

CSC444 - Software Engineering I

Week 7-2

Verification vs. Validation

- How do you know if you build the right product?
 - Would you have satisfied customers?
 - Error free program?
- When do you know it?
 - Can you know it?
 - What is the risk?

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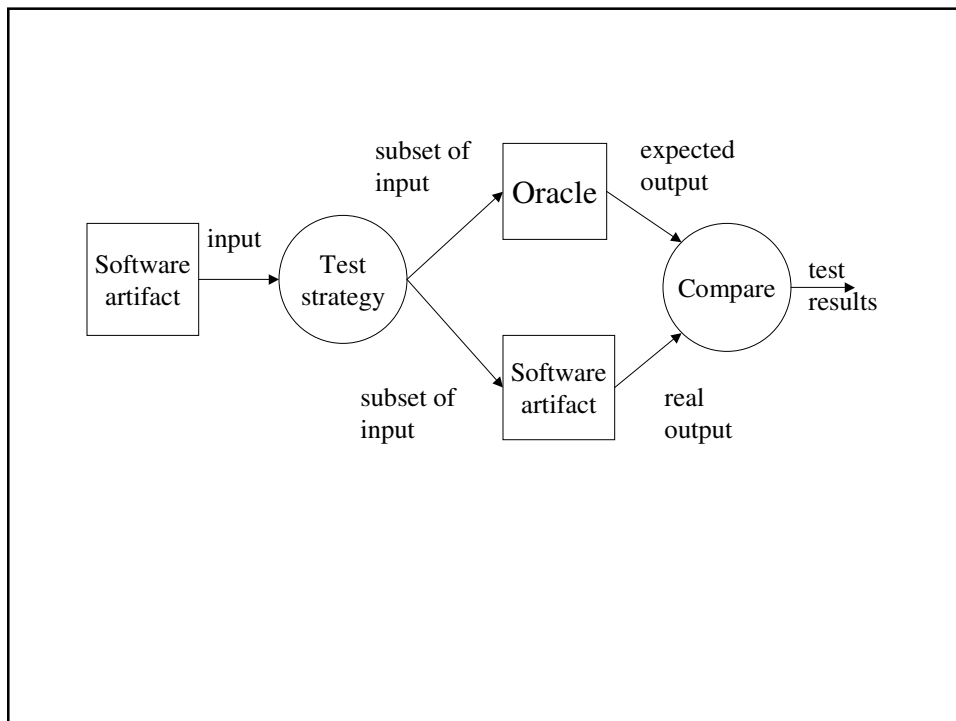
- Testing reveals only the presence of errors, not their absence
 - Can I convince you there is no error?
- Complete testing of a large software system is not practical. Why?
- What is the objective of testing?
 - Find as many errors as possible?
 - Test as many parts of the system as possible?

Definitions

- **Error:** a human action that produces an incorrect result
- **Fault:** a manifestation of an error.
- **Failure:** when a fault is encountered, it may result in a failure
- During testing, we look for failures!
 - A failure may be caused by many faults
 - A fault can cause many failures
 - Many to many relationships

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- Failure is relative:
 - with respect to the specification
- Dichotomy
 - Verification: have we built the system right?
 - Does the system satisfy its specification
 - Validation: have we built the right system?
 - Does the specification satisfy the customer's expectation



Types of testing

- Text book classification
 - **Coverage-based testing:** how much of the artifact we test
 - **Fault-based testing:** how many faults identified
 - **Error-based testing:** focus on error-prone areas
- Other classification
 - **White-box** /structural/ program-based
 - **Black-box** /functional/ specification-based

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- Application of various testing
 - unit testing: applies to modules
 - system testing: applies to the system as a whole
 - regression testing: over time
 - ad hoc or random testing
- Adequacy criteria specifies requirements for testing
 - stopping rule, coverage criterion,
- Objective of testing:
 - fault detection vs. confidence building

Another taxonomy of testing for full life cycle

White-box
testing

Black-box
testing

Static
testing

Dynamic
testing

Testing life cycle

- **Specification**
 - criteria
 - completeness, consistency, feasibility, testability
 - white-box, static
 - missing, wrong, or extra information
 - standards support this
- **Design**
 - similar to specification
 - check for ilities
 - standard styles facilitate test

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- **Implementation**
 - white-box
 - static testing: code review, inspection, walk through
 - dynamic testing: unit testing, individual modules
 - black-box
 - dynamic: function verification, system verification, and regression ... 3rd party integration
- **Maintenace**