SWE 637 Software Testing
Activities, week 4

Testing with test doubles

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https://go.gmu.edu/SWE637
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Class Activity #4

Test doubles

Consider testing a class for airline reservation services. It has a ranking service as a dependency, with the idea that higher ranking customers get better arrangements (better seats, early boarding, etc.). *We are not testing the ranking service*, and we should assume it’s stochastic (that is, it might give different answers every time).
A simple example

An implementation of ReservationService might look like this:

```java
public class ReservationService {
    // instance variables, constructors, other methods omitted for now

    public void reserve (Customer customer) {
        RankingService rankingService = new RankingService();
        // more code that uses the ranking service by calling its method
        // public Rank getRank(Customer customer)
        // on the rankingService object.
    }
}
```

An associated test might look like this:

```java
@Test public void testReservationService () {
    ReservationService reservationService = new ReservationService();
    RankingService fakeRankingService = new FakeRankingService(); // inherits from RankingService
    // Umm... How do I get RankingService.reserve() to use this test double?
    // some assertion about reservationService.reserve("John Smith");
    // some assertion about reservationService.reserve("Jane Doe");
}
```
Utilizing the Test Double

What if we make rankingService a member variable of ReservationService?

```java
public class ReservationService {
    private RankingService rankingService;
    // instance variables, constructors, other methods omitted for now
    public void reserve (Customer customer) {
        rankingService = new RankingService();
        // more code that uses the ranking service by calling
        // public Rank getRank(Customer customer)
        // on the rankingService object.
    }
}
```

What else do we need to do? Hint: think about seams

Develop one or more simple tests with FakeRankingService. Focus on what you want to test, not the JUnit syntax.
Utilizing Seams

Given what we know about seams, develop an approach to using a fake ranking service

1. Using a compiler seam
2. Using an inheritance seam without dependency injection
3. Using an inheritance seam with dependency injection
4. Using Jmockit (try this one if your group finishes your assigned approach)
1. Using a compiler seam

```java
public class ReservationService {
    private boolean testMode = false;

    public ReservationService (boolean testMode) {
        this.testMode = testMode;
    }

    // instance variables, other methods omitted for now

    public void reserve (Customer customer) {
        RankingService rankingService;
        int rank;
        if (testMode) {
            rankingService = new RankingServiceFake();
        } else {
            rankingService = new RankingService();
        }
        rank = rankingService.getRank();
        // more code that uses the rank provided by the getRank() call
    }
}

@Test public void testReservationService () {
    ReservationService reservationService = new ReservationService(true);
    // some assertion about reservationService.reserve("John Smith");
    // some assertion about reservationService.reserve("Jane Doe");
}
```

Here we set ‘test mode’ in the constructor and execute different code if we’re in ‘test mode’.
2a. Without dependency injection

```java
public class ReservationService {

    private RankingService rankingService;

    public ReservationService () {
        this.rankingService = RankingServiceFactory.getRankingService();
    }

    public void setTestMode (){
        this.rankingService = RankingServiceFactory.getRankingServiceFake();
    }

    // instance variables, other methods omitted for now

    public void reserve (Customer customer) {
        // more code that uses the ranking service by calling
        // public Rank getRank(Customer customer)
        // on the rankingService object.
    }

    @Test public void testReservationService () {
        ReservationService reservationService = newReservationService();
        reservationService.setTestMode(); // enable unit test mode
        // some assertion about reservationService.reserve(“John Smith”);
        // some assertion about reservationService.reserve(“Jane Doe”);
    }
}
```

What if a call to `setTestMode()` sneaks into delivered software?

Here we use a method to put the class into ‘test mode’ and get a fake ranking service using a `RankingServiceFactory` class.
public class ReservationService {
    private RankingService rankingService;
    public ReservationService () {
        this.rankingService = RankingServiceFactory.getRankingService();
    }
    public ReservationService (RankingService rankingServiceFake) {
        this.rankingService = rankingServiceFake;
    }
    // instance variables, other methods omitted for now
    public void reserve (Customer customer) {
        // more code that uses the ranking service by calling
        //   public Rank getRank(Customer customer)
        // on the rankingService object.
    }
}

@Test public void testReservationService () {
    RankingService rankingServiceFake = new RankingServiceFake(); // inherits from RankingService
    ReservationService reservationService = new ReservationService(rankingServiceFake);
    // some assertion about reservationService.reserve(“John Smith”);
    // some assertion about reservationService.reserve(“Jane Doe”);
}
3. With dependency injection

```java
public class ReservationService {
    private RankingService rankingService;
    // instance variables, constructors, other methods omitted
    public void setRankingService (RankingService rankingService) {
        this.rankingService = rankingService;
    }
    public void reserve (Customer customer) {
        // more code that uses the ranking service by calling
        // public Rank getRank(Customer customer)
        // on the rankingService object.
    }
}

@Test public void testReservationService () {
    ReservationService reservationService = new ReservationService();
    RankingService rankingServiceFake = new RankingServiceFake(); // inherits from RankingService
    reservationService.setRankingService(rankingServiceFake);
    // some assertion about reservationService.reserve("John Smith");
    // some assertion about reservationService.reserve("Jane Doe");
}
```

This affects ReservationService users and breaks encapsulation
4. Using JMockit

```java
public class ReservationService {

    private RankingService rankingService;

    // instance variables, constructors, other methods omitted for now

    public void reserve (Customer customer) {
        rankingService = RankingServiceFactory.getRankingService();
        // more code that uses the ranking service by calling
        // public Rank getRank(Customer customer)
        // on the rankingService object.
    }
}

@Mocked
RankingService rankingServiceMock;

@Test
public void testReservationService () {
    new Expectations() {
        RankingService.getRank(new Customer("John Smith"));
        returns(5); // John Smith has rank=5

        RankingService.getRank(new Customer("Jane Doe"));
        returns(2); // Jane Doe has rank=2
    }

    ReservationService reservationService = new ReservationService();
    // some assertion about reservationService.reserve("John Smith");
    // some assertion about reservationService.reserve("Jane Doe");
}
```

"Expect the getRank() method to be called with 'John Smith' as the argument, and when that happens, then return 5."