6. Testing & Refactoring

How we create classes?

- We think about what a class must do
- We focus on its implementation
- We write fields
- We write methods
- We may write a few test cases to see if it works
- We hand it off to users of our code
- We then wait for them to come back with feedback (problems)

Test First Coding

- How about starting with a test case even before we have any code for our class?
- How about first write test that fail because the code to support it does not exist?
- How about adding functionality to our system by adding tests incrementally and then adding code to make those tests succeed?

Test First Coding Benefits

- It would
  - completely revert the way we develop
  - We think about how our class will be used first
    - Helps us develop better interfaces that are easier to call and use
  - Would change the way we perceive things
  - Will have code that verifies operations
  - Will increase robustness of code
  - Will verify changes we make
  - Will give us more confidence in our code

Test First Coding Benefits…

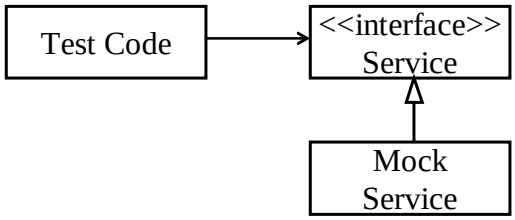
- Forces us to make our code testable
- Tests decouple the program from its surroundings
- Serves as invaluable form of documentation
  - Shows others how to use our code

Test Isolation – Mock Objects

- How do we create a test when our system may depend on
  - A database to persist information
  - A third party simulator to perform calculations/functions
  - A printer to print output
  - A scanner or device to read input?
- We may implement out system with Mock Objects

Mock Objects

- A Mock Object
  - Provides the expected functionality
  - Isolates the code from details that may be filled in later
  - Speeds up development of test code
  - Can be refined incrementally by replacing with actual code



Unit Testing

- Unit testing
  - Is more of an act of design than verification
  - Is more of an act of documentation than verification
  - Provides excellent feedback

Types of Tests

- White-box testing
  - Knows and depends on internal structure of modules being tested
  - Unit Testing
    - Drives the design
    - Validates changes made
    - Insufficient as verification tool however
- Black-box testing
  - Does not know and depend on internal structure of modules being tested
  - Acceptance testing
    - Written by customers, QA
    - Focuses on functionality of the system

Acceptance Testing

- Manual testing is not the preferred way
- Need to find ways to automate this as well
- Promotes separation of business logic from UI
- May be written using scripts, XML, etc.

Continuous Integration

- What good are the test cases if they are not run
- How often should we run them?
- Every night at least
- How about once every hour?
- Or better still when ever code change is checked in
- When code is checked in the code is compiled automatically and all tests cases are executed
  - If a test fails the team is alerted
  - When test fails, nothing else important/high priority
    - Fix the code to make the test succeed
    - Or modify the test to fit the changes if appropriate

Tools for Testing

- A number of tools are available
- A number of them are open source as well
- For Java and .NET
  - JUnit/NUnit
    - Automated Unit testing tool
  - Ant/NAnt
    - Automated build system
  - Cruise control/Cruise Control .NET
    - Continuous integration

A Test Driven Exercise

- Problem Statement
- Test code generation
- Coding and Design
- Testing and continuous integration
- Change

What is Refactoring?

- The Process of changing a software system in such a way that it does not alter the external behavior of the code yet improves its internal structure
- Why fix what's not broken?
  - A software module
    - Should function its expected functionality
      - It exists for this
    - It must be affordable to change
      - It will have to change over time, so it better be cost effective
    - Must be easier to understand
      - Developers unfamiliar with it must be able to read and understand it

A Refactoring Exercise

- Revisiting the code
- Improvements to be made
- Reasoning
- Benefits