

- Process of determining whether a



# Execution-based Testing

- Generating and Executing Test Cases on the Software
- Types of Execution-based Testing
  - ~~0.0~~ **Specification-based**

# Black-box Testing

# White-box Testing

- Example

# Discussion

- Which is superior?
- Each technique has its strengths -  
Use both



# Surprise Quiz

- Determine test cases so that each **print statement** is executed at least once

```
input(x);
```

```
if (x < 100)
```





# Symbolic Evaluation

- Symbolic Execution
  - Program flow-graph

# Symbolic Execution

- **Symbolic Execution**
  - **Initialize Execution**
    - Token on edge leading to first node

# Symbolic Execution

- Program State
  - Path expression & path condition
- State Space
  - For a program without loops, what does the state space look like?
    - A Tree: can (in principle) be exhaustively explored to check for problems
  - With loops, the state space is infinite. Only some paths may be checked, i.e., explore a sample of the state space
- Symbolic Testing
  -

# Symbolic Execution

- Using Symbolic Execution
  - Can we fail to accept a correct program?
    - Pessimistic inaccuracy
  - Can we fail to reject an incorrect program?
    - How about unexplored paths? What if a fault lies on one of them!!
    - Optimistic inaccuracy

# Global Symbolic Evaluation

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# Global Symbolic Evaluation

- Every path is made up of a finite sequence of sub-paths and
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# Simulation

- Integration with system hardware is central to the design
- Model the external hardware
- Model the interface
  
- Examples
- Discussion

# Boundary-value Analysis

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- Choose test data that lies both inside each input class and at the boundary of each class
- Select input that causes output at each class boundary and within each class
- Also known as **stress testing**



# Cause-effect Graphing

- Input stimulus is called a “cause”
- Output can be partitioned into various classes called “effects”
- Group causes by their effects to minimize test suite size
- Generally used from high-level specifications

# Structural Testing

- Coverage-based testing
  - Test cases to satisfy statement coverage
  - Or branch coverage, etc.
- Complexity-based testing
  - Cyclomatic complexity
    - Graph representation
    - Find the basis set
    - # of braches + 1

