First Experience Teaching Software Testing

Lessons Learned

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Agenda

- Background
- Things that worked
- Things that didn't work
- Wish list
- Questions

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CS525T: Fall 2002

- Graduate course: *Software Testing*
  - http://www.cs.wpi.edu/~gpollice/cs525t-f02/
- 14 weeks
- Text: *A Practical Guide to Testing Object-Oriented Software*, McGregor and Sykes
- Goals
  - General understanding of testing principles
  - The role of testing in modern SDLCs
  - Experience testing software and using tools
  - Prepare students for further research

CS525T: Fall 2002

- Students
  - 28 graduate students
  - No previous testing courses
- Student motivation
  - Will help entry into industry
  - Needed a project course
- Department motivation
  - Add to software engineering offerings

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CS525T: Fall 2002

- Two projects
  - Small teams, 2-5 students
  - Evaluate a testing tool
    - Commercial or non-commercial
    - Prepare an evaluation report (template provided)
    - No two teams could do the same tool
  - Test an open-source product
    - radical Java GUI builder from SourceForge
    - Several types of testing (left mostly up to the team)
    - Prepare a software readiness report

CS525T: Fall 2002

- Templates provided for several artifacts
  - Tool evaluation report
  - Test plan
  - Defect report
  - Test report
  - Simple test cases
  - JUnit TestCase and TestSuite files
- Several templates taken from, or adapted from the Rational Unified Process®

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Black Box Testing

- Easiest for students to understand
- Simple examples
  - Triangle problem
  - Roman numeral converter
- Easy to grasp the concept of test cases
- It was fun for the students
  - Free pizza challenge

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Project 1: Tool Evaluation

- Goals:
  - Understand something about a “real” testing tool
  - Learn how to evaluate a tool for its appropriateness to different situations
  - Learn how to use the tool
- Template provided

Project 1: Results

- Ten reports produced
  - One ended up on tool vendor's Web pages
- What I didn't do
  - Provide enough time for presentation and discussion

(Semi)Formal Methods

- Used OCL to specify software and develop constraint test cases
  - Focus on the technique rather than strict adherence to the formal method
- Homework assignment: Develop OCL specifications for Java TreeMap class and implement tests in JUnit

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Formal Methods Results

- Coupled theory and practice
- Helped develop good techniques for test implementation
- Common errors
  - Using a method to test itself
  - Making tests too specific
- Grading OCL took a long time
- Grading the JUnit tests was easy

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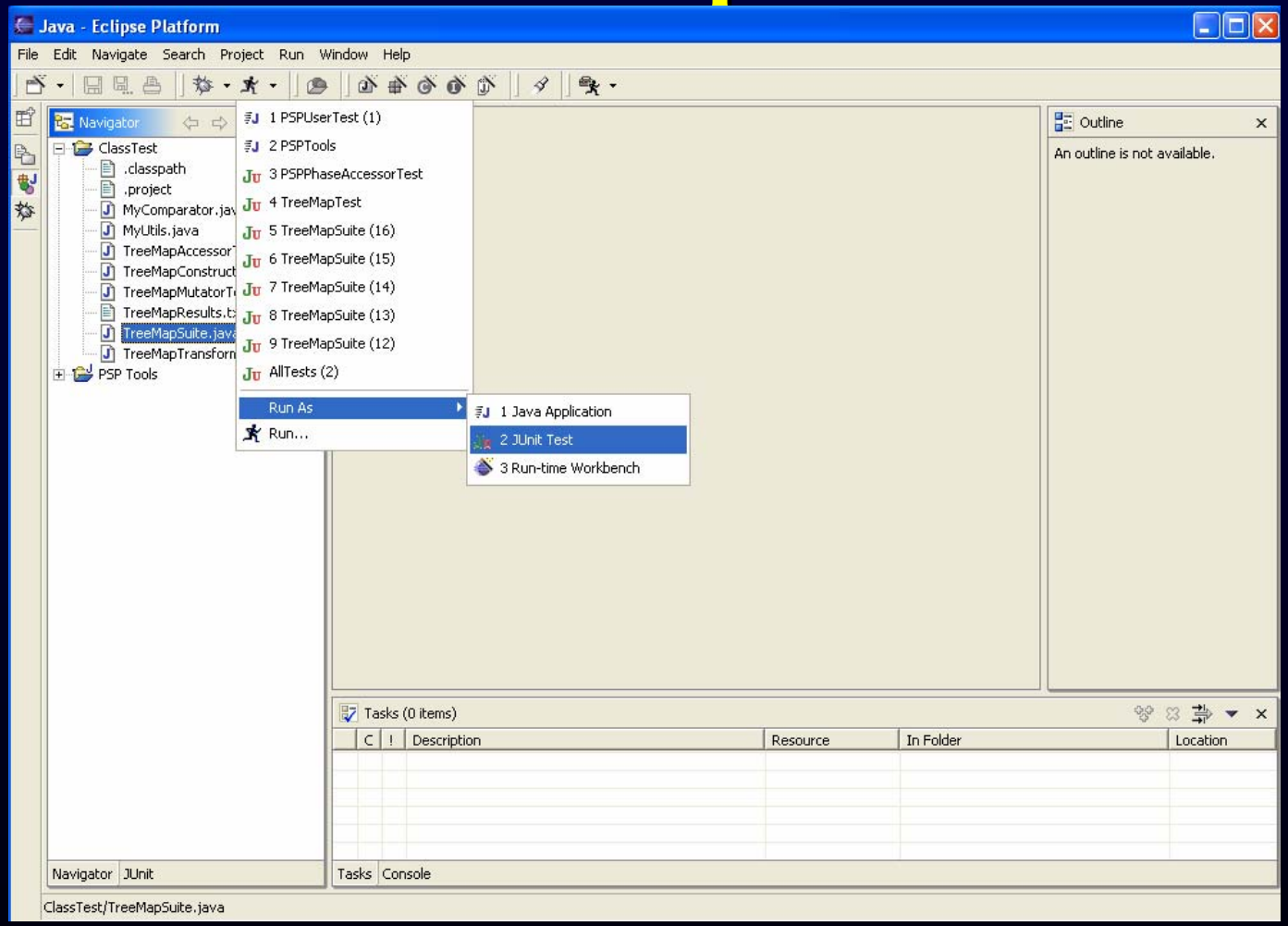
Examples


Java - Eclipse Platform
File Edit Navigate Search Project Run Window Help
Navigator
ClassTest
.classpath
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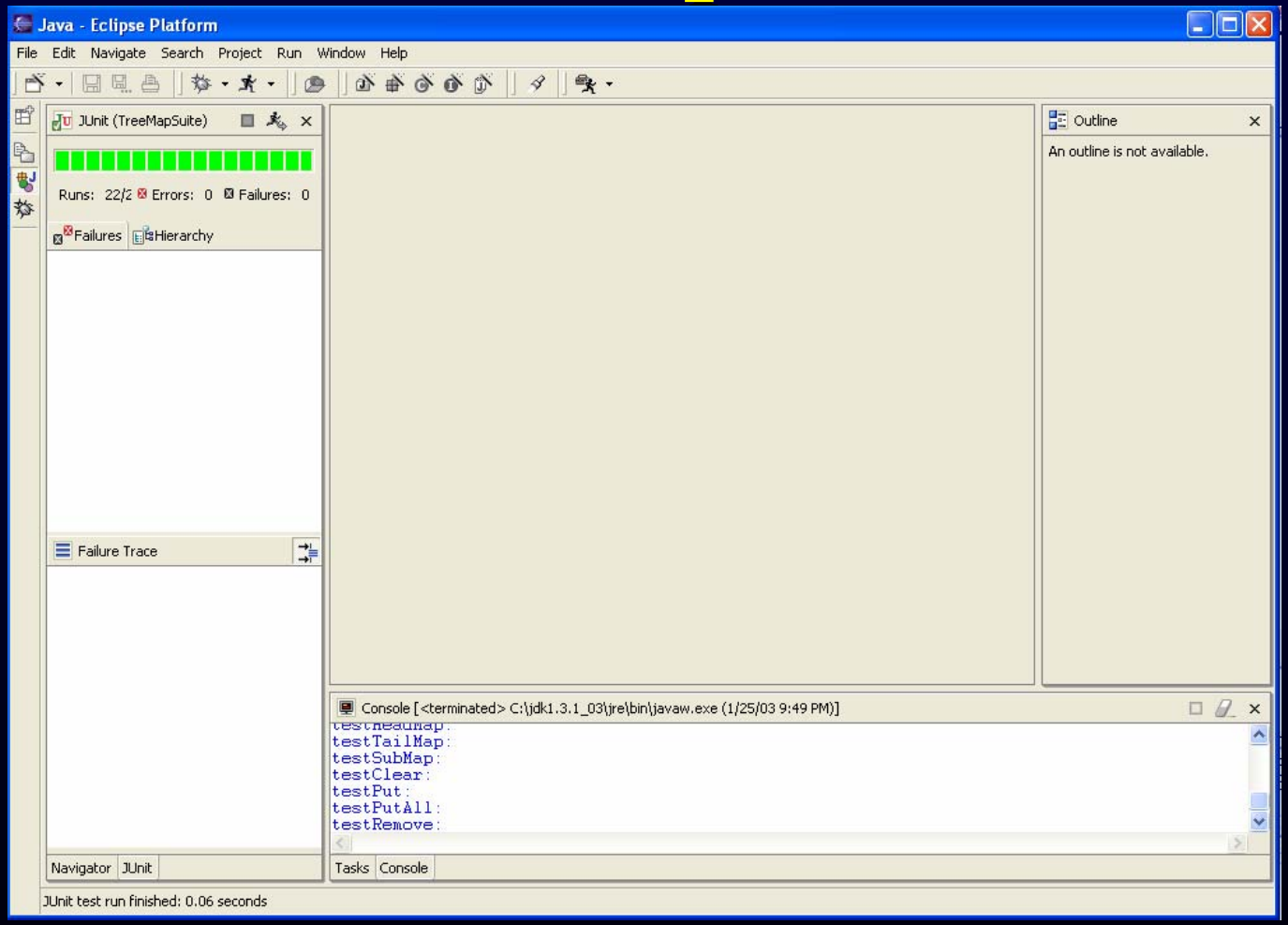
MyComparator.jav
MyUtils.java
TreeMapAccessor
TreeMapConstruct
TreeMapMutatorT
TreeMapResults.t
TreeMapSuite.java
TreeMapTransforn
PSP Tools
1 PSPUserTest (1)
2 PSPTools
3 PSPPhaseAccessorTest
4 TreeMapTest
5 TreeMapSuite (16)
6 TreeMapSuite (15)
7 TreeMapSuite (14)
8 TreeMapSuite (13)
9 TreeMapSuite (12)
AllTests (2)
Run As
Run...
1 Java Application
2 JUnit Test
3 Run-time Workbench
Outline
An outline is not available.
Tasks (0 items)
C ! Description Resource In Folder Location
Navigator JUnit
Tasks Console
ClassTest/TreeMapSuite.java

Examples


Java - Eclipse Platform
File Edit Navigate Search Project Run Window Help
JUnit (TreeMapSuite)
Runs: 22/2 Errors: 0 Failures: 0
Failures Hierarchy
Failure Trace
Navigator JUnit
Outline
An outline is not available.
Console [<terminated> C:\jdk1.3.1_03\jre\bin\javaw.exe (1/25/03 9:49 PM)]
testTailMap:
testSubMap:
testClear:
testPut:
testPutAll:
testRemove:
Tasks Console
JUnit test run finished: 0.06 seconds

Examples

```
/**
 * Test the containsKey method.
 *
 * TreeMap::containsKey(obj : Object) : boolean
 *  Pre:    true
 *  Post:   result = self->keySet().contains(obj)
 *
 * Test Cases:
 *  (self->containsKey(obj), true)
 *  (!(self->containsKey(obj)), false)
 */
public void testContainsKey()
{
    System.out.print("\ntestContainsKey: ");

    TreeMap map = makeTreeMap();
    // Test Case 1
    Object obj = new Integer(1);
    boolean result = map.keySet().contains(obj);
    Assert.assertEquals(map.containsKey(obj), result);
    Assert.assertTrue(result);
    // Test Case 2
    obj = new Integer(99);
    result = map.keySet().contains(obj);
    Assert.assertEquals(map.containsKey(obj), result);
    Assert.assertFalse(result);
}
```

Project 2: Test Real Software

- Challenges
  - Where do you get the software
  - Like the 3 Bears' porridge, not too easy, not too hard, but just right
  - Can you test multiple builds / iterations?
- Open source provides a lot of possibilities
  - Over 7000 projects on SourceForge in Java
  - We used the Radical Java GUI builder project

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Project 2: Minimum Deliverables

- Test plan
- Coverage of at least 80% line coverage
- Use case test
  - Students had to write the use case
- UI testing
- Exploratory testing
- Defect Report

Project 2: Results

- All teams achieved coverage goals
- Automated GUI testing was not effective
  - Only a single snapshot so record/playback was not necessary
- Number of defects reported was low
  - Largest number was 16
  - Lowest number was 5
- Students learned coverage tool well
- Some students worried more about form than results

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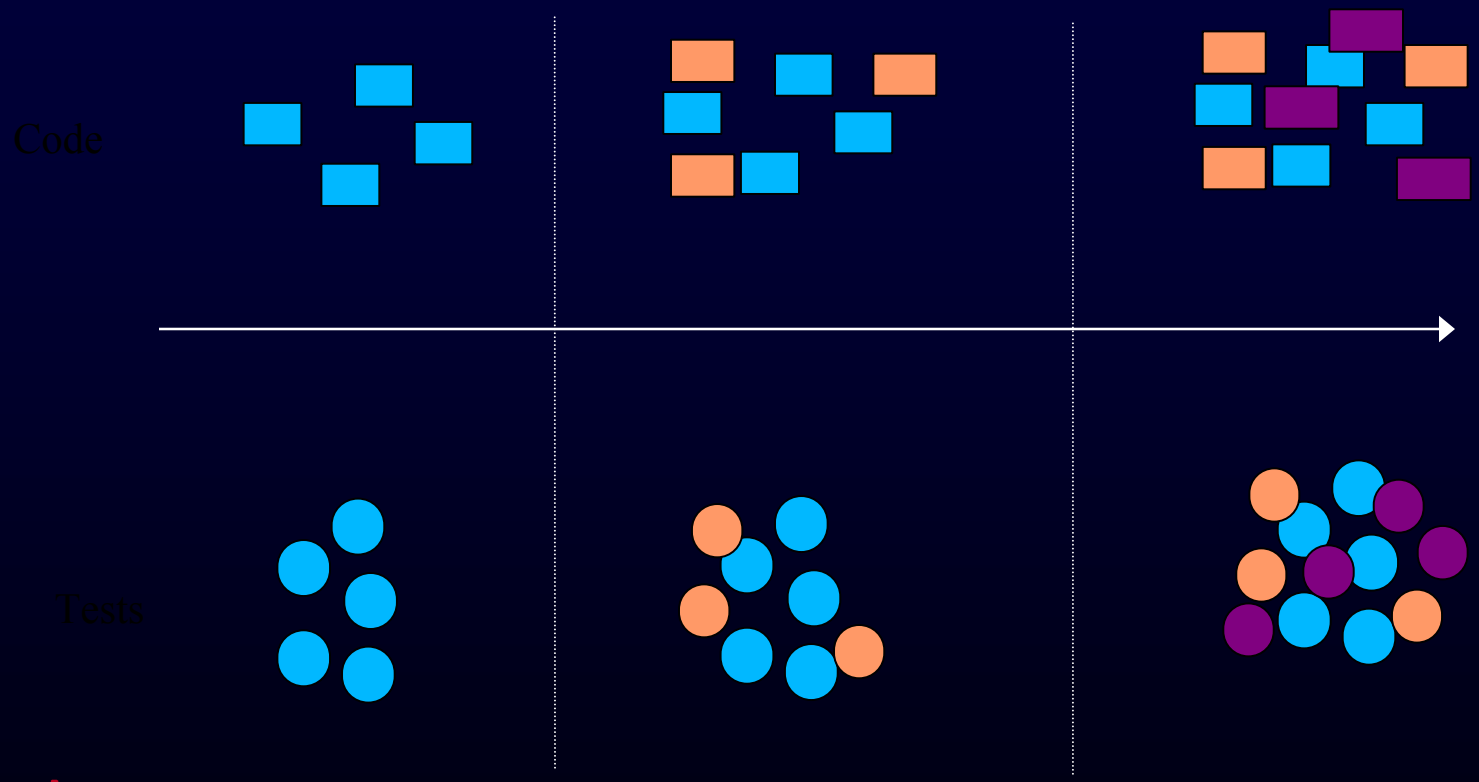
Testing in an Iterative Process

- You need iterations and the materials that go with them
- Learning about iterations and process is not the same as participating in an iterative project

Iterative Development Testing



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Building Test Tools

- Significant part of the software tester's job
- Not enough time
  - Perhaps a separate course on toolsmithing, not just test tools
- Emphasizing the need for good development skills for testers

Miscellaneous Disasters

- OATS
  - Difficult to motivate
- Distribution
  - Lack of resources
- Product lines and frameworks
  - Time and resources

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Teaching Resources

- Notes and slides
- Recommended readings
- Techniques

Tool Resources

- Commercial
- Free
- Where to get them
- Applicability
- Reviews

Software Resources

- The software testing tutorial resources!
  - Code
  - Models
  - Multiple technologies
- Allow instructors to mix-and-match
- Open source projects may be a place to mine
  - Current individual study at WPI looking into this

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Thank You!

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