Software Testing Strategies

White Box Testing

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Black Box Testing

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Introduction

- Software testing ensures that a system works as expected.
- Two main testing strategies:
  - White Box Testing (Structural Testing)
  - Black Box Testing (Behavioral Testing)

White Box Testing - Definition

- Also known as Structural, Clear Box, or Glass Box Testing.
- Tests the internal structure, design, and code of a program.
- Tester must understand the internal logic and source code.

White Box Testing - Purpose & Features

- **Purpose:**
  - Verify input/output flow through the code.
  - Ensure paths, conditions, and loops work correctly.
  - Detect hidden logical or security errors.
  - Improve code efficiency and coverage.

- **Features:**
  - Requires programming knowledge.
  - Focuses on code logic, control flow, and data flow.
  - Usually performed by developers or technical testers.

White Box Testing - Techniques

- **Statement Coverage**: Every line executed at least once.
- **Branch Coverage:** Each decision (True/False) tested.
- **Path Coverage:** All possible paths tested.
- **Loop Testing**: Loops tested for zero, one, and multiple iterations.
- **Condition Coverage:** Logical conditions tested for both outcomes.

White Box Testing - Advantages, Disadvantages

- **Advantages:**
  - Detects hidden errors.
  - Optimizes code performance.
  - Ensures maximum code coverage.
  - Finds security loopholes.

- **Disadvantages:**
  - Time-consuming for large projects.
  - Requires coding knowledge.
  - Cannot detect missing functionalities.

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White Box Testing - Example

- **Example:**

```
def is_even(num):
    if num % 2 == 0:
        return True
    else:
        return False
```

- A tester ensures both branches (if/else) are executed and boundary cases (e.g., 0, negatives) are checked.

Black Box Testing - Definition

- Also known as Behavioral or Functional Testing.
- Tester doesn't know internal structure or code.
- Focuses on input-output behavior based on requirements.

Black Box Testing - Purpose & Features

- **Purpose:**
  - Validate functional requirements.
  - Check expected behavior for inputs.
  - Ensure software meets user needs.

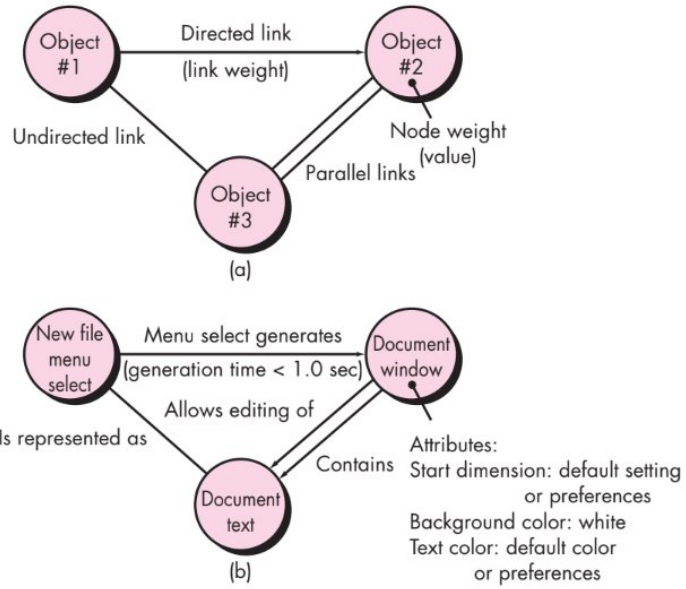
- **Features:**
  - No programming knowledge required.
  - Focuses on what the system does, not how.
  - Done by testers, QA engineers, or end users.

Black Box Testing - Techniques

- **Equivalence Partitioning:** Divide inputs into valid/invalid sets.
- **Boundary Value Analysis (BVA):** Test values at input edges.
- **Use Case Testing:** Tests user scenarios based on requirements.

Black Box Testing - Techniques

- **Graph-Based Testing:** Uses graphs of nodes and edges to represent software components and their relationships, ensuring all possible connections and paths are tested.



Black Box Testing - Advantages, Disadvantages

- **Advantages:**
  - Easy to perform.
  - Focused on user requirements.
  - Effective for large systems.
  - Detects missing functionalities.
- **Disadvantages:**
  - Limited coverage.
  - Cannot find code-level errors.
  - May include redundant test cases.

Black Box Testing - Example

- **Example:**
  - Testing a login form:
    - Inputs: username, password.
    - Output: success/error message. Tester checks if correct message appears, not the internal code.

Comparison Table

Feature	White Box Testing	Black Box Testing
Knowledge Required	Programming Knowledge	No Programming Knowledge
Focus	Internal Code structure	Functionality & user interface
Performed By	Developers	Testers/QA Team
Testing Basis	Code Logic	Requirements & Specification
Main Goal	Verify Code correctness	Verify System Behaviour
Example	Path, Loop, Condition Testing	BVA, Equivalence Partitioning

Conclusion

- Both testing types complement each other.
- **White Box Testing:** Ensures code correctness.
- **Black Box Testing:** Ensures functional correctness.
- Combined, they ensure high-quality, reliable software.

White Box Testing checks **how** the system works internally.
Black Box Testing checks **what** the system does externally.