at the unit level.
    - False. Defect based testing can be applied at any level of testing.
- True or False? Defect based testing looks to create test cases that target specific defect categories.
    - True. Defect based testing can target any defect category from the Beizer Generic Defect Taxonomy Categories.

Exploratory Testing

Exploratory Testing

- See slides

Exploratory Testing Knowledge Check

- True or False? In exploratory testing, all test scripts are not developed in advance.
    - True. What is tested next is based on the results of the previous tests.
- True or False? Exploratory testing focuses on a tour that helps detect a specific error.
    - True. Exploratory testing can consist of requirements, features, continuous use, documentation, etc. tours that focus on different errors.

Unit 3 Quiz
All Correct

1. Assume we are testing a function with 3 variables:

   Variable A: has values 0 and 1

   Variable B: has values 0 and 1

   Variable C: has values 0 and 1

   What is the total 3-way variable value configuration coverage achieved by the following tests:

   A=0; B=0; C=0

   A=0; B=1; C=1

   A=1, B=1, C=0

   A=1, B=1, C=1

   - ○ 6/12
   - ○ 3/8
   - ◉ 4/8
   - ○ 4/12

2. Assume we are testing a function with 3 variables:

   Variable A: has values 0 and 1

   Variable B: has values 0 and 1

   Variable C: has values 0 and 1

   What is the total 2-way variable value configuration coverage achieved by the following tests:

   A=0; B=0; C=1

   A=0; B=1; C=1

   A=1, B=0, C=0

- ○ 3/8
- ○ 7/12
- ◉ 8/12
- ○ 9/12

3. True or False? Design of Experiments allows for examination of both single and combinations of inputs.

- (●) True
- ( ) False

4. True or False? Defect based testing utilized defect taxonomies to create test cases to target certain defects.

- (●) True
- ( ) False

5. Given 3 inputs: P1 with values V1, V2, V3; P2 with values V4, V5, V6 and P3 with values V7 and V8, how many tests are there for a pairwise combination design of experiments?

- (●) 9
- ( ) 18
- ( ) 6
- ( ) 8

6. True or False? Assume all test cases pass for program x. Assume a mutant of the program y is created and all test cases also pass for y. This provides confidence that the original test cases are good.

- ○ True
- ◉ False

7. True or False? Automation helps run large numbers of tests against the original program and mutants of a program

- ◉ True
- ○ False

8. True or False? An assumption of mutation testing is the belief that detecting small errors can also help detect complex errors.

- ◉ True
- ○ False

9. True or False? Mutation fuzz based testing is based upon a testing "seed", otherwise known as a valid test case.

- ◉ True
- ○ False

10. True or False? Fuzz testing requires having a test oracle.

- ○ True
- ◉ False