Daniel Fitzmaurice(43961229)

1 Software Architecture

1.1 Quality

Cohesion – Degree to which elements of a module fit together

Coupling – Degree of interdependence between modules

2 Continuous Integration

Merge Frequently; Don't push broken code; Don't push untested code; Don't push when the build is broken; If the build is broken, fix it

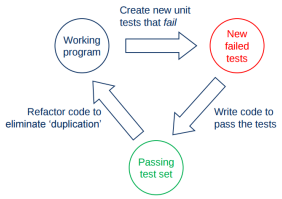
3 Test-Driven Development

A software development methodology based on: Short development iterations, Satisfying pre-prepared test cases. An independent offshoot of Agile methodologies. Based on using automated unit testing to drive software development.

```
import org.junit.Test;
import static org.junit.Assert.*;

public class FloopTest {

  @Test
  public void testWorking() {
    // do some set up

    int result = flooper.floop();
    assertEquals("Wasn't 3", 3, result);
  }
}
```

```
import org.junit.Test;
import org.junit.Before;
import org.junit.BeforeClass;
import static org.junit.Assert.*;

public class FloopTest {

  @Before
  public void beforeEachTest() {
    // some set up that's run before each test
    // in this class
  }

  @BeforeClass
  public static void beforeAnyTests() {
    // some set up that's run once before
    // any of the tests in this class
  }

  // etc
}
```

3.1 Test-Driven Dev: Red, Green, Refactor



Applying Test-Driven Development relies on the existence of an automated unit testing environment. You are obliged to maintain a suite of test cases. Code must not be released until is has associated tests. The test are written **before** the code.

3.2 Refactoring

Code that needs refactoring has: Duplication, Unclear intent, Tight coupling, Pure data classes, Over-sized or under-sized classes, Complex or long methods, Switch statements instead of polymorphism.

3.3 Designing Unit Tests

Test one thing only (Use few assertions per test). Work in isolation (Without relying on other tests). Test boundary conditions early. Avoid testing against "real" resources, i.e. GUIs or databases, to support testing determinism (Use mock objects and services - with fixed data)

How Many Tests?

Test or both black-box and glass-box. As the programmer add glass-box tests for: Conditionals, Loops, Operations, Polymorphism.

3.4 Mocking

Dummies - test objects which are never used but exist only to satisfy syntactic requirements

Stubs - test objects whose methods return fixed values, and support the specific test cases only

Fakes - test objects whose methods work but have only limited functionality

Mocks - test object which know how they're meant to be used, e.g. the sequence in which their methods should be called (allowing behavioural verification instead of just state verification)

4 Pair Programming

Constant review from two people ensures fewer defects. Works well for mentoring: inexperienced staff, new team members, learning new techniques or tools.

Driver - person at the keyboard

Navigator - focusing on design

Both need to be actively engaged - keep a running commentary

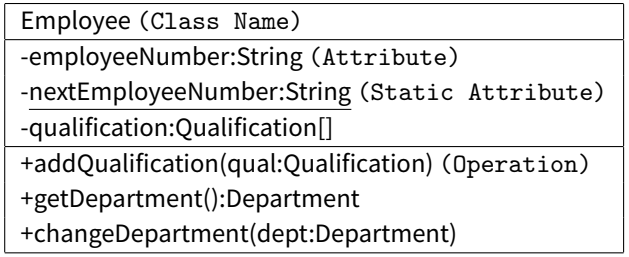
Switch roles frequently - every few minutes

4.1 Ping-Pong Programming

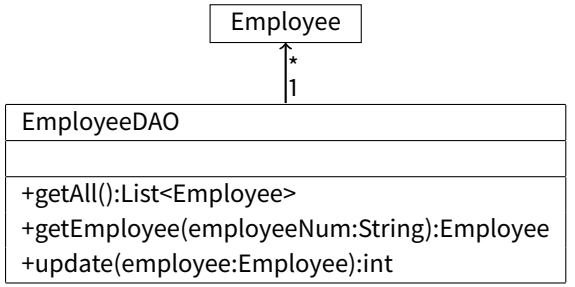
Driver writes a failing unit test. Driver & Navigator switch roles. New driver implements code to pass test - then write a new failing unit test. Switch roles again

5 Class Model

5.1 Class Icon



5.2 Association



Navigability; arrow in direction of usage, no arrow is bi-directional. Multiplicity; min..max (or n), * is unlimited.

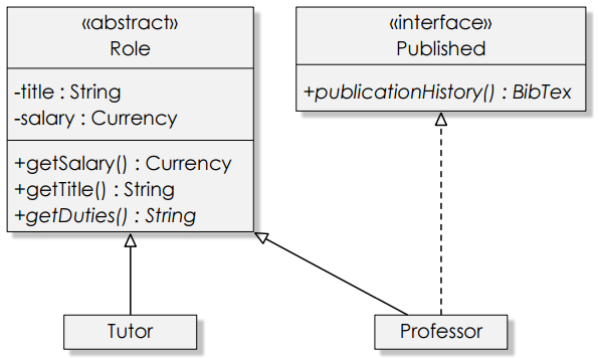
5.3 Aggregation

Strong relationship "has a". Hollow diamond

5.4 Composition

Strong relation "is part of". When composite is destroyed so is the part coincident life-span. Filled diamond

5.5 Inheritance/Subtyping



Generalisation/Specialisation: solid line, hollow arrow head. Implements: dashed line, hollow arrow head. Italics == abstract.

5.6 Packages

Dashed line = dependency. Solid line = Nesting

6 Design Patterns

Apply at various levels of abstraction. Are not reusable classes. Are not complex, domain-specific designs. Are limited in scope. Capture design intent, but not the full detail.

6.1 Common Language

Provide a common language for describing solutions; Each window is a composite - with decorators providing titles and scroll bars, To save memory - each image is a flyweight.

6.2 Pattern Form (GOF)

Pattern Name - short descriptive moniker and any aliases. Intent - short statement summarizing what problem it solves. Motivation - scenario that describes a problem this pattern solves. Applicability - how to identify when to use this pattern. Structure - description of class relationships and the object interactions. Participants - classes making up the pattern and their responsibilities. Collaborations - how the classes collaborate to perform their responsibilities. Consequences - benefits and trade-offs of using the pattern. Implementation - hints for implementing the pattern (consider language specific issues). Known Uses - examples of the use of this pattern in real systems (the Rule of Three). Related Patterns.

6.3 Common Patters

Singleton

Intent: Ensure a class only has one instance, and provide a global point of access to it (`getInstance()` function)

Observer

Intent: Define a one-to-many dependency between objects so that when one object changes state, all its dependents are notified and updated automatically.
Consequences: Loose coupling between Subject and Observer, Broadcast communication.

Composite

Intent: Compose objects into tree structures to represent whole-part hierarchies. Composite lets clients treat individual objects and compositions of objects uniformly.
Examples: Menu Bars, Graphics.

Command

Encapsulate a request as an object, thereby letting you parameterize clients with different requests.

Visitor

Represent an operation to be performed on the elements of an object structure.

State

Allow an object to alter its behavior when its internal state changes.

Lazy Loading

Avoid creating a large/complex/expensive object until you actually need it. Create a placeholder object that can be substituted out when the real object is actually needed.
Proxy - loads real object when data is accessed then forwards messages to real object (delegates).
Ghost - real object is created but without any data. Loads data when a method is invoked.

Radial Menus

Intent: Present user commands or choices radiating out from a central point.
Similar Patterns: Icons instead of Text.
Advantages: Shorter average distance to each item, greater distance between each item, faster interaction for expert users, works well for selecting graphical options.
Disadvantages: Doesn't scale/nest as well as vertical menus (best for 3-12 items or so), not as intuitive to read for the novice user, less familiar, text has to remain horizontal.

6.4 Anti-Patterns

Some things look like patterns, but make things worse, not better. Knowing these is almost as valuable as knowing the "good" patterns.

7 Code Smells

Code smells refer to any symtom in the source code that could possibly indicate a deeper problem. Code smells are not the problem. They do not produce compile errors and are not even bugs. Simply, they are evidence that there might be a bug or other issue nearby.

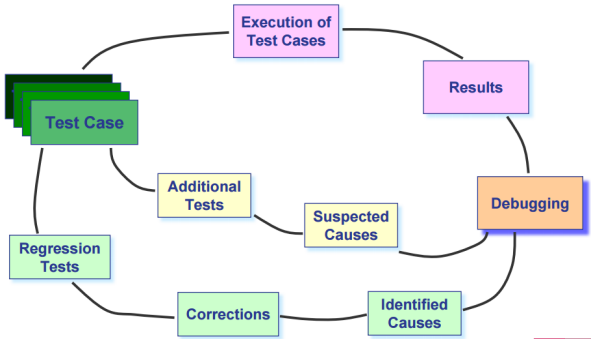
7.1 Code Smells V Anti-Patterns

Code smells are not the problem, however the benefit of understanding code smells is to help you discover and correct the anti-patterns and bugs that are the real problems.

8 User-Centered Design

Understand -> Define -> Ideate(Sketch) -> Prototype -> Test -> Deliver!

9 Debuggin Process



10 Logging

10.1 java.util.logging

Levels: SEVERE, WARNING, INFO, CONFIG, FINE, FINER, FINEST (in order, also OFF and ALL). Level of the logger is a cutoff for recording messages

10.2 Log4J

Levels: FATAL, ERROR, WARN, INFO, DEBUG, TRACE (also OFF, ALL)

10.3 slf4j

Brings all the loggers together, enabling switching during runtime or on compilation. Avoids every library having its own logging facility. Uses all the log levels of log4j but FATAL.

11 System

Jenkins – Builds the changes to the repo; SonarQube – checks for codesmells and code errors; Gradle – For testing and running on local machine