What Exactly are the Techniques of
Software Verification and Validation
Areas Covered

Software Verification and Validation
When Combined Together Are
Abbreviated as V & V
What does these Two Provide

Verification Ensures that:

Every Step in the Process of Building the Software Delivers the Correct Product

Validation Ensures that:

Software Being Developed or Changed Satisfies Functional and All Other Requirements
Firstly Let Us Understand

What Kind of Verification Do we Have?
Major Categories of Verification

There are Two Major Categories of Verification Testing:

• Dynamic Testing
• Static Testing
Firstly Let Us Go Deeper Into Dynamic Testing
Dynamic Testing - A Type of Verification

What Does Dynamic Testing Do?

- Involves Execution of a System or Component
- Selection of a Group of Test Cases Consisting of Test Data
- Finding out Output Test Results out of Input Test Cases
Dynamic Testing - A Type of Verification

Sub Categories of Dynamic Testing

• Functional Testing
• Structural Testing
• Random Testing
Sub Categories Dynamic Testing

Functional Testing: A Type of Dynamic Testing

- Involves Identification & Testing of all Functions of the System as Defined in Basic Requirements Documents

- It is a Black Box Testing Not Expecting that the Tester should have any Knowledge of the Basic Code & Implementation of the System

Contd......
Sub Categories Dynamic Testing

Functional Testing: A Type of Dynamic Testing

• It uses Test Cases Designed to Investigate Certain Feature of the System
Sub Categories Dynamic Testing

Structural Testing: A Type of Dynamic Testing

• It is a White Box Testing Expecting Full knowledge of the Implementation of the System

• Information of the Internal Structure of the System is Used to Design Tests for Checking the Function of Individual Components

Contd……..
Sub Categories Dynamic Testing

Structural Testing: A Type of Dynamic Testing

• Like Functional Testing, it also uses Test Cases Designed to Investigate Certain Feature of the System
Sub Categories Dynamic Testing

Random Testing: A Type of Dynamic Testing

- Uses Free Selection of Test Cases out of a set of All Possible Test Cases
- Uses Randomly Decided to Detect Faults which Go Undetected by Other Systematic Testing Techniques

Contd......
Random Testing: A Type of Dynamic Testing

- Exhaustive Testing is a Form of Random Testing, Involving Input Test Cases having Every Possible Set of Input Values

- Although We do Exhaustive Testing at Every Stage of Life Cycle, Complete Verification of the System, is not Possible & Realistic
Secondly Let Us Go Deeper Into Static Testing

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Static Testing - A Type of Verification

Attributes of Static Testing

- Does not Involve Operation of the System or Component
- Involves Manual as well as Automated Testing Techniques
Static Testing - A Type of Verification

Sub Categories of Static Testing

• Consistency Techniques
  : Meant for Doing Analysis of Consistency

• Measurement Techniques
  : Meant for Doing Measurement of Some Property of the Program
Static Testing - A Type of Verification

Consistency Techniques of Static Testing

Ensures Correctness of Program Properties Like:

# Correct Syntax

# Correct Parameter Matching Between Procedures

Contd......
Static Testing - A Type of Verification

Consistency Techniques of Static Testing

Ensures Correctness of Program Properties Like:

# Correct Typing

# Correct Requirements and Translation of Specifications
Static Testing - A Type of Verification

Measurement Techniques of Static Testing

Measures the System Properties Like:

# Being Error Prone

# Being Understandable

# Being Well Structured
Secondly Let Us Understand

What is All About Validation Testing?
When Does Validation Come into Picture

Validation comes into picture at the end of the development cycle.

- It views the complete system exactly opposite of verification.
- It focuses on smaller sub-systems.
What are the Techniques of Validation Testing?
Techniques of Validation Testing

Formal Methods:
A Technique of Validation Testing

• Besides being a Verification Technique it is a Validation Technique as well

• Involves use of Mathematical and Logical Techniques to: Express, Investigate, & Analyze the Specification, Design, Documentation and Behavior of Hardware as well as Software
Techniques of Validation Testing

Fault Injection:
A Technique of Validation Testing

Is an Intentional Activation of Faults by Either Hardware or Software to Observe the System Operation under such Faulty Situations
Techniques of Validation Testing

Hardware Fault Injection:
A Technique of Validation Testing

Also known as Physical Fault Injection since Faults are Injected into the Physical Hardware
Techniques of Validation Testing

Software Fault Injection: A Technique of Validation Testing

• Involves Injection of Errors into the Computer Memory through some Software Techniques

• It is a sort of a Simulation of Hardware Fault Injection
Dependency Analysis:
A Technique of Validation Testing

Involves Identification of Hazards and Subsequently Proposing Methods to Reduce the Risk of the Hazards
Techniques of Validation Testing

Hazard Analysis:
A Technique of Validation Testing

Involves using Instructions to Identify Hazards, Their Root Causes, and Possible Countermeasures
Techniques of Validation Testing

Risk Analysis:
A Technique of Validation Testing

Goes Beyond Hazard Analysis by Identifying the Possible Consequences of Each Hazard and Their Probability of Occurrence
Pros & Cons of Verification & Validation

• Verification and Validation are Quite Time Consuming Processes

• They Involve Planning from the Beginning, the Development of Test Cases, Actual Testing, and Analysis of Testing Results

• Best Practice is to have Persons Dedicated to V & V and made to operate with the Designers
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Thank You