Names __Angelos Angelis_____

Points _____   **Effort in hours** ____3____

1. 2048 Web Application and CI/CD Pipeline   (4 + 10 + 10 Points)

Use your implementation of the game 2048 from the last assignment to create a web application and a continuous integration and continuous delivery (CI/CD) pipeline for it. Your CI/CD pipeline should execute the following jobs:

1. Build
Automatically build your web application (`mvn compile`)

2. Test
Run all tests (`mvn test`)

3. Package
Create a web application archive (*.war) file to deploy the application (`mvn package`)

4. Deploy
Deploy and run your application in a Docker container on your machine using Apache Tomcat

Your task consists of three parts:

a) On Moodle you find a project which contains a template for a simple Java Servlet and a web application. Add your source code of the 2048 game and the tests to this project and complete the web application. Test it locally on your machine, either by configuring Tomcat support in the IntelliJ run configuration of the project, or by calling `mvn tomcat7:run`. Verify and document that your application and all tests work as expected by executing the different Maven goals (`mvn compile`, `mvn test`, `mvn package`) on the command line.

b) Register yourself at https://gitlab.com, create a new project and push the sources of your web application to the Git repository of the project. Install a GitLab runner on your machine and register the runner for the project, as explained in `README.md`. Add a file named `.gitlab-ci.yml` to the root folder of the repository and define a GitLab CI/CD pipeline which executes the steps described above. Document that your pipeline works as expected.

c) Register yourself at https://github.com and repeat the process of creating your CI/CD pipeline using GitHub Actions. For deployment set up a self-hosted runner in a Docker container, as described in `README.md`. Document that your pipeline works as expected.

SPW4 Exercise 3:

Task a)

Mvn compile:

```
✓ game2048 [compile] 4 sec. 225 ms   "C:\Program Files\OpenJDK\jdk-17.0.2\bin\java.exe" "-Dmaven.multiModuleProjectDirectory=C:\Users\Angelos Angelis\OneDrive\$Uni\CodeSpace\Se
                              [INFO] Scanning for projects...
                              [INFO]
                              [INFO] ------------------------< spw4:game2048 >------------------------
                              [INFO] Building 2048 Game Web Application 1.0-SNAPSHOT
                              [INFO] --------------------------[ war ]---------------------------
                              [INFO]
                              [INFO] --- jacoco-maven-plugin:0.8.8:prepare-agent (default) @ game2048 ---
                              [INFO] argLine set to "-javaagent:C:\\Users\\Angelos Angelis\\.m2\\repository\\org\\jacoco\\org.jacoco.agent\\0.8.8\\org.jacoco.agent-0.8.8
                              [INFO]
                              [INFO] --- maven-resources-plugin:3.2.0:resources (default-resources) @ game2048 ---
                              [INFO] Using 'UTF-8' encoding to copy filtered resources.
                              [INFO] Using 'UTF-8' encoding to copy filtered properties files.
                              [INFO] skip non existing resourceDirectory C:\Users\Angelos Angelis\OneDrive\$Uni\CodeSpace\Semester_4\SPW\spw4-game248\src\main\resources
                              [INFO]
                              [INFO] --- maven-compiler-plugin:3.10.1:compile (default-compile) @ game2048 ---
                              [INFO] Nothing to compile - all classes are up to date
                              [INFO] ------------------------------------------------------------
                              [INFO] BUILD SUCCESS
                              [INFO] ------------------------------------------------------------
                              [INFO] Total time:  2.014 s
                              [INFO] Finished at: 2022-06-26T21:40:00+02:00
                              [INFO] ------------------------------------------------------------

                              Process finished with exit code 0
```

Mvn Test:

```
[INFO] -------------------------------------------------------
[INFO]  T E S T S
[INFO] -------------------------------------------------------
[INFO] Running spw4.game2048.Tests2048
[INFO] Tests run: 12, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.344 s - in spw4.game2048.Tests2048
[INFO]
[INFO] Results:
[INFO]
[INFO] Tests run: 12, Failures: 0, Errors: 0, Skipped: 0
[INFO]
[INFO]
[INFO] --- jacoco-maven-plugin:0.8.8:report (report) @ game2048 ---
[INFO] Loading execution data file C:\Users\Angelos Angelis\OneDrive\$Uni\CodeSpace\Semester_4\SPW\spw4-game248\target\jacoco.exec
[INFO] Analyzed bundle '2048 Game Web Application' with 4 classes
[INFO] ------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------
[INFO] Total time:  5.284 s
[INFO] Finished at: 2022-06-26T21:42:22+02:00
[INFO] ------------------------------------------------------------

Process finished with exit code 0
```

Mvn package:

[INFO] Scanning for projects...

[INFO]

[INFO] --------------------------< spw4:game2048 >--------------------------

[INFO] Building 2048 Game Web Application 1.0-SNAPSHOT

[INFO] ------------------------------[war]-------------------------------

[INFO]

[INFO] --- jacoco-maven-plugin:0.8.8:prepare-agent (default) @ game2048 ---

[INFO] argLine set to "-javaagent:C:\\Users\\Angelos
Angelis\\.m2\\repository\\org\\jacoco\\org.jacoco.agent\\0.8.8\\org.jacoco.agent-0.8.8-
runtime.jar=destfile=C:\\Users\\Angelos
Angelis\\OneDrive\\$Uni\\CodeSpace\\Semester_4\\SPW\\spw4-game248\\target\\jacoco.exec"

[INFO]

[INFO] --- maven-resources-plugin:3.2.0:resources (default-resources) @ game2048 ---

[INFO] Using 'UTF-8' encoding to copy filtered resources.

[INFO] Using 'UTF-8' encoding to copy filtered properties files.

[INFO] skip non existing resourceDirectory C:\Users\Angelos
Angelis\OneDrive\$Uni\CodeSpace\Semester_4\SPW\spw4-game248\src\main\resources

[INFO]

[INFO] --- maven-compiler-plugin:3.10.1:compile (default-compile) @ game2048 ---

[INFO] Nothing to compile - all classes are up to date

[INFO]

[INFO] --- maven-resources-plugin:3.2.0:testResources (default-testResources) @ game2048 ---

[INFO] Using 'UTF-8' encoding to copy filtered resources.

[INFO] Using 'UTF-8' encoding to copy filtered properties files.

[INFO] skip non existing resourceDirectory C:\Users\Angelos
Angelis\OneDrive\$Uni\CodeSpace\Semester_4\SPW\spw4-game248\src\test\resources

[INFO]

[INFO] --- maven-compiler-plugin:3.10.1:testCompile (default-testCompile) @ game2048 ---

[INFO] Nothing to compile - all classes are up to date

[INFO]

[INFO] --- maven-surefire-plugin:3.0.0-M6:test (default-test) @ game2048 ---

[INFO] Using auto detected provider org.apache.maven.surefire.junitplatform.JUnitPlatformProvider

[INFO]

[INFO] ---

[INFO] T E S T S

[INFO] ---

[INFO] Running spw4.game2048.Tests2048

[INFO] Tests run: 12, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.335 s - in spw4.game2048.Tests2048

[INFO]

[INFO] Results:

[INFO]

[INFO] Tests run: 12, Failures: 0, Errors: 0, Skipped: 0

[INFO]

[INFO]

[INFO] --- jacoco-maven-plugin:0.8.8:report (report) @ game2048 ---

[INFO] Loading execution data file C:\Users\Angelos Angelis\OneDrive\$Uni\CodeSpace\Semester_4\SPW\spw4-game248\target\jacoco.exec

[INFO] Analyzed bundle '2048 Game Web Application' with 4 classes

[INFO]

[INFO] --- maven-war-plugin:3.3.2:war (default-war) @ game2048 ---

[INFO] Packaging webapp

[INFO] Assembling webapp [game2048] in [C:\Users\Angelos Angelis\OneDrive\$Uni\CodeSpace\Semester_4\SPW\spw4-game248\target\game2048]

[INFO] Processing war project

[INFO] Copying webapp resources [C:\Users\Angelos Angelis\OneDrive\$Uni\CodeSpace\Semester_4\SPW\spw4-game248\src\main\webapp]

[INFO] Building war: C:\Users\Angelos Angelis\OneDrive\$Uni\CodeSpace\Semester_4\SPW\spw4-game248\target\game2048.war

[INFO] --

[INFO] BUILD SUCCESS

[INFO] --

[INFO] Total time: 5.820 s

[INFO] Finished at: 2022-06-26T21:43:16+02:00

[INFO] --

Process finished with exit code 0

Mvn tomcat7:run

[INFO] Scanning for projects...

[INFO]

[INFO] --------------------------< spw4:game2048 >---------------------------

[INFO] Building 2048 Game Web Application 1.0-SNAPSHOT

[INFO] --------------------------------[war]---------------------------------

[INFO]

[INFO] >>> tomcat7-maven-plugin:2.2:run (default-cli) > process-classes @ game2048 >>>

[INFO]

[INFO] --- jacoco-maven-plugin:0.8.8:prepare-agent (default) @ game2048 ---

[INFO] argLine set to "-javaagent:C:\\Users\\Angelos
Angelis\\.m2\\repository\\org\\jacoco\\org.jacoco.agent\\0.8.8\\org.jacoco.agent-0.8.8-
runtime.jar=destfile=C:\\Users\\Angelos
Angelis\\OneDrive\\$Uni\\CodeSpace\\Semester_4\\SPW\\spw4-game248\\target\\jacoco.exec"

[INFO]

[INFO] --- maven-resources-plugin:3.2.0:resources (default-resources) @ game2048 ---

[INFO] Using 'UTF-8' encoding to copy filtered resources.

[INFO] Using 'UTF-8' encoding to copy filtered properties files.

[INFO] skip non existing resourceDirectory C:\Users\Angelos
Angelis\OneDrive\$Uni\CodeSpace\Semester_4\SPW\spw4-game248\src\main\resources

[INFO]

[INFO] --- maven-compiler-plugin:3.10.1:compile (default-compile) @ game2048 ---

[INFO] Nothing to compile - all classes are up to date

[INFO]

[INFO] <<< tomcat7-maven-plugin:2.2:run (default-cli) < process-classes @ game2048 <<<

[INFO]

[INFO]

[INFO] --- tomcat7-maven-plugin:2.2:run (default-cli) @ game2048 ---

[INFO] Running war on http://localhost:8080/game2048

[INFO] Using existing Tomcat server configuration at C:\Users\Angelos
Angelis\OneDrive\$Uni\CodeSpace\Semester_4\SPW\spw4-game248\target\tomcat

[INFO] create webapp with contextPath: /game2048

Juni 26, 2022 9:44:22 PM org.apache.coyote.AbstractProtocol init

INFO: Initializing ProtocolHandler ["http-bio-8080"]

Juni 26, 2022 9:44:22 PM org.apache.catalina.core.StandardService startInternal

INFO: Starting service Tomcat

Juni 26, 2022 9:44:22 PM org.apache.catalina.core.StandardEngine startInternal

INFO: Starting Servlet Engine: Apache Tomcat/7.0.47

Juni 26, 2022 9:44:24 PM org.apache.coyote.AbstractProtocol start

INFO: Starting ProtocolHandler ["http-bio-8080"]

Task b)

Gitlab-ci.yml:

```yaml
stages:
  - build
  - test
  - package
  - deploy

image: maven:3.8.5-openjdk-17

variables:
  maven_packages_cache: ".m2/repository"
  MAVEN_OPTS: "-Dmaven.repo.local=./$maven_packages_cache"
build: # job
  stage: build
  tags:
    - docker
  cache:
    paths:
      - $maven_packages_cache
  artifacts:
    name: $CI_JOB_NAME-$CI_COMMIT_REF_SLUG-$CI_COMMIT_SHORT_SHA
    expire_in: 1 week
    paths:
      - "target/*"
  script:
    - mvn compile

test:
```

```yaml
  stage: test
  tags:
    - docker
  dependencies:
    - build
  cache:
    paths:
      - $maven_packages_cache
  artifacts:
    name: $CI_JOB_NAME-$CI_COMMIT_REF_SLUG-$CI_COMMIT_SHORT_SHA
    expire_in: 1 week
    paths:
      - "target/surefire-reports/*"
      - "target/site/jacoco/*"
  script:
    - mvn test

package:
  stage: package
  tags:
    - docker
  dependencies:
    - build
  cache:
    paths:
      - $maven_packages_cache
  artifacts:
    name: $CI_JOB_NAME-$CI_COMMIT_REF_SLUG-$CI_COMMIT_SHORT_SHA
    expire_in: 1 week
    paths:
      - "target/*.war"
  script:
    - mvn package

deploy_test:
  stage: deploy
  tags:
    - shell
  dependencies:
    - package
  environment:
    name: test
    action: start
    url: http://localhost:8080/game2048
    on_stop: stop_test
  when: manual
  script:
    - docker rm --force tomcat
    - docker image rm --force game2048
    - echo -e 'FROM tomcat:8.5.78-jdk17-openjdk-slim-bullseye \n COPY
./target/game2048.war /user/local/tomcat/webapps' | docker build -t game2048
-f- .
    - docker run --rm -d --name tomcat -p 8080:8080 game2048

stop_test:
  stage: deploy
  tags:
```

```
    - shell
  environment:
    name: test
    action: stop
  when: manual
  script:
    - docker rm --force tomcat
    - docker image rm --force game2048
```

Result:

Task c)

Main.yml:

```yaml
name: Maven CI
on:
  push

env:
  maven_package_cache: ".m2/repository/"
  MAVEN_OPTS: "-Dmaven.repo.local=./$maven_package_cache"

jobs:
  build:
    runs-on: self-hosted
    steps:
    - name: Cache Maven Packages
      uses: actions/cache@v2
      with:
        path: $maven_packages_cache
        key: ${{runner.os}}-build

    - uses: actions/checkout@v2
```

```yaml
    - name: Set up JDK 17
      uses: actions/setup-java@v2
      with:
        java-version: '17'
        distribution: 'adopt'

    - name: Build with Maven
      run: mvn compile
    - name: Use the Upload Artifact GitHub Action
      uses: actions/upload-artifact@v2
      with:
        name: code-${{ github.job }}-${{ github.sha }}
        path: .

  test:
    needs:
      - build
    runs-on: self-hosted
    steps:
    - name: Cache Maven Packages
      uses: actions/cache@v2
      with:
        path: $maven_packages_cache
        key: ${{runner.os}}-build

    - uses: actions/checkout@v2

    - name: Set up JDK 17
      uses: actions/setup-java@v2
      with:
        java-version: '17'
        distribution: 'adopt'

    - name: Test with Maven
      run: mvn test

  package:
    needs:
      - test
    runs-on: self-hosted
    steps:
    - name: Cache Maven Packages
      uses: actions/cache@v2
      with:
        path: $maven_packages_cache
        key: ${{runner.os}}-build

    - uses: actions/checkout@v2

    - name: Set up JDK 17
      uses: actions/setup-java@v2
      with:
        java-version: '17'
        distribution: 'adopt'

    - name: Package with Maven
      run: mvn package
```

```yaml
    - name: Use the Upload Artifact GitHub Action
      uses: actions/upload-artifact@v2
      with:
        name: war-${{ github.job }}-${{ github.sha }}
        path: ./target/*.war

  deploy_test:
    needs:
      - package
    runs-on: self-hosted
    environment:
      name: Test Env
      url: http://localhost:8081/game2048
    steps:
      - name: Deploy War
        run: cp -f ./target/*.war /usr/local/tomcat/webapps
```

Result: