USF UNIVERSITY OF SAN FRANCISCO
CHANGE THE WORLD FROM HERE

Software Testing

CS 272 Software Development

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An Introduction to Software Testing...

- Could be an entire **lecture**
- Could be an entire **course**
- Could be an entire **degree**
- Could be an entire **profession**
- Could be an entire **field of study**

Software Testing Questions

Software Testing Questions

Who **What** When Where Why How

- **Who performs testing?**
  - Developers? End users? Third party groups?
- **What (attributes) are you testing?**
  - Correctness? Efficiency? Flexibility?

Software Testing Questions

Who | What | When | Where | Why | How

- **When do you perform testing?**
  - At start, throughout or end of development cycle?
- **Where (or what level) do you perform testing?**
  - Individual components? Interactions? Entire system?

Software Testing Questions

Who | What | When | Where | Why | How

- **Why (what objectives) are you performing testing?**
  - Validation or verification?
- **How are you performing testing?**
  - Methodology? Automated? Toolkit?

Who Performs Testing?

- **Developers**
  - \+ Allows immediate fixes
  - ○ Lowest cost?
  - – Too close to code?
- **End Users**
  - \+ Realistic usage
  - – Limited to functionality
- **Third Party Groups**
  - \+ No bias
  - \+ Can examine code
  - \+ Can test functionality
  - ○ Less familiar with code
  - – Very expensive

What Attributes To Test?

Operation

- Correctness
- Reliability
- Efficiency
- Usability
- Security
- Integrity

Revision

- Maintainability
- Testability
- Flexibility

Transition

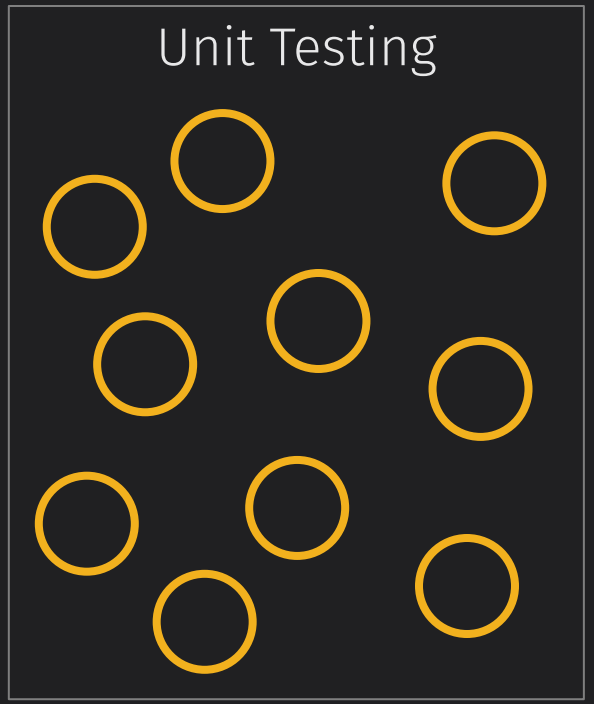
- Portability
- Reusability
- Interoperability

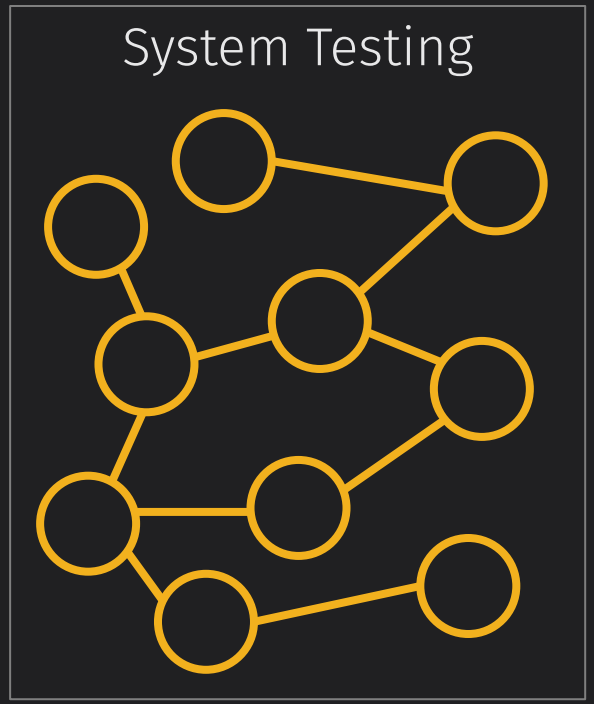
https://en.wikipedia.org/wiki/List_of_system_quality_attributes

When Perform Testing?

- **Before** code development
  - Create tests before code, incrementally develop functionality to pass tests (test-driven)
- **Throughout** the development cycle
  - Continuous, test after each phase
- **End** of development cycle
  - After functionality developed, before reaching customer

What Level of Testing?





Why Perform Testing?

- **Verification**
  - Have we built the **system right**?
  - *e.g. Did we build a calculator that can't add correctly?*
- **Validation**
  - Have we built the **right system**?
  - *e.g. Did we build a calculator when we needed a phone? (both have number buttons after all!)*

How Perform Testing?

- **Who** (developers, users, third party) is doing the testing?
- **What** quality attributes are you testing?
- **When** (in the development cycle) are you testing?
- **Where** (unit, integration, system) are you testing?
- **Why** are you testing (verification vs validation)?
- **How** (which approach) will you take based on above?

Testing Approaches

- **Accuracy** versus **usability** versus **accessibility** versus **performance** versus **load** versus ... testing
- **Open**/clear/transparent ~~white~~ box versus **closed**/opaque ~~black~~ box testing
- **Coverage** versus **fault** versus **error**-based testing
- **Fuzz** testing versus **mutation** testing
- ...and many more

https://en.wikipedia.org/wiki/Software_testing

OSS-Fuzz

- Continuous fuzzing for open-source software
- Offered as a cloud-service for "critical" open source projects or run locally
- Found 28k+ bugs in 850 open source projects since 2023
- Itself also an open-source project supported by Google

https://github.com/google/oss-fuzz and https://google.github.io/oss-fuzz/

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