Waukesha County Technical Institute
152-198 Distributed Java

Class 8 Plan and Assignments

Discussion Activities:

- **Due Today and Announcements:**
    1. Fixes to Calculator labs due today on GitHub
    2. JSTL and EL reading assignments should be completed by today

- **Q&A**

- **Review of Student Work on JstlExperiments project**

Introduction to JSTL (Java Standard Tag Library) and EL (Expression Language)

- Syntax and basic usage (see reference material below)
- Advantages:
    - Reduce coupling to server side objects
    - Reduce complexity by removing Java code from view and replacing with what are essentially macros that do things simply and with less code
    - Reduce labor
    - Fails gracefully – no exceptions to worry about!
- Disadvantages:
    - Two more "languages" to learn
    - Hard to debug
    - Not designer friendly
- Important To Dos
    - **SQL Functions:** Do not use! Violates Single Responsibility Principle in VIEW pages.
    - **i18n:** for internationalization. Don't use now. We'll discuss later in semester.
    - **EL:** you do not need anything special in your JSP pages to use EL, however, you must be in a JSP page and you must be aware of the version of EL you are using (we are using the EL version that works with JEE 7)
    - **JSTL:** you must be in a JSP page and you must add taglib statements at the top of the page. Here are the most common taglibs which you can place at the top of every JSP even if you don't use them (no performance penalty):

```
<%@taglib prefix="c" uri="http://java.sun.com/jsp/jstl/core" %>
<%@taglib prefix="fn" uri="http://java.sun.com/jsp/jstl/functions" %>
<%@taglib prefix="fmt" uri="http://java.sun.com/jsp/jstl/fmt" %>
```

Begin bookWebApp Project

- Today we are going to begin a new Maven-based JEE project in Netbeans called the "bookWebApp" project. We will build on this project by adding more and more new JEE features throught the rest of the semester.

- **It is critically important that you do not allow yourself to fall behind** in implementing new features introduced in this class. If you do, adding new features will be nearly impossible because those new features will be based on previous updates. You must stay current.

- To get started, see the lab notes below.

Lab:

- For this lab we are going to start working with a practice project that we will use for the rest of the semester. This project will manage authors and, eventually, the books associated with those authors. This data will eventually come from a database, but for now we will just hard code the data into a model class. And for now, we will just work with authors. No books yet.
- Create a new Maven-based web project called "bookWebApp". Git-enable this project, perform an add and commit, and push to GitHub after creating your GitHub project. Finally, create and checkout a new Git branch named "NoDb". We will work with this branch today.
- Use the MVC pattern create a home page with links to various administrative actions. For now just create a link to view all authors. Clicking this link should send a request to an "AuthorController" for a list of author objects (entities), which it should retrieve from an "AuthorService" model object that hard codes author objects into a list. This list should then be sent back to a authorList.jsp page. Use the provided Author class to instantiate your author objects.
- In the authorList.jsp page use JSTL and EL Expressions to display a list of authors in a table. Use columns for id, name and date added. Use a JSTL "<c:forEach>" tag to loop over the list. Also use JSTL choose-when-otherwise to check the "rowCount.count" value of the "varStatus" attribute of the JSTL forEach tag. Use the modulus operator to see if this is an even number, and then set the background-color style of the row to white, or if the value is odd, set it to some other light color, providing a greenbar effect to your report.
- Use EL expressions to extract author information in your table columns. For example, given a JSTL forEach tag with a "var" attribute that has a value of "a" (an author object) and a "items" attribute with a value of "authors" you can retrieve the author name like this: ${a.authorName}
- Use Bootstrap in your web pages.

Introduction to Relational Database Management Systems (RDMS)

- ✓ Relational Database Concepts: http://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm
  - o Tables, columns (fields), data types, records, relationships (joins), primary keys, foreign keys
  - o Structured Query Language (SQL): http://www.w3schools.com/sql/default.asp
- ✓ Embedded vs. Network accessible server
  - o Derby (embedded or server, standard plugin in Netbeans

        - Using the Database Management View in Netbeans (look under the "Services" tab
    - MySql (open source server): one of the most popular network RDMS in the world
        - Using the installed MySql Workbench
- ✓ You need to add a JDBC driver jar file to your "Libraries" folder in your NetBeans project.
    - Drivers for various databases can be found in the project directory for the "IntroJDBC" sample project
    - The latest MySql driver is posted on Blackboard

- ✓ **Introduction to the Java Database Connectivity API (JDBC)**
    - Java JDBC Tutorial: http://docs.oracle.com/javase/tutorial/jdbc/
    - Netbeans Tutorial: (Connecting to Derby): https://netbeans.org/kb/docs/ide/java-db.html
    - Netbeans Tutorial: (Installing MySql on Windows): https://netbeans.org/kb/docs/ide/install-and-configure-mysql-server.html
    - Netbeans Tutorial: (Connecting to MySql): https://netbeans.org/kb/docs/ide/mysql.html
    - Instructor Demo (see screencast to be published on Blackboard)
    - Versions:
        - JDBC 2 (widely used, widely available drivers)
        - JDBC 3 (the new standard)
        - JDBC 4 (released recently; bleeding edge)
    - DriverManager class – controls loading of Java database driver software
    - Drivers: software, either native or Java-based, used to connect your Java program code to a database or middleware software
        - Type I: JDBC-ODBC Bridge (provided with JDK, requires Microsoft ODBC (Open Database Connectivity) support (least desirable, but most likely to work with any data source, including non-database soruces such as spreadsheets and text files. Use this, e.g., to connect to MS-Access databases.
        - Type II: Native API, may include some Java. Not portable because native code must be compiled specially for each platform.
        - Type III: Pure Java, but used only by Network-enabled middleware, such as a Java Enterprise Edition Application Server.
        - Type IV: <u>the best choice</u> – pure Java; need one for each database supported, but portable across O/S platforms
    - Other important classes in the Java API:
        - Connection class – need this to communicate with db
        - Statement class – need this to send commands to db
        - PreparedStatement class – same as above but pre-compiled and allows variables in commands (sql)
        - ResultSet class – queries produce ResultSet objects which contain the data requested; no ResultSet is produced when inserting, updating or

deleting records … instead an integer is returned indicating the number of records affected.

- Popular Relational Databases used by Java programmers (not a complete list):
    - Oracle (Commercial)
    - Microsoft SQL Server (Commercial)
    - IBM DB2 (Commercial)
    - MySQL – Free
    - PostgreSQL – Free
    - Derby -- Free
    - Others, including pure Object Databases such as Cache and db4o, and the new NoSql Databases, such as MongoDb
- Instructor samples: (see Blackboard – "IntroJDBC.zip". The folder contains various JDBC driver ".jar" files. However, if you ever need one you can always find them at the database vendor web sites.

- For a **normal Java application or non-Maven** Java web app, the drivers can be installed by right-clicking on the "Libraries" folder in your project, then selecting "Add Library > Java DB". This has already been done for you in "IntroJDBC" sample project.

- **For a Maven-based project** you will need to add a dependency on the MySql Driveer library to your pom.xml file:

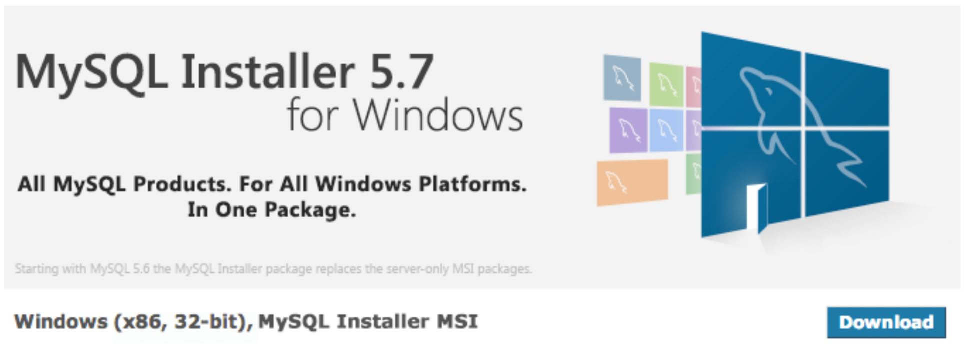
```
<dependencies>
   <dependency>
      <groupId>javax</groupId>
      <artifactId>javaee-web-api</artifactId>
      <version>7.0</version>
      <scope>provided</scope>
   </dependency>

   <!-- ADD THIS -->
   <dependency>
      <groupId>mysql</groupId>
      <artifactId>mysql-connector-java</artifactId>
      <version>5.1.40</version>
   </dependency>
   <!-- END ADD -->

</dependencies>
```

- How to install and use MySql Database and MySqlWorkbench
    1. We will use MySql Database Server for the rest of the semester. MySqlWorkbench is the administrative tool.
    2. Go to http://dev.mysql.com/downloads/ to download the product, which comes in two parts: 1) the database server, and 2) the MySqlWorkbench which is the administrative tool.

3. **If you are on Windows** you can download a single installer that has both parts by first clicking on the "MySQL Community Server" link and then scrolling down about half-way on the page until you see a graphic for the installer. Notice that the graphic also describes this installer as: "All MySQL Products. For All Windows Platforms. In One Package".


MySQL Installer 5.7
for Windows
All MySQL Products. For All Windows Platforms.
In One Package.
Starting with MySQL 5.6 the MySQL Installer package replaces the server-only MSI packages.
Windows (x86, 32-bit), MySQL Installer MSI
Download

   Now click on the Download button for the MSI installer right below the graphic. Don't worry if you're on a 64-bit O/S. This is the installer you want.
4. Once you've downloaded the installer you can run it. However, VERY IMPORTANT, don't install if you currently have an existing version of MySQL. You must uninstall that first.
5. When running the installer accept all defaults except when it asks you whether you want to run this as a service or as an application. Choose "service". Also, you will be asked to provide a password for the "root" user (the super user account). Please use "admin".
6. Instructor demo
7. If you are on a **Macintosh or Linux** you will have to download the server as a separate installer, and then the MySqlWorkbench as a separate installer. Make sure you install the server FIRST!!!
8. If you are on a **Macintosh** you must not download the current version of MySqlWorkbench (v6.3.8 at the time of this writing). It has a bug that will be fixed in the upcoming v6.3.9. For now, however, you must use an earlier version 6.1.7 which is on Blackboard for your convenience.

- **A first look at writing Java code to access a database**
  1. Open the "IntroJDBC" sample project in Netbeans
  2. Look for the package "introjdbc". Inside that package look for the class file "SimpleDB_MySql_Demo.java"

3. Compare this file with “SimpleDB_MSSQLServer.java”, which is the MS-SQL Server version. Note that except for specific database and table references the code is basically the same.
4. These demo files are designed to keep things simple while learning – all of the code in one place, reducing complexity. However, this also violates best practices. Later we’ll learning how to use SOA to resolve this issue.

Service Oriented Architecture (SOA)

- ✓ Motivations:
  - create a flexible system that can adapt to changes easily; reduce coupling between modules
  - provide interchangeable, low-level data access strategy objects that speak JDBC and are as generic as possible so the code can be used with any project. These are low-level objects in the DIP.
  - provide Data Access Objects (DAOs) that use domain terminology and translate raw data to domain objects. These are both low-level objects in the DIP and high-level objects that have data access objects as components.
  - provide Data Transfer Objects (DTOs) that use domain terminology and translate raw data from multiple columns into one pseudo-domain object. These are low-level objects in the DIP.
  - provide a Façade (service object) that hides complexity and serves as main point of access. This is a high-level object in the DIP.
- ✓ Data transformation and challenges for flexibility (need for generic data structures in low-level db classes). How do you write code that works for any database, any table(s) and where the column names and column data types are unknown? We’ll demonstrate.
- ✓ Time-permitting: build a simple sample in preparation for similar homework assignment

Textbook Chapters (and other resources) covered:

- JSTL and EL Quick Reference PDF on Blackboard
- Official EL Reference: https://docs.oracle.com/javaee/7/tutorial/jsf-el.htm#GJDDD
- Official JSTL Reference (outdated JEE 5): http://docs.oracle.com/javaee/5/tutorial/doc/bnake.html
- EL and JSTL tutorials and references listed in Class 4 Plan
- Titter Bootstrap: http://getbootstrap.com/
- CSS Tutorials: http://w3schools.com/css
- Java EE v1.7 tutorial: http://docs.oracle.com/javaee/7/tutorial/doc/home.htm
- Java SE API (v1.8): http://docs.oracle.com/javase/8/docs/api/
- Java EE API (v1.7): http://docs.oracle.com/javaee/7/api/
- Online tutorials for client-side: http://w2schools.com

- Netbeans web development tutorials: https://netbeans.org/kb/trails/java-ee.html
- Netbeans Git User Guide: http://netbeans.org/kb/docs/ide/git.html
  (don't use SSH – we'll be using the modern HTTPS approach)

Preparation Work for Next Class – No points for compliance, but failure to comply costs up to -10 points depending on severity. Do these in order:

1. Complete any unfinished lab challenges
2. Continue research and practice with Bootstrap.
3. **Install MySql Database Server and MySqlWorkbench on your homework machine.**
4. **Review the IntroJDBC sample project** originally provided in Advanced Java and now provided again for your use (see Blackboard). Before reviewing the sample code, read this online tutorial: http://docs.oracle.com/javase/tutorial/jdbc/ . Then, examine the sample code in IntroJDBC, looking specifically at the "SimpleDB_MySql_Demo.java" file in the "introjdbc" package, and then all of the files in the "lab1" package.