Final Project: Secure Online Quiz Application

Estimated Duration: 90 minutes

Learning Objectives

After completing this project, you will be able to:

- Build Spring Boot applications using Spring Initializr
- Create Maven projects from scratch
- Utilize appropriate annotations in Spring
- Design and implement controllers, models, getters, and setters for a robust Spring MVC application
- Implement logging mechanisms using SLF4J in Spring applications
- Craft intuitive Spring MVC forms with Thymeleaf
- Configure security features to safeguard your Spring MVC application

About the project

Welcome to the final project for this Spring Framework Fundamentals course. In this project, you will apply the knowledge and skills you learned in this course to a simulated scenario.

In this project, you will create a secure `Quiz Application` using Spring framework incorporating Spring Web, Thymeleaf, and Spring Security as dependencies.

This final project includes 11 tasks and will take about 60 minutes to complete. One you have completed the project, you will be asked to answer questions based on the project.

You are currently viewing this lab in a Cloud-based Integrated Development Environment (Cloud IDE). This fully-online environment comes preinstalled with JDK 21, allowing you to code, develop, and learn in one location.

Install the tools and initialize the project

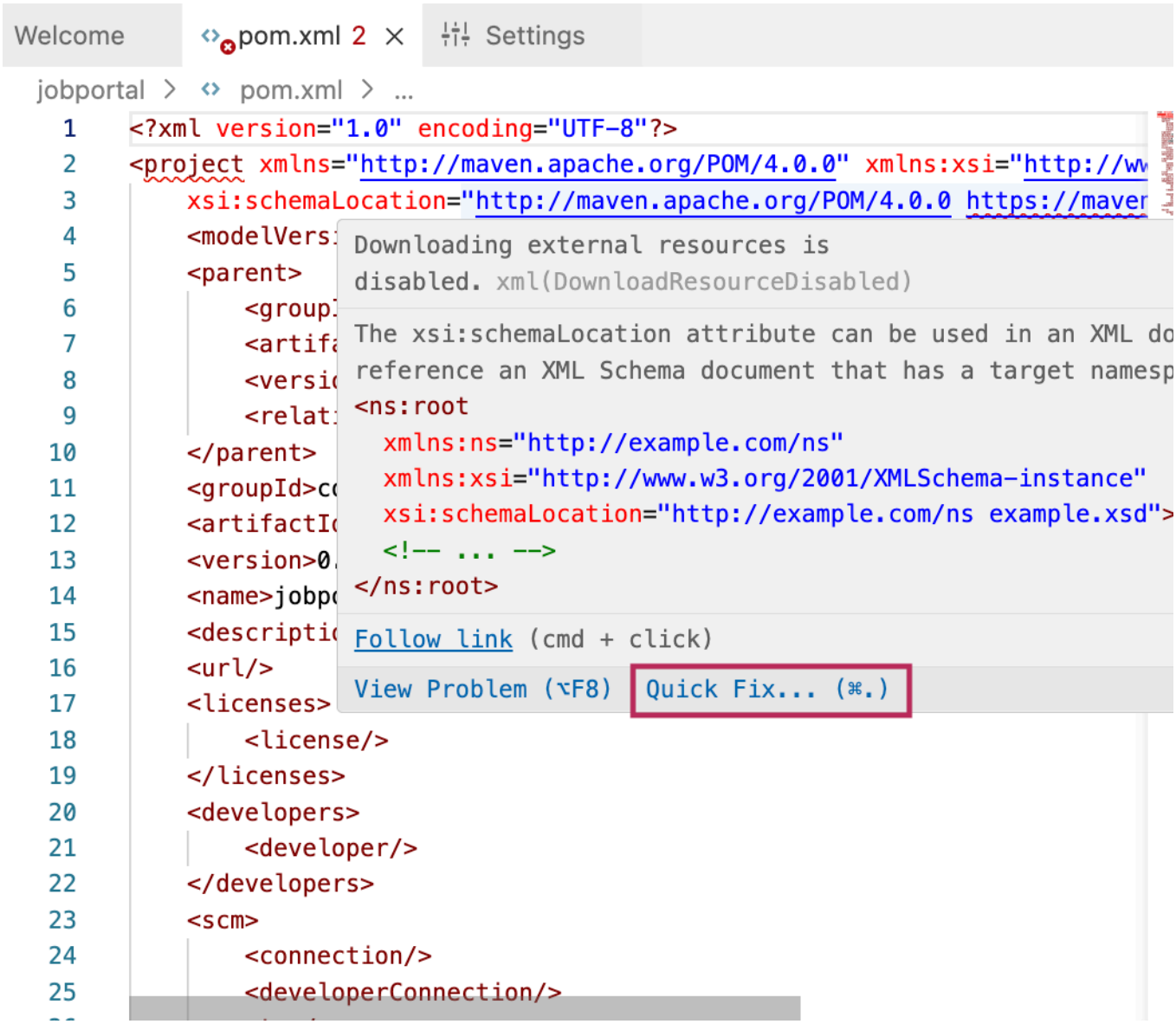
1. Install the `Spring Initializr Java Support` extension required for developing a Spring MVC project.

2. Generate a Spring Boot project using Spring Initializr with dependencies for Spring Web, Thymeleaf, and Spring Security.

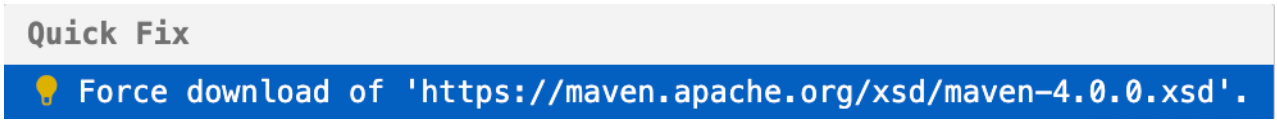
3. Open the `pom.xml` file and verify that the packaging is set to `jar`. You must generate the jar file for submission.

    ```
    <version>0.0.1-SNAPSHOT</version>
    <packaging>jar</packaging>
    ```

4. Hover over the highlighted links on `pom.xml` and click. A suggestion comes up. Click on `Quick Fix`.



5. Click to download the `xsd` file.



Create the folders to organize the code

Create the following folders under the appropriate package structure for your application:

- `model` to store your data models
- `controller` to implement the Controller that provides the REST API endpoints
- `service` to contain the service class that handles user details
- `config` to house the Configuration class that manages endpoint security

▶ Click here for guidance

Create User and Question class

1. Create a class named `User` under the `model` folder with these attributes:

- username
- email
- password
- role

Implement overloaded constructors. Encapsulate the attributes and provide setters and getters. Include a toString method to return the string representation of the class.

Note: Consider which attributes you should exclude from the toString method. Not all user details should be displayed.

2. Create a class named `Question` under the `model` folder with these attributes:

- id (int)
- questionText (String)
- options (ArrayList<String>)
- correctAnswer (String)

Implement overloaded constructors. Encapsulate the attributes and provide setters and getters. Include a toString method to return the string representation of the class.

Create service class for the users and questions

1. Create `QuizUserDetailsService` class. Use a data structure to store user details in the service layer. Define and implement these methods:

- `loadUserByUsername`: Returns `UserDetails` object when provided with username and password
- `registerUser`: Registers a new user with username, password, email, and role

2. Create `QuestionsService` class. Use a data structure (*Suggestion: HashMap*) to store questions in memory within the service layer. Define and implement these methods:

- `loadQuizzes`: Returns a List<Question>
- `addQuiz`: Accepts a Question object as a parameter and adds it to the collection
- `editQuiz`: Accepts a Question object as parameter and updates the corresponding Question in the collection
- `deleteQuiz`: Accepts a question ID and removes the corresponding question from the collection

Create a controller to provide endpoints

Implement a controller that handles these API requests:

- GET request for retrieving the login page
- GET request for retrieving the regitration page
- POST request for registering user
- GET mapping for the retrieving the addQuiz page
- POST request for adding quiz questions
- GET mapping for the retrieving the editQuiz page
- PUT request for editing quiz questions
- DELETE request for removing quiz questions
- GET request for retrieving quiz questions (home page - different for admin and regular users)
- POST request for submitting answers
- GET request for retrieving the result page

Create a class to protect endpoints

Create a `WebSecurityConfig` class that authenticates users and authorizes endpoint access based on user roles:

- Anyone on the site is allowed access to registration and login pages
- QuizList page is allowed only for those with admin role
- Quiz page is allowed only for those with user role
- All other endpoints require to be authenticated

Create user interface

Create the following HTML files using Thymeleaf templates:

1. **Login**:
   Default landing page for all users with an option to access the registration page. Enforce data validation for username and password fields.
2. **Registration**:
   Form to collect username, password, email, and role with appropriate data validation.
3. **QuizList**:
   Admin view displaying all existing quizzes with edit and delete options. Include a link to the `Add quiz` page.
4. **Add Quiz**:
   Form for admins to create new quiz questions, including answer options and correct answer designation.
5. **Edit Quiz**:
   Form for admins to edit quiz questions, including answer options and correct answer designation.
6. **Quiz**:
   Page for users to view and submit quiz answers. Users are directed to this page after logging in.
7. **Result**:
   Page displaying quiz results for the user.

Create the runnable jar file

1. Run the application and test it to ensure it behaves as expected.

   Checklist for your application:

   - The home page should redirect to the login page when you open the app.
   - The login page must include a registration link.
   - The registration page should contain textboxes for username and email, a password box, and a dropdown for role selection.
   - After successful login, the application should direct admin users to the `QuizList` page and regular users to the `Quiz page`.
   - The `QuizList` page should display all questions with `edit` and `delete` options for each, plus a link to add new quizzes.
   - The `Add Quiz` page should allow editing existing questions.
   - The `Edit Quiz` page should allow adding new questions.
   - The `Quiz` page should list all questions with selectable options for users.
   - The user should be able to submit the quiz.
   - The results page should accurately display the number of correctly answered questions.

2. Create the runnable jar file.

Congratulations! You have created a Spring MVC application.

Author(s)

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