Software Testing

CS 272 Software Development

Professor Sophie Engle
Department of Computer Science

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**

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Software Testing Questions

Who **What** **When** **Where** **Why** **How**

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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?

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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?

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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?

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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

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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

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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
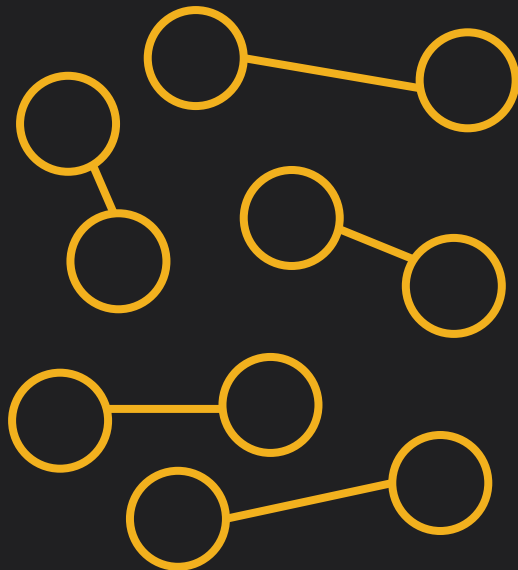 - After functionality developed, before reaching customer

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What Level of Testing?

Unit Testing

Integration Testing

System Testing

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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!)*

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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?

- **What** level (unit, integration, system) are you testing?

- **Why** are you testing (verification vs validation)?

- **How** (which approach) will you take based on above?

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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

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OSS-Fuzz

- Continuous fuzzing for open-source software

- Offered as a cloud-service for "critical" open source projects or run locally

- Found 25k+ bugs in 375 open source projects since 2020

- 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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