Unit Testing with JUnit

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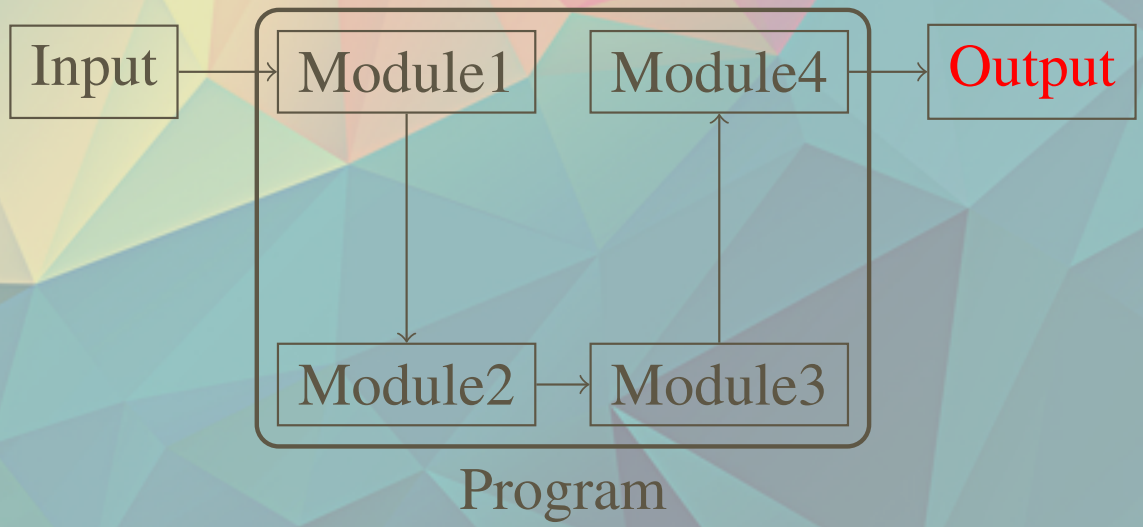
Testing

- Testing
  - An empiric method for verifying the correctness of a software
  - An automated process aimed at showing the behavior of a software on a give input
- Two categories: black box v.s. white box

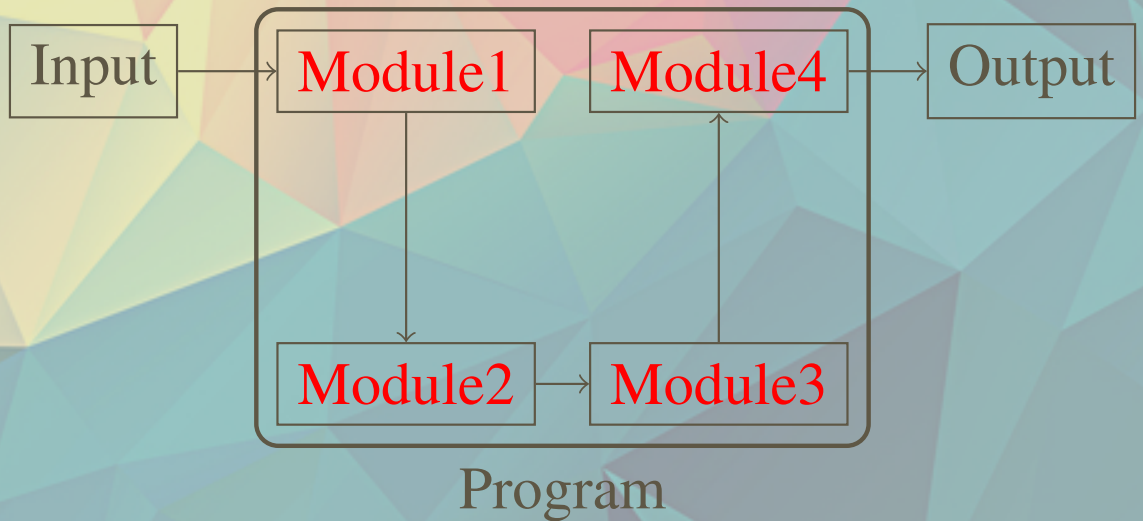
Black Box Test

- Black box: Given an input, tests whether the software outputs the expected result, ignoring how the software really works



White Box Test

- White box: Single portions of source code are tested



Unit Testing

- Unit Testing is a white box testing methodology that tests the unit of a source code
- A unit is the smallest portion of code that may be tested
  - In procedural programming it may be a single program, or a function
  - In Java it may be a class, an interface, or even a method
- Unit Testing is the testing of a specific unit

Why Unit Testing?

- A source code cannot be considered correct without being verified
- Divide-et-impera approach
  - Subdivide the system into unit
  - Each unit is debugged separately
  - Reduce probability of presenting bugs
  - Errors are not propagated among units
- Support regression testing
  - Verify that the application works as specified even after the changes/additions/modification were made to it
  - The original functionality continues to work as specified even after changes/additions/modification to the software application
  - The changes/additions/modification to the software application have not introduced any new bug

JUnit

- Unit testing can be performed by a software
- JUnit is a Java Unit Testing framework
  - API for easily create tests
  - Comprehensive assertion facilities (expected vs actual result)
  - Test runner for running tests
  - Test aggregation facilities

JUnit: Basic Concepts

- Test Case: a method that verify a specific functionality of the unit
- Test Suite: a collection of Unit Test
- Test Fixture: all the things that must be in place in order to run a test and expect a particular outcome

JUnit: Conventions

- The name of the test case method should indicate the expected behavior
  - good: sqrtWorks, minWorks, etc.
  - bad: test1, myTest, etc.
- Test class usually ends their name with “Test”
  - good: MathTest, PersistenceTest, etc.
  - bad: MyClass, WTFAmIDoingWithMyLife, etc.

JUnit:Test case

- JUnit is annotation driven
- There is no need to extend any special class
- Test cases are annotated with @Test
  - Test method are void and takes no parameters
  - Extra infos suggests specific behaviors
    - @Test(timeout = 10): test succeeds if terminate within 10 seconds
    - @Test(expected = IllegalArgumentException.class): test succeeds if IllegalArgumentException is thrown
  - @Ignore("reason") ignore a test

JUnit: Annotations

- @Before: mark a method for being invoked before each test case
- @After: mark a method for being invoked after each test case
- @BeforeClass: mark a method for being invoked at the beginning of the test
- @AfterClass: mark a method for being invoked at the end of the test
- @Before and @After are meant to prepare/release the test fixture for each test case
- @BeforeClass @AfterClass are static method and must appear at most once in each test

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JUnit: Parametrized Tests

- Using @RunWith(Parameterized.class) and a parameter marked with @Parameters, we can execute a test over multiple values of the parameter

```
@RunWith(value=Parameterized.class)
public class FactorialTest {
    private long expected;
    private int value;
    @Parameters
    public static Collection<Object[]> data() {
        return
          Arrays.asList(new Object[][]{{1,0},{1,1},{2,2},{120,5}});
    }
    public FactorialTest(long expected, int value) { // constructor
        this.expected = expected;
        this.value = value;
    }
    @Test
    public void factorial() {
        assertEquals(expected, new Calculator().factorial(value));
    }
}
```

JUnit: Test Suite

- Test Suites group tests into hierarchies

```
@RunWith(value=Suite.class)
@SuiteClasses(value={MyProgramTest.class, AnotherTest.class})
public class AllTests{

...

}
```

JUnit: Asserts

- assertEquals (expected, actual)
  - Works with object, int, long, byte, string, . . ., etc.
  - Object: it invokes object.equals(object) to check for equality
- assertEquals (expected, actual, epsilon)
  - For float and double
- assertTrue / assertFalse (bool)
- assertNull / assertNotNull (object)
- assertSame / assertNotSame (object, object)
- assertArrayEquals (object[], object[])