

# 1 Team

Complementary Skills; Mutual Accountability;  
Common Commitment; Shared Goal; Collective Work  
Products; More than the sum of its parts

## 1.1 Meetings

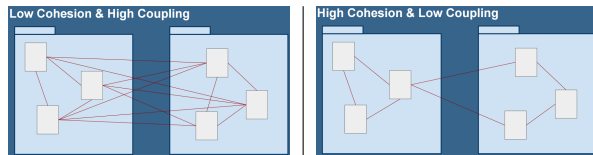
Hogging – talking too much; Flogging – beating an  
issue to death; Frogging – jumping from topic to  
topic; Bogging – getting stuck on an issue; Ignoring  
the Elephant in the Corner

# 2 Software Architecture

## 2.1 Quality

Cohesion – Degree to which elements of a module fit  
together

Coupling – Degree of interdependence between  
modules



# 3 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

# 4 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 FlooperTest {

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

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

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

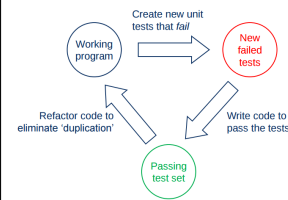
public class FlooperTest {

    @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
}
```

## 4.1 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 it has associated  
tests. The tests are written  
**before** the code.

## 4.2 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.

## 4.3 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?

## 4.4 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)

# 5 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

## 5.1 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

# 6 Class Model

## 6.1 Class Icon

Employee (Class Name)
-employeeNumber:String (Attribute)
-nextEmployeeNumber:String (Static Attribute)
-qualification:Qualification[]
+addQualification(qual:Qualification) (Operation)
+getDepartment():Department
+changeDepartment(dept:Department)

## 6.2 Association

```
classDiagram
    Employee "1" -- "*" EmployeeDAO
    class EmployeeDAO {
        +getAll():List<Employee>
        +getEmployee(employeeNum:String):Employee
        +update(employee:Employee):int
    }
```

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

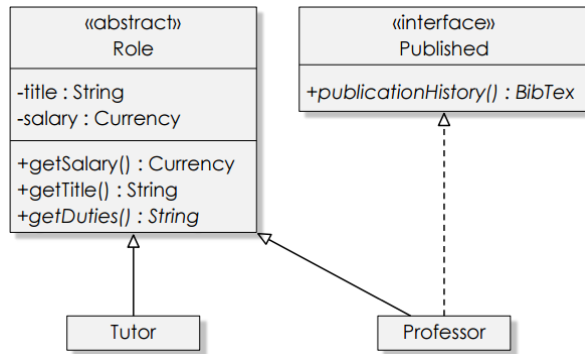
## 6.3 Aggregation

Strong relationship “has a”. Hollow diamond

## 6.4 Composition

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

## 6.5 Inheritance/Subtyping



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

## 6.6 Packages

Dashed line = dependency. Solid line = Nesting

## 7 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.

### 7.1 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.

### 7.2 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.

### 7.3 Common Patterns 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.

### 7.4 Anti-Patterns

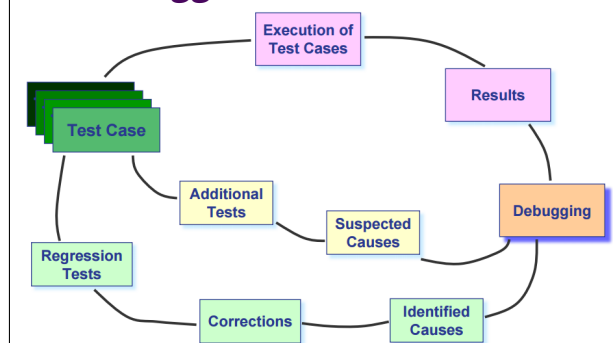
Some things look like patterns, but make things worse, not better. Knowing these is almost as valuable as knowing the "good" patterns.

## 8 User-Centered Design

Understand -> Define -> Ideate (Sketch)

-> Prototype -> Test -> Deliver!

## 9 Debugging 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