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Unit Testing

CS 272 Software Development

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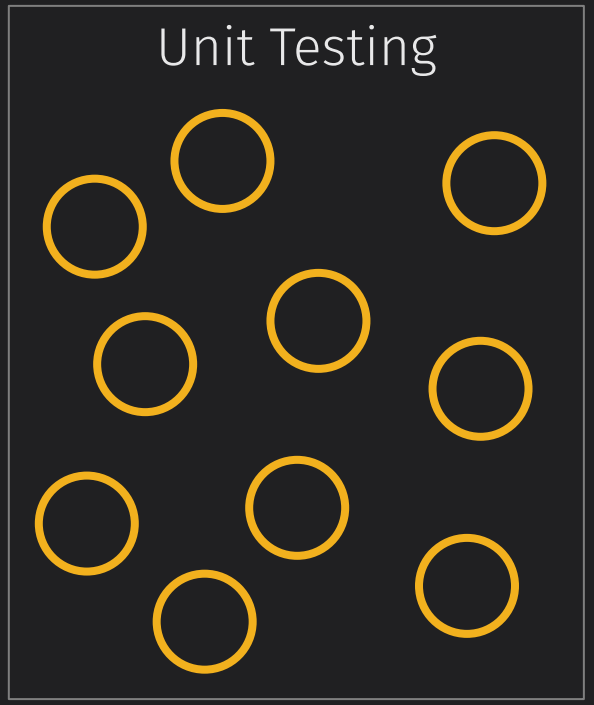
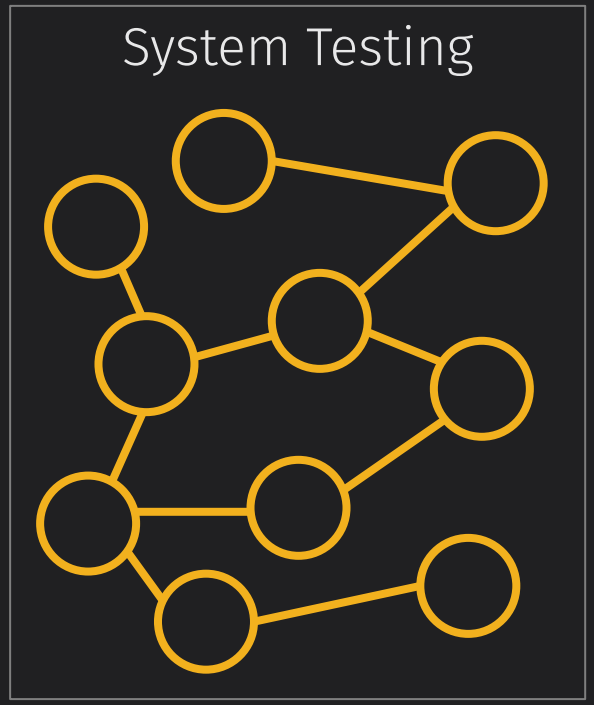

Unit Testing


Integration Testing


System Testing

Unit Testing

Who: Performed by **developers**

What: Improves software **correctness**

When: Usually part of **continuous testing** and/or **test-driven development**

Where: Tests **individual** methods

Why: Tests for **verification** of implementation

How: Tests are **automatable** using different frameworks

JUnit Framework

- Used for primarily for **unit testing**
- Built into Eclipse IDE (and most IDEs)
- Uses custom assertion methods (not **`assert`** statements)
- Latest versions (v4+) uses **annotations**
  - `@Test`, `@BeforeEach`, `@AfterEach`

https://junit.org/junit5/

JUnit Assertion Methods

- `assertFalse()`
- `assertNotNull()`
- `assertNotSame()`
- `assertArrayEquals()`
- `assertTrue()`
- `assertNull()`
- `assertSame()`
- `assertEquals()`

https://junit.org/junit5/docs/current/user-guide/#writing-tests-assertions
https://junit.org/junit5/docs/current/api/org/junit/jupiter/api/Assertions.html

JUnit Annotations

- Use **`@BeforeEach`** for code called before every test
  - Used to setup environment before test
- Use **`@Test`** to indicate a method is a unit test
  - Should contain one assertion method*
- Use **`@AfterEach`** for code called after every test
  - Used to clean up environment after test

https://junit.org/junit5/docs/current/user-guide/#writing-tests-annotations

JUnit `@Test` Annotations

- Many related test annotations
  - `@Test`, `@RepeatedTest`, `@ParameterizedTest`
- Double check importing right annotations!
  - Similar to annotations in JUnit 4
  - Imports should be from `org.junit.jupiter.api`
- Using `System.exit()` can break unit tests

https://junit.org/junit5/docs/current/user-guide/#writing-tests
https://junit.org/junit5/docs/current/api/org/junit/jupiter/api/Test.html

Advanced JUnit Tests

- Able to create **parameterized tests**
  - Create single test that expects parameters
  - Create specific list of parameters to test
- Able to **group tests** into nested classes
  - Create multiple nested classes of test cases
  - Can also inherit test cases from other classes

https://junit.org/junit5/docs/current/user-guide/#writing-tests-parameterized-tests
https://junit.org/junit5/docs/current/user-guide/#writing-tests-nested

Example Normal Test

```
@Test
public void testNullFlag() {
    boolean actual = ArgumentParser.isFlag(null);
    Assertions.assertFalse(actual, "null");
}
```

https://github.com/usf-cs272-spring2022/homework-ArgumentParser-template/blob/01d2c51a1986ee4007ad0a040fe6ffbdc9641cb1/src/test/java/edu/usfca/cs272/ArgumentParserTest.java#L92-L96

Example Parameterized Test

```
@ParameterizedTest
@ValueSource(strings = { "-a", "-hello", ... })
public void testValidFlags(String flag) {
    boolean actual = ArgumentMap.isParser(flag);
    Assertions.assertTrue(actual, flag);
}
```

https://github.com/usf-cs272-spring2022/homework-ArgumentParser-template/blob/01d2c51a1986ee4007ad0a040fe6ffbdc9641cb1/src/test/java/edu/usfca/cs272/ArgumentParserTest.java#L65-L71

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