Task 1: Build Lifecycle. Demonstrate the use of Maven lifecycle phases (clean, compile, test, package, install, deploy) by executing them on a sample project and documenting what happens in each phase.

Step 1: Create a Sample Maven Project

- First, let's create a simple Maven project. Open a terminal or command prompt and run the following command:

```
mvn archetype:generate -DgroupId=com.example -DartifactId=my-app -DarchetypeArtifactId=maven-archetype-quickstart -DinteractiveMode=false
```

- Navigate to project directory:

```
cd my-app
```

- Now, let's go through each Maven lifecycle phase.

Step 2: Clean Phase

- The clean phase is used to remove all files generated by the previous build.

➢ **Command:**

```
mvn clean
```

➢ **What happens:**

- Deletes the target directory, which is where Maven stores all the compiled and packaged code.

Step 3: Compile Phase

- The compile phase compiles the source code of the project.

➢ **Command**:

```
mvn compile
```

➢ **What happens:**

- Maven compiles the Java source files located in src/main/java and places the compiled .class files in the target/ classes directory.

Step 4: Test Phase

- The test phase runs the unit tests using a suitable testing framework (e.g., JUnit).

➢ Command:

```
mvn test
```

➢ **What happens:**

- Maven compiles the test source files located in src/test/java.
- Runs the compiled test classes using a testing framework.
- Outputs the test results in the target/surefire-reports directory.

Step 5: Package Phase

- The package phase packages the compiled code into a distributable format, such as a JAR file.

➢ **Command:**

```
mvn package
```

➢ **What happens**:

- Compiles the code.
- Runs the tests.
- Packages the code into a JAR file (or WAR file for web applications) and places it in the target directory.

Step 6: Install Phase

- The install phase installs the package into the local repository, which is typically located at ~/.m2/repository.

➢ **Command:**

```
mvn install
```

➢ What happens:

- Compiles the code.
- Runs the tests.
- Packages the code.
- Installs the package into the local Maven repository, making it available for other projects on the same machine.

Step 7: Deploy Phase

- The deploy phase copies the final package to the remote repository for sharing with other developers and projects. This phase usually requires configuring the distribution Management section in the pom.xml to specify the remote repository.

➢ **Command:**

```
mvn deploy
```

➢ **What happens**:

- All previous phases (compile, test, package, install) are executed.
- The package is deployed to a remote repository as specified in the pom.xml.

➢ **Complete Execution Example**

- Here is a complete example of executing all phases step-by-step.

1. **Clean: -**

```
mvn clean
```

Output: -

```
[INFO] Scanning for projects...
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
```

2. **Compile: -**

```
mvn compile
```

Output: -

```
[INFO] Compiling 1 source file to /path/to/my-app/target/classes
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
```

3. **Test: -**

```
mvn test
```

Output: -

```
[INFO] Compiling 1 source file to /path/to/my-app/target/test-classes
[INFO] Running com.example.AppTest
[INFO] Tests run: 1, Failures: 0, Errors: 0, Skipped: 0
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
```

4. **Package: -**

```
mvn package
```

Output: -

```
[INFO] Building jar: /path/to/my-app/target/my-app-1.0-SNAPSHOT.jar
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
```

5. **Install: -**

```
mvn install
```

Output: -

```
[INFO] Installing /path/to/my-app/target/my-app-1.0-SNAPSHOT.jar to
/home/user/.m2/repository/com/example/my-app/1.0-SNAPSHOT/my-app-1.0-
SNAPSHOT.jar
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
```

6. **Deploy: -**

```
mvn deploy
```

```
[INFO] Deploying /path/to/my-app/target/my-app-1.0-SNAPSHOT.jar to
http://repository.url/path/to/repository

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

[INFO] BUILD SUCCESS

[INFO] ------------------------------------------------------------------------
```

- **Summary**
  - **Clean:** Deletes the target directory.
  - **Compile:** Compiles the source code.
  - **Test:** Compiles and runs unit tests.
  - **Package:** Packages the compiled code into a JAR/WAR file.
  - **Install:** Installs the package into the local repository.
  - **Deploy:** Deploys the package to a remote repository.