Accommodating Test Dependence in Testing Algorithms

Reed Oei  Mentor: Wing Lam

Background

• Writing tests for software can help protect against bugs
• Testing algorithms can reveal bugs faster
  ○ Prioritization - Run tests that are likely to reveal errors first
  ○ Selection - Run only tests relevant to changes
  ○ Parallelization - Run multiple tests simultaneously
• Dependent tests are tests that produce a different test result depending on the order in which the tests are executed [1]
• Microsoft has estimated that for complicated systems like Microsoft Windows, the total cost of test result inspections, i.e. verifying whether a test is dependable, can cost up to $2 million a year [2]
• Dependent tests are undesirable because they waste developer’s time with debugging

```java
public class DependentTestExamples {
    // Global variable both functions can use
    private static int x = 0;

    @Test
    public void testA() {
        // Only works if x has not changed
        assertEquals(0, x);
    }

    @Test
    public void testB() {
        x++; // Changes x to be 1
        assertEquals(1, x);
    }
}
```

Fixing Dependent Tests

• Currently working to fix dependent tests in our subjects
• Fixed several dependent tests in two subjects
• Will make pull requests to contribute fixes to programs’ developers

Results

• The results I added are highlighted

<table>
<thead>
<tr>
<th>Program Name</th>
<th>LOC*</th>
<th># of Dependent Tests</th>
<th>Usages **</th>
</tr>
</thead>
<tbody>
<tr>
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<td>5</td>
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</table>

*Lines of Code  **Number of artifacts on Maven that use this program

Finding Dependent Tests

• Finding dependent tests in open source projects can tell us if dependent tests commonly cause problems with testing algorithms in real-world programs
• Identified dependent tests by applying testing algorithms
• Improved process of finding new subjects by improving the automation of the analysis tools and scripts
• Wrote tool to copy automatically generated tests from old version to new version of subject, removing any incompatible tests

References