

---

## CSE 143 Java

### Testing and JUnit

Reading: [www.junit.org](http://www.junit.org); [DrJava JUnit Help](#)

10/5/2004

(c) 2003-4, University of Washington

04a-1

---

## Testing & Debugging

- Testing Goals
  - Verify that software behaves as expected
  - Be able to recheck this as the software evolves
- Debugging
  - A controlled experiment to discover what is wrong
  - Strategies and questions:
    - What's wrong?
    - What do we know is working? How far do we get before something isn't right?
    - What changed?
    - (Even if the changed code didn't produce the bug, it's fairly likely that some interaction between the changed code and other code did.)

10/5/2004

(c) 2003-4, University of Washington

04a-2

---

## Unit Tests

- Idea: create small tests that verify individual properties or operations of objects
  - Do constructors and methods do what they are supposed to?
  - Do variables and value-returning methods have the expected values?
  - Is the right output produced?
- Lots of small unit tests, each of which test something specific, not big, complicated tests
  - If something breaks, the broken test is a clue about where the problem is

10/5/2004

(c) 2003-4, University of Washington

04a-3

---

## Writing Tests

- When?

Before you write the code!!!
- Say what? Why would you do that?
  - Helps you understand the problem and think about code design and implementation
  - Gives you immediate feedback once the code is written

10/5/2004

(c) 2003-4, University of Washington

04a-4

---

## Where to put the tests?

- DrJava's interactions window
  - Great way to prototype tests
  - Way too tedious to do any extensive testing
- Main methods
  - Either too many to do a thorough job, or
  - Methods that test too much – hard to isolate problems
- Either way, someone has to check the output
- Better: automate this by writing self-checking tests

10/5/2004

(c) 2003-4, University of Washington

04a-5

---

## JUnit

- Test framework for Java Unit tests
- Idea: implement classes that extend the JUnit TestCase class
- Each test in the class is named testXX (name starting with "test" is the key)
- Each test performs some computation and then checks the result
- Optional: setUp() method to initialize instance variables or otherwise prepare before each test
- Optional: tearDown() to clean up after each test
  - Less commonly used than setUp()

10/5/2004

(c) 2003-4, University of Washington

04a-6

## Example (from DrJava help)

- Tests for a simple calculator object

```
import junit.framework.TestCase;
public class CalculatorTest extends TestCase {

    public void testAddition() {
        Calculator calc = new Calculator();
        int expected = 7;
        int actual = calc.add(3, 4);
        assertEquals("adding 3 and 4", expected, actual);
    }
    ...
}
```

10/5/2004

(c) 2003-4, University of Washington

04a-7

## Another Calculator Test

```
public void testDivisionByZero() {
    Calculator calc = new Calculator();
    try {
        calc.divide(2, 0);           // exception handling - coming attraction
        fail("should have thrown an exception");
    } catch (ArithmeticException e) {
        // do nothing - this is what we expect
    }
}
```

10/5/2004

(c) 2003-4, University of Washington

04a-8

## What Kinds of Checks are Available

- Look in `junit.framework.Assert` (JavaDocs on [www.junit.org](http://www.junit.org))

- Examples

```
assertEquals(expected, actual); // works on any type except double
                                // uses .equals() for objects
assertEquals(message, expected, actual); // all have variations with messages
assertEquals(expected, actual, delta); // for doubles to test "close enough"
assertFalse(condition);
assertTrue(condition);
assertNotNull(object);
assertNull(object);
fail();
// and some others
```

10/5/2004

(c) 2003-4, University of Washington

04a-9

## setUp

- If the tests require some common initial setup, we can write this once and it is automatically executed before each test (i.e., each test starts with a fresh setUp)

```
import junit.framework.TestCase;
public class CalculatorTest extends TestCase {
    private Calculator calc; // calculator object for tests
    /** initialize for each test */
    protected void setUp() {
        calc = new Calculator();
    }

    // tests as before, but without local declaration/initialization of calc
}
```

10/5/2004

(c) 2003-4, University of Washington

04a-10

## Summary

- Unit tests – a key to robust software
  - Verify correct operation of new code
  - Repeated running of tests as code changes increases confidence that changes don't introduce bugs (or makes it much easier to track down problems that do occur)
  - Tests become part of the project history/culture
- Write the tests before you write the code
- If you discover a bug you didn't test for, add a test
- A little up-front effort will pay off in much better quality code and much less time tracking down problems

10/5/2004

(c) 2003-4, University of Washington

04a-11