Testing

ENGI 5895: Software Design

Andrew Vardy

Faculty of Engineering & Applied Science
Memorial University of Newfoundland

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Outline

1. Levels of Testing
2. Testing Methods
3. Test Driven Development
4. JUnit
"Program testing can be used to show the presence of bugs, but never to show their absence!" [E. W. Dijkstra]
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All of these are important, but methods for integration and system testing will depend on your application. We focus here on **unit testing**.
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We will take the perspective of the developer and focus on **white box testing**.
Test Driven Development

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5. **Refactor code and re-run tests**
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![Coupled Payroll Model Diagram](image)

**Figure 4-1** Coupled Payroll Model
Decoupling

In order to write a unit test, we will need to decouple the software unit being tested from other objects.

e.g. Test the `payEmployees` method of our Payroll class. Here is our design so far:

(Note: modified from [Martin(2003)]).

How can we test Payroll without complete implementations for the other classes? Solution: the Mock Object design pattern.
Create interfaces in place of the other classes and provide mock implementations. Later these mock implementations can be replaced:
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Figure 4-2 Decoupled Payroll using Mock Objects for testing
We can now write our test for payEmployees:

```java
public void testPayroll() {
    MockEmployeeDatabase db = new MockEmployeeDatabase();
    MockCheckWriter w = new MockCheckWriter();
    Payroll p = new Payroll(db, w);

    p.payEmployees();

    assert w.checksWereWrittenCorrectly();
    assert db.paymentsWerePostedCorrectly();
}
```
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- Basic usage:
  - BoundedAngle and TestBoundedAngle

- Using a test fixture:
  - IntVect and TestIntVect
References

Robert C. Martin.  