

**UNIT TESTS PASSING**



**NO INTEGRATION TESTS**

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# Module 2-7

## Integration Testing

# Objectives

- What is an integration test?
- DAO Integration testing

# Integration Testing

- Broad category of tests that validate integration between
  - Units of code
  - Outside dependencies such as databases or network resources

# Integration Testing

- Use same tools as unit tests (i.e. Junit)
- Usually slower than unit tests (but still measured in ms)
- More complex to write and debug
- Can have dependencies on outside resources like files or a database

# DAO Integration Testing

DAOs exist solely to interact with database

Best tested with integration tests

Rules of testing:

- DRY – production code should be DRY – don't repeat yourself
- WET – testing code should be WET – write everything twice

# DAO Integration Testing

Integration tests with a database should ensure that the DAO code functions correctly:

- SELECT statements are tested by inserting dummy data before the test
- INSERT statements are tested by searching for the data
- UPDATE statements are tested by verifying dummy data has been changed
- DELETE statements are tested by seeing if dummy data is missing

# DAO Integration Testing

Tests should be:

- Repeatable – If test passes/fails on first execution, it should pass/fail on second execution if no code has changed
- Independent – A test should be able to run on its own, independently of other tests, OR together with other tests and have the same result either way
- Obvious – When a test fails, it should be as obvious as possible as to why it failed



# How to manage test data

- Remotely Hosted Shared Test Database
  - Advantages:
    - Easy setup
    - Production-like software and (possibly) hardware
  - Disadvantages
    - Unreliable and brittle
    - Lack of test isolation
    - Temptation to rely on existing data (which can change)

# How to manage test data

- Locally Hosted Test Database

- Advantages

- Production-like software
    - Reliable (local control)
    - Isolation

- Disadvantages

- Requires local hardware resources
    - RDBMS needs to be installed and managed

# How to manage test data

- Embedded, In-memory Database

- Advantages

- Very Reliable
    - Consistent across dev machines (managed by source control)
    - Lightweight

- Disadvantages

- Not same software used in production
    - Cannot use proprietary features of production RDBMS

# Mocking

- Make a replica or imitation
- Creating objects that simulate the behavior of real objects
- Typically used in unit testing, but we need to create fake data in order to test CRUD statements

# Database considerations

- When testing, we create “test data”
  - Insert new data, update data, or remove rows of data
- Do not want these to be permanent changes
  - Need to roll back changes when done

# SingleConnectionDataSource class

- We have used BasicDataSource for our production code
- For integration testing, we use SingleConnectionDataSource
  - Preferred implementation for testing
- Both BasicDataSource and SingleConnectionDataSource are implementations of DataSource

# @BeforeClass method

- Generally set up the data source in a @BeforeClass method:

```
@BeforeClass
public static void setup() {
    dataSource = new SingleConnectionDataSource();
    dataSource.setUrl("jdbc:postgresql://localhost:5432/dvdstore");
    dataSource.setUsername("postgres");
    dataSource.setPassword("postgres1");
    dataSource.setAutoCommit(false);
}
```

# @Before method

- Where we would insert mocked data into the database:

```
@Before
public void setupData() {
    String sqlInsertCountry = "INSERT INTO country (code, name, continent, " +
        "region, surfacearea, indepyear, population, lifeexpectancy, gnp, " +
        "gnpold, localname, governmentform, headofstate, capital, code2) " +
        "VALUES (?, 'Afghanistan', 'Asia', 'Southern and Central Asia', " +
        "652090, 1919, 22720000, 45.9000015, 5976.00, NULL, " +
        "'Afganistan/Afqanestan', 'Islamic Emirate', 'Mohammad Omar', " +
        "1, 'AF')";
    JdbcTemplate jdbcTemplate = new JdbcTemplate(dataSource);

    jdbcTemplate.update(sqlInsertCountry, TEST_COUNTRY);
    dao = new JBCCityDAO(dataSource);
}
```



# @After method

- Want to rollback after each test method runs using the @After annotation:

```
@After
public static void rollback() {
    dataSource.getConnection().rollback();
}
```

# @AfterClass method

- Destroy the data source when done with all the tests using the @AfterClass annotation

```
@AfterClass
public static void closeDataSource() {
    dataSource.destroy();
}
```

Let's Code!