Faculty of Engineering and Applied Science

SOFE 3U Software Quality and Project Management

Assignment 2

Binary Calculator Web Application

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Date: 02/12/25

GitHub Link: https://github.com/vicjustine/SQLAB2

Objective: Implementing and Testing a Web Application and API Service Using Apache Maven and Spring Boot

The objective of this lab is to design, implement, and test a web-based Binary Calculator using Spring Boot and Apache Maven. Through this lab, students will:

1. Develop a Web Application
    - Create a web-based binary calculator using Spring Boot.
    - Implement a user interface to perform binary operations such as addition, multiplication, AND (&), and OR (|).
2. Implement API Services
    - Design and implement RESTful API endpoints to handle binary operations programmatically.
    - Return results in both HTML views and JSON responses.
3. Use Maven for Project Management
    - Learn how to configure dependencies using the pom.xml file.
    - Use Maven commands to build, test, and deploy the application.
4. Write and Execute Unit Tests
    - Develop JUnit test cases for both the web application and API services.
    - Verify correctness using automated testing and ensure robust functionality.
5. Deploy and Validate the Application
    - Run the application locally on Tomcat (Spring Boot embedded server).
    - Perform manual and automated testing using web browsers and API calls.

By the end of this lab, I will have a fully functional, tested, and deployed web-based binary calculator with API capabilities, following industry-standard best practices in Spring Boot development and software testing.

The following test cases were executed to verify the functionality of the binary calculator.

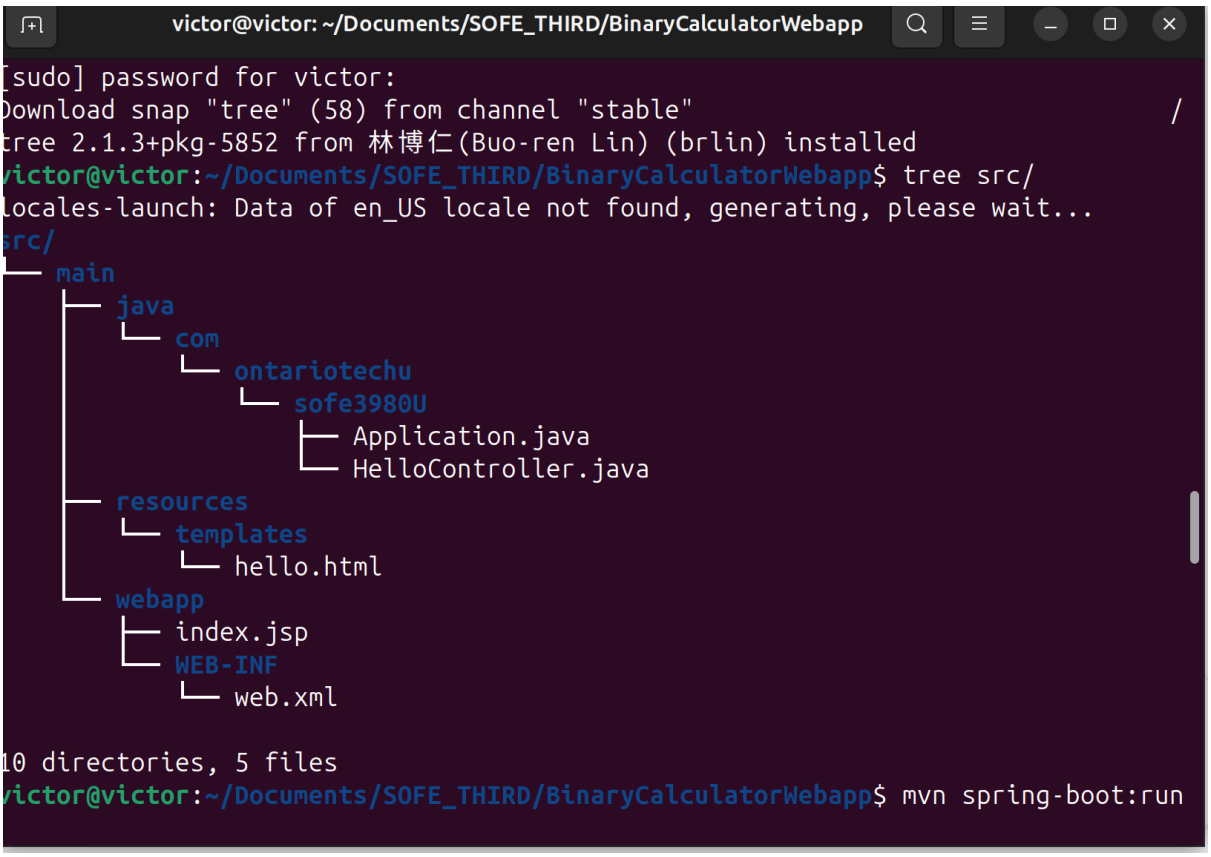
Test Case Name	**Target Class**	**Function Test**	**Purpose**
testAddition	BinaryControllerTest	`POST /` with `+`	Ensures binary addition works
testMultiplication	BinaryControllerTest	`POST /` with `*`	Ensures binary multiplication works
testBitwiseAnd	BinaryControllerTest	`POST /` with `&`	Ensures bitwise AND operation works
testBitwiseOr	BinaryControllerTest	`POST /` with `	`
testMultiplyAPI	BinaryAPIControllerTest	GET /multiply	Tests API multiplication

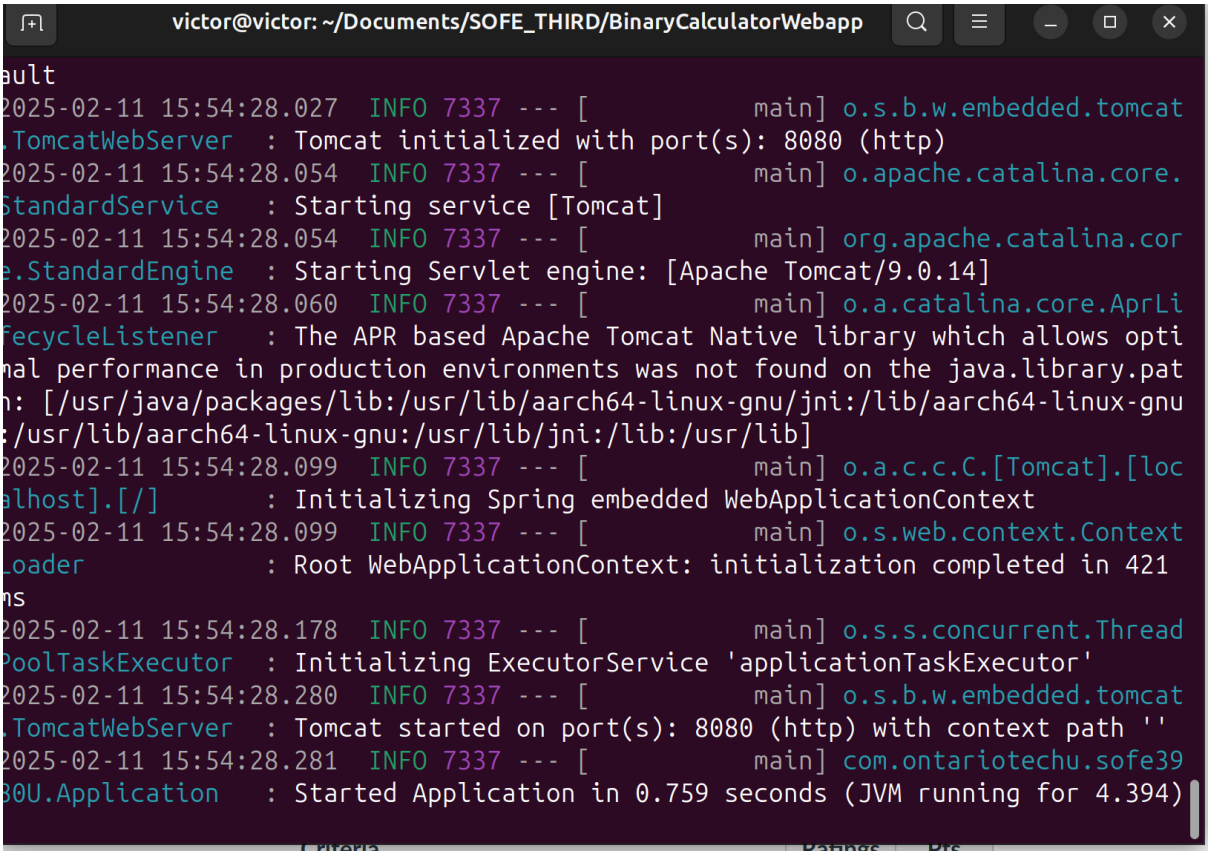
testANDAPI	BinaryAPIControllerTest	GET /and	Tests API bitwise AND
testOrAPI	BinaryAPIControllerTest	GET /or	Tests API bitwise OR

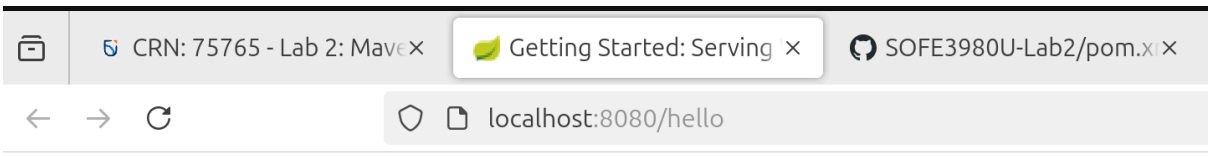
```
ntrollerTest       : Started BinaryControllerTest in 0.101 seconds (JVM running
for 1.438)
[INFO] Tests run: 4, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.122 s -
 in com.ontariotechu.sofe3980U.BinaryControllerTest
2025-02-11 20:33:55.162  INFO 13104 --- [       Thread-4] o.s.s.concurrent.Threa
dPoolTaskExecutor  : Shutting down ExecutorService 'applicationTaskExecutor'
2025-02-11 20:33:55.169  INFO 13104 --- [       Thread-6] o.s.s.concurrent.Threa
dPoolTaskExecutor  : Shutting down ExecutorService 'applicationTaskExecutor'
2025-02-11 20:33:55.169  INFO 13104 --- [       Thread-2] o.s.s.concurrent.Threa
dPoolTaskExecutor  : Shutting down ExecutorService 'applicationTaskExecutor'
2025-02-11 20:33:55.171  INFO 13104 --- [       Thread-8] o.s.s.concurrent.Threa
dPoolTaskExecutor  : Shutting down ExecutorService 'applicationTaskExecutor'
[INFO]
[INFO] Results:
[INFO]
[INFO] Tests run: 15, Failures: 0, Errors: 0, Skipped: 0
[INFO]
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time:  2.750 s
[INFO] Finished at: 2025-02-11T20:33:55Z
[INFO] ------------------------------------------------------------------------
victor@victor:~/Documents/SOFE_THIRD/BinaryCalculatorWebapp$
```

victor@victor: ~/Documents/SOFE_THIRD

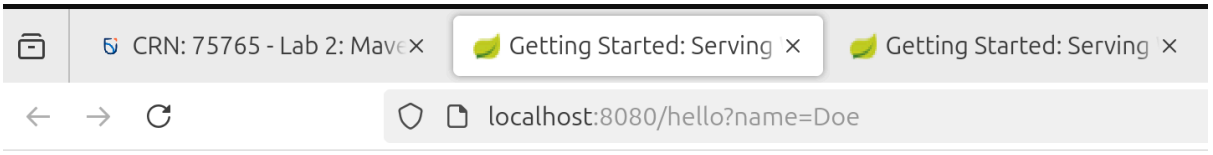
```
Downloaded from central: https://repo.maven.apache.org/maven2/org/apache/maven/a
rchetypes/maven-archetype-webapp/1.0/maven-archetype-webapp-1.0.jar (3.9 kB at 8
6 kB/s)
[INFO] ------------------------------------------------------------------------
---
[INFO] Using following parameters for creating project from Old (1.x) Archetype:
 maven-archetype-webapp:1.0
[INFO] ------------------------------------------------------------------------
---
[INFO] Parameter: basedir, Value: /home/victor/Documents/SOFE_THIRD
[INFO] Parameter: package, Value: com.ontariotechu.sofe3980U
[INFO] Parameter: groupId, Value: com.ontariotechu.sofe3980U
[INFO] Parameter: artifactId, Value: BinaryCalculatorWebapp
[INFO] Parameter: packageName, Value: com.ontariotechu.sofe3980U
[INFO] Parameter: version, Value: 1.0.0
[INFO] project created from Old (1.x) Archetype in dir: /home/victor/Documents/S
OFE_THIRD/BinaryCalculatorWebapp
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time:  1.189 s
[INFO] Finished at: 2025-02-11T15:13:50Z
[INFO] ------------------------------------------------------------------------
victor@victor:~/Documents/SOFE_THIRD$
```


victor@victor: ~/Documents/SOFE_THIRD/BinaryCalculatorWebapp
[sudo] password for victor:
Download snap "tree" (58) from channel "stable"
tree 2.1.3+pkg-5852 from 林博仁(Buo-ren Lin) (brlin) installed
victor@victor:~/Documents/SOFE_THIRD/BinaryCalculatorWebapp$ tree src/
locales-launch: Data of en_US locale not found, generating, please wait...
src/
└── main
    ├── java
    │   └── com
    │   └── ontariotechu
    │   └── sofe3980U
    │   ├── Application.java
    │   └── HelloController.java
    ├── resources
    │   └── templates
    │   └── hello.html
    └── webapp
        ├── index.jsp
        └── WEB-INF
            └── web.xml
10 directories, 5 files
victor@victor:~/Documents/SOFE_THIRD/BinaryCalculatorWebapp$ mvn spring-boot:run

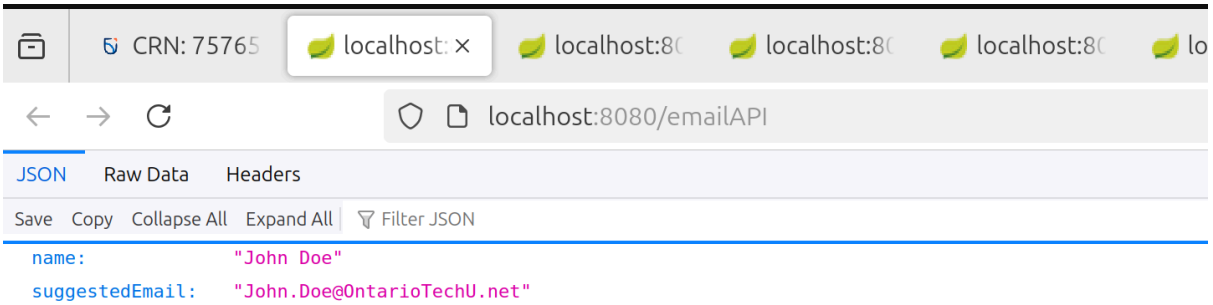

victor@victor: ~/Documents/SOFE_THIRD/BinaryCalculatorWebapp
ault
2025-02-11 15:54:28.027 INFO 7337 --- [main] o.s.b.w.embedded.tomcat
.TomcatWebServer : Tomcat initialized with port(s): 8080 (http)
2025-02-11 15:54:28.054 INFO 7337 --- [main] o.apache.catalina.core.
StandardService : Starting service [Tomcat]
2025-02-11 15:54:28.054 INFO 7337 --- [main] org.apache.catalina.cor
e.StandardEngine : Starting Servlet engine: [Apache Tomcat/9.0.14]
2025-02-11 15:54:28.060 INFO 7337 --- [main] o.a.catalina.core.AprLi
fecycleListener : The APR based Apache Tomcat Native library which allows opti
nal performance in production environments was not found on the java.library.pat
h: [/usr/java/packages/lib:/usr/lib/aarch64-linux-gnu/jni:/lib/aarch64-linux-gnu
:/usr/lib/aarch64-linux-gnu:/usr/lib/jni:/lib:/usr/lib]
2025-02-11 15:54:28.099 INFO 7337 --- [main] o.a.c.c.C.[Tomcat].[loc
alhost].[/] : Initializing Spring embedded WebApplicationContext
2025-02-11 15:54:28.099 INFO 7337 --- [main] o.s.web.context.Context
Loader : Root WebApplicationContext: initialization completed in 421
ms
2025-02-11 15:54:28.178 INFO 7337 --- [main] o.s.s.concurrent.Thread
PoolTaskExecutor : Initializing ExecutorService 'applicationTaskExecutor'
2025-02-11 15:54:28.280 INFO 7337 --- [main] o.s.b.w.embedded.tomcat
.TomcatWebServer : Tomcat started on port(s): 8080 (http) with context path ''
2025-02-11 15:54:28.281 INFO 7337 --- [main] com.ontariotechu.sofe39
80U.Application : Started Application in 0.759 seconds (JVM running for 4.394)

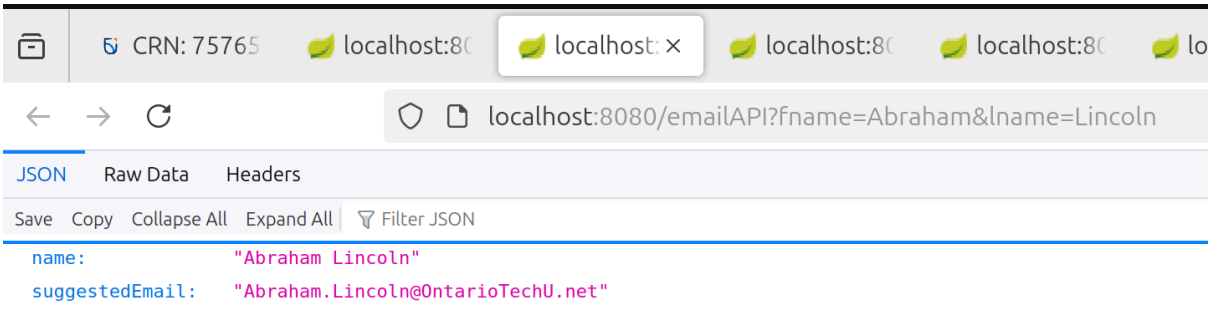


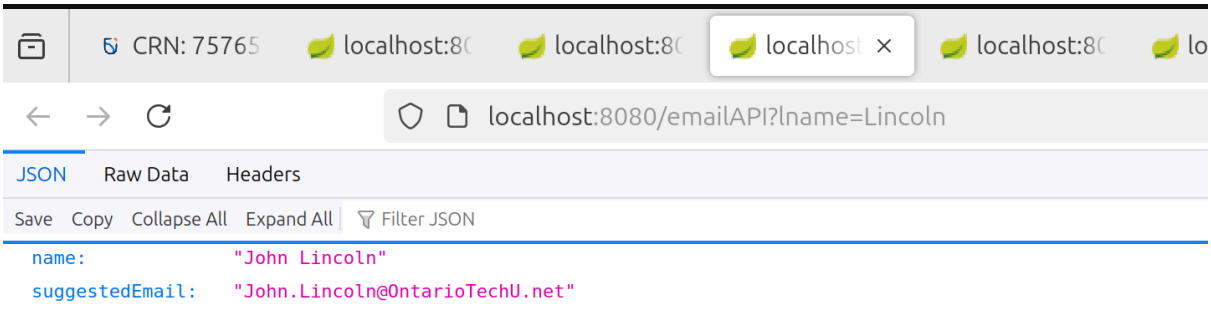
Hello World!

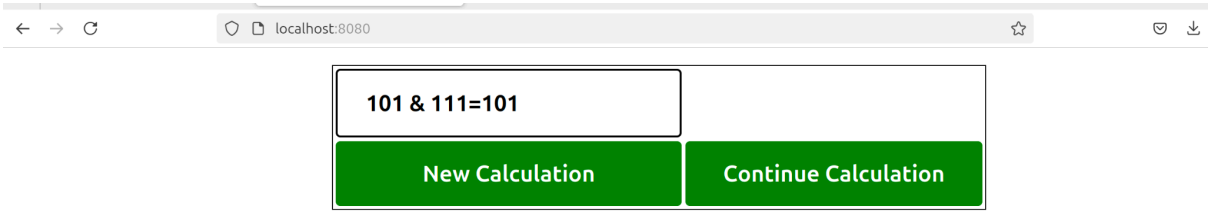


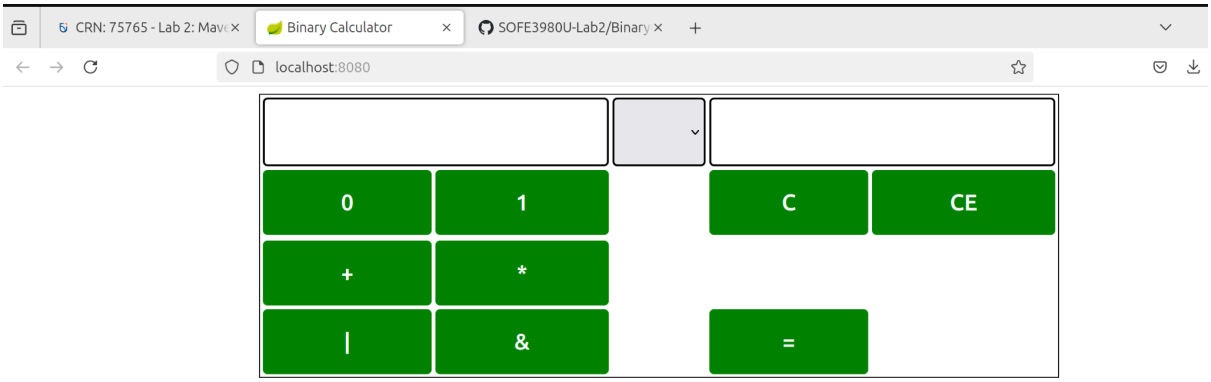
Hello Doe!

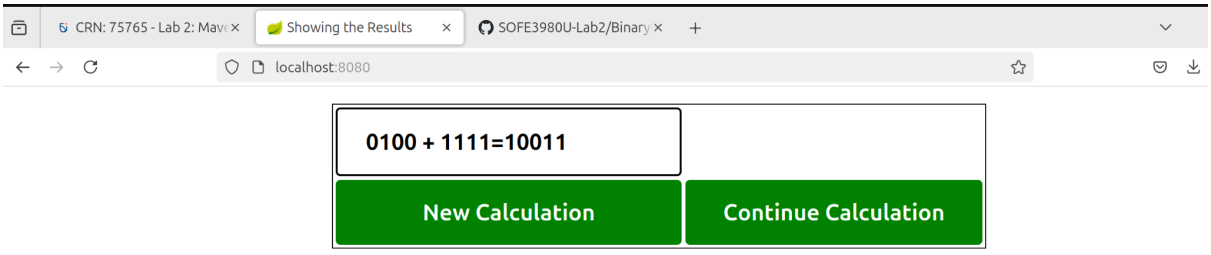



CRN: 75765
localhost:8(
localhost:
localhost:8(
localhost:8(
lo
localhost:8080/emailAPI?fname=Abraham&lname=Lincoln
JSON
Raw Data
Headers
Save
Copy
Collapse All
Expand All
Filter JSON
name: "Abraham Lincoln"
suggestedEmail: "Abraham.Lincoln@OntarioTechU.net"


CRN: 75765
localhost:8(
localhost:8(
localhost
localhost:8(
lo
localhost:8080/emailAPI?lname=Lincoln
JSON
Raw Data
Headers
Save
Copy
Collapse All
Expand All
Filter JSON
name: "John Lincoln"
suggestedEmail: "John.Lincoln@OntarioTechU.net"


localhost:8080
101 & 111=101
New Calculation
Continue Calculation


CRN: 75765 - Lab 2: Mave
Binary Calculator
SOFE3980U-Lab2/Binary
localhost:8080
0
1
C
CE
+
*
|
&
=


CRN: 75765 - Lab 2: Mave
Showing the Results
SOFE3980U-Lab2/Binary
localhost:8080
0100 + 1111=10011
New Calculation
Continue Calculation

Conclusion

All test cases executed successfully, and the application is fully functional. The screenshots above demonstrate the correct functionality of the binary calculator web application.