

EXPERIMENT 7

TO BUILD THE PIPELINE OF JOBS USING MAVEN / GRADLE / ANT IN JENKINS, CREATE A PIPELINE SCRIPT TO TEST AND DEPLOY AN APPLICATION OVER THE TOMCAT SERVER

Theory:

1. Introduction to Jenkins and CI/CD

Jenkins is an open-source automation server used for continuous integration and continuous deployment (CI/CD). It helps automate the software development lifecycle by building, testing, and deploying applications.

1.1 CI/CD Concepts

- **Continuous Integration (CI):** Automatically integrates code changes into a shared repository and runs tests.
- **Continuous Deployment (CD):** Automates the process of deploying applications to production or staging environments.

1.2 Tools Used

- **Jenkins** – Automation server.
- **Maven/Gradle/Ant** – Build automation tools.
- **Tomcat** – A web server for deploying Java applications.

2. Installing and Configuring Jenkins

1. Download and Install Jenkins:

- Download from Jenkins official site.
- Install and start the Jenkins service.
- Access Jenkins at <http://localhost:8080/>.

2. Install Required Plugins:

- Go to **Manage Jenkins > Plugin Manager**.
- Install **Pipeline**, **Maven Integration**, and **Deploy to Container** plugins.

3. Creating a Jenkins Pipeline

Jenkins pipelines define a series of automated steps for building, testing, and deploying applications.

3.1 Steps to Create a Pipeline

1. **Open Jenkins Dashboard** and click on **New Item**.
 2. Select **Pipeline** and provide a project name.
 3. Click **OK** and navigate to the **Pipeline** section.
 4. Write a Pipeline script (Declarative or Scripted) to define the build and deployment process.
-

4. Writing a Jenkins Pipeline Script

The following script builds a Java application using **Maven** and deploys it to **Tomcat**:

groovy

CopyEdit

```
pipeline {
    agent any
    stages {
        stage('Checkout Code') {
            steps {
                git 'https://github.com/your-repository.git'
            }
        }
        stage('Build with Maven') {
            steps {
                sh 'mvn clean package'
            }
        }
        stage('Deploy to Tomcat') {
            steps {
                deploy adapters: [tomcat8(credentialsId: 'tomcat-cred', path: '', url: 'http://your-
tomcat-server:8080')],
                war: '**/*.war'
            }
        }
    }
}
```

5. Configuring Jenkins for Deployment

1. Configure Tomcat Server:

- Install Tomcat and start the server.
- Set up a user with deployment privileges in conf/tomcat-users.xml:

xml

CopyEdit

```
<role rolename="manager-gui"/>
<role rolename="manager-script"/>
<user username="admin" password="admin" roles="manager-gui,manager-script"/>
```

- Restart Tomcat.

2. Set Up Jenkins Credentials:

- Go to **Manage Jenkins > Credentials**.
- Add a username/password credential for Tomcat deployment.

3. Run the Pipeline in Jenkins:

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- Click **Build Now** to execute the pipeline.
- Verify the deployment at <http://your-tomcat-server:8080/your-app>.

Example 1 :

Creating a job:

Start building your software project


Create a job





Naming the job and setting it as freestyle:


Enter an item name


» Required field


**Freestyle project**
Classic, general-purpose job type that checks out from up to one SCM, executes build steps serially, followed by post-build steps like archiving artifacts and sending email notifications.

**Pipeline**
Orchestrates long-running activities that can span multiple build agents. Suitable for building pipelines (formerly known as workflows) and/or organizing complex activities that do not easily fit in free-style job type.

**Multi-configuration project**
Suitable for projects that need a large number of different configurations, such as testing on multiple environments, platform-specific builds, etc.

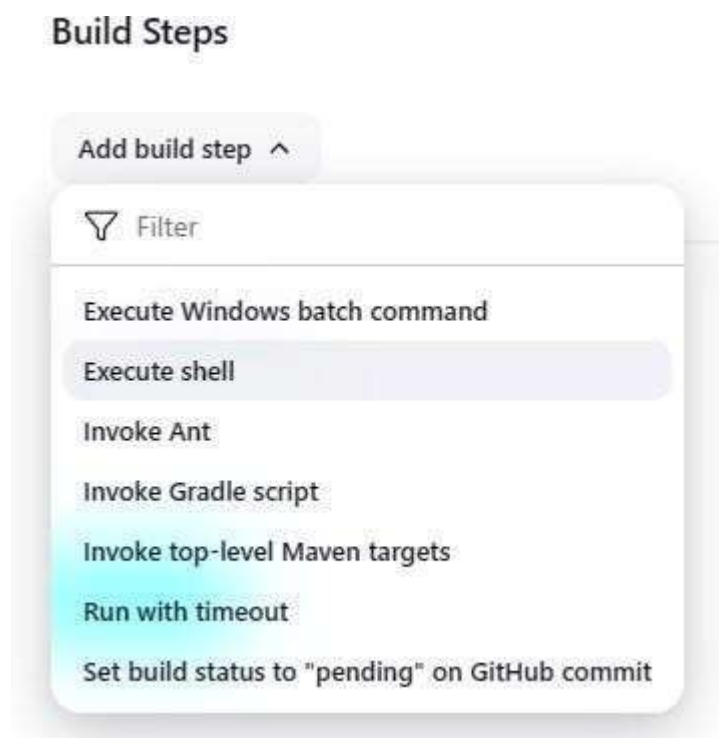
**Folder**
Creates a container that stores nested items in it. Useful for grouping things together. Unlike view, which is just a filter, a folder creates a separate namespace, so you can have multiple things of the same name as long as they are in different folders.

**Multibranch Pipeline**
Creates a set of Pipeline projects according to detected branches in one SCM repository.

**Organization Folder**
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Selecting build type as “Execute shell”:



Entering a simple command for the shell execution:



Applying and saving the project configuration:



Building the project:

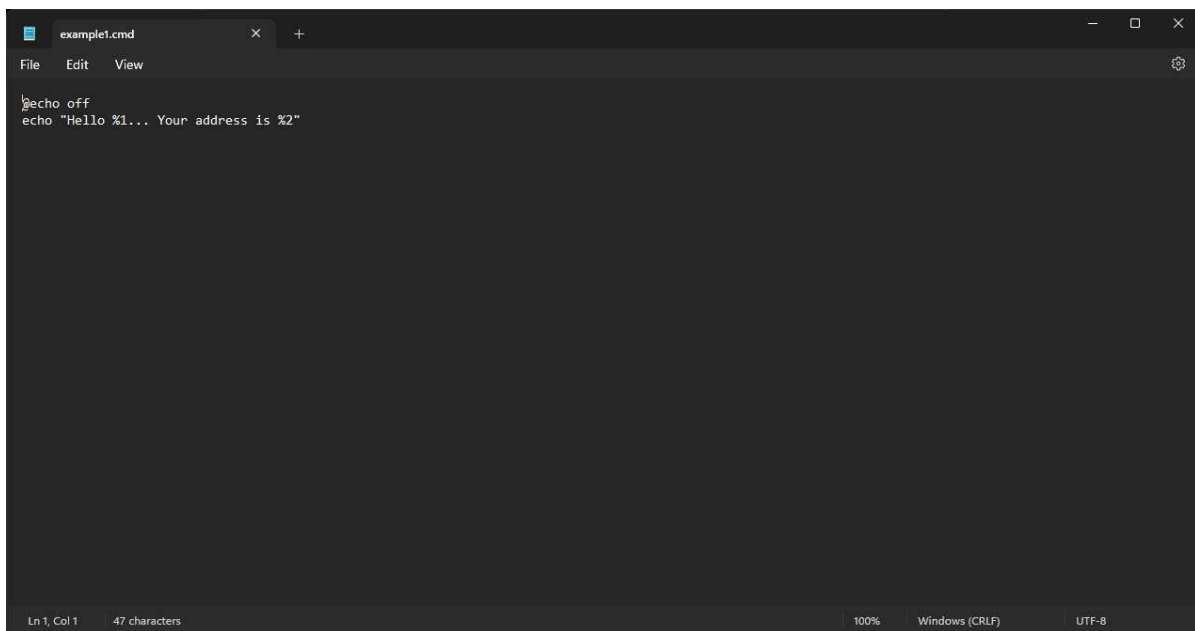
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Console output (after building):



Example 1.2: Taking parameters through files Contents of
script `example1.cmd`:



Executing script `example1.cmd` on the terminal:

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```
Microsoft Windows [Version 10.0.22621.3296]
(c) Microsoft Corporation. All rights reserved.

C:\Users\AI&DS 202>Microsoft Windows [Version 10.0.22631.3155] (c) Microsoft Corporation. All rights reserved.
'Microsoft' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\AI&DS 202>C:\Admin\Academics\TSEC\Start3\SEPM>example1.cmd
The system cannot find the path specified.

C:\Users\AI&DS 202>"Hello... Your address is "
'Hello... Your address is "' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\AI&DS 202>C:\Admin\Academics\TSEC\Start3\SEPM>example1.cad Tanishq
The system cannot find the path specified.

C:\Users\AI&DS 202>"Hello Tanihsq... Your address is "
'Hello Tanihsq... Your address is "' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\AI&DS 202>C:\Admin\Academics\TSEC\Start3\SEPM>example1.cmd Tanishq Girgaon "Helle Tanishq... Your address is Gi
rgaon"
The system cannot find the path specified.
```

Modifying the Jenkins project to execute the script while supplying required parameters:

Build Steps

The screenshot shows the 'Execute Windows batch command' build step configuration in Jenkins. The 'Command' field contains the text: `C:\Admin\Academics\TSEC\Start3\SEPM\example1.cmd Siddhant Goregaon`. Below the command field is an 'Advanced' dropdown menu. At the bottom of the configuration area is an 'Add build step' button.

Console output after building the modified project:

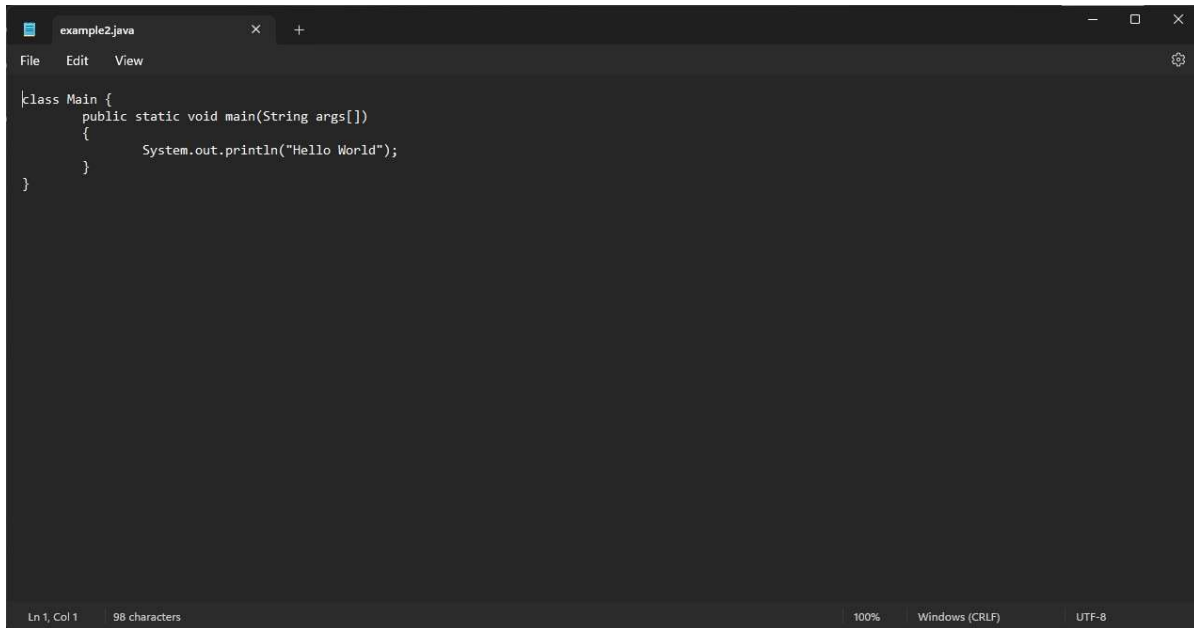
The screenshot shows the Jenkins console output for a successful build. The left sidebar contains links for 'Status', 'Changes', 'Console Output', 'View as plain text', 'Edit Build Information', 'Delete build #4', and 'Previous Build'. The main console output area shows the following text:

```
Started by user Siddhant Chetlur
Running as SYSTEM
Building in workspace C:\ProgramData\Jenkins\jenkins\workspace\Example1
[Example1] $ cmd /c call C:\WINDOWS\TEMP\jenkins7075095818165161158.bat
C:\ProgramData\Jenkins\jenkins\workspace\Example1>C:\Admin\Academics\TSEC\Start3\SEPM\example1.cmd Siddhant Goregaon
"Hello Siddhant... Your address is Goregaon"
Finished: SUCCESS
```

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Example 2 Example 2.1: Running a Java program under

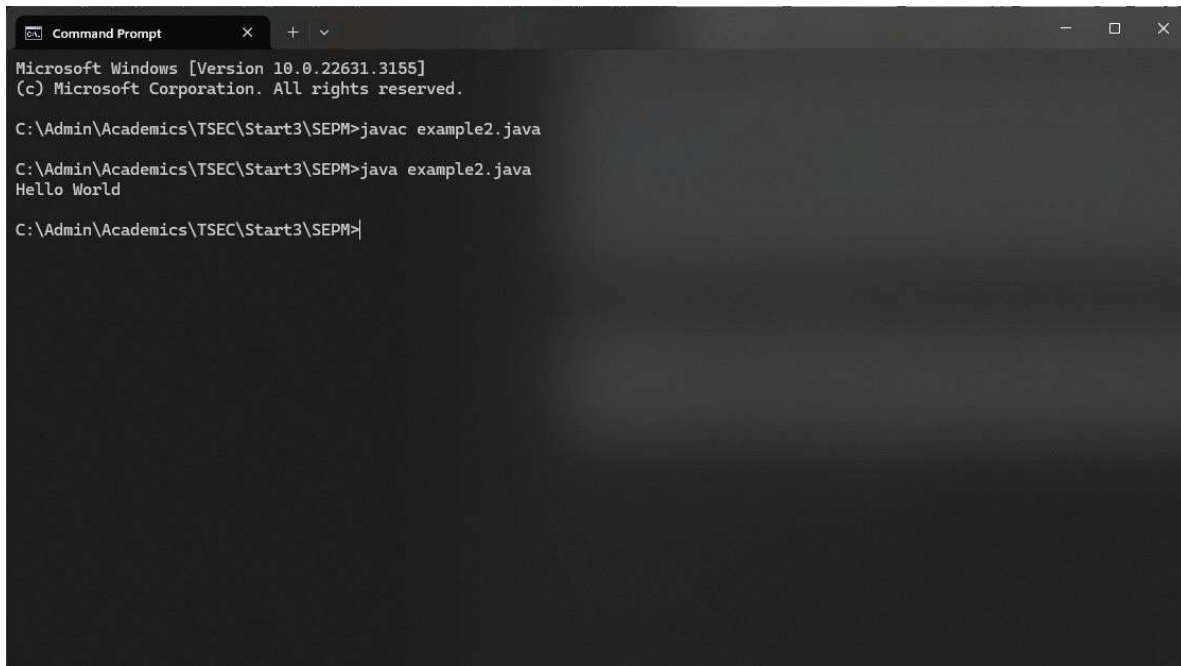
Jenkins Creating a simple Java program:

A screenshot of a code editor window titled 'example2.java'. The editor contains the following Java code:

```
class Main {  
    public static void main(String args[])  
    {  
        System.out.println("Hello World");  
    }  
}
```

The status bar at the bottom indicates 'Ln 1, Col 1', '98 characters', '100%', 'Windows (CRLF)', and 'UTF-8'.

Compiling and running the program on the terminal:

A screenshot of a Windows Command Prompt window. The text displayed is as follows:

```
Microsoft Windows [Version 10.0.22631.3155]  
(c) Microsoft Corporation. All rights reserved.  
  
C:\Admin\Academics\TSEC\Start3\SEPM>javac example2.java  
  
C:\Admin\Academics\TSEC\Start3\SEPM>java example2.java  
Hello World  
  
C:\Admin\Academics\TSEC\Start3\SEPM>
```

Creating a new freestyle project:

Dashboard > All >

Enter an item name

Example2

Required field

- Freestyle project**
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Orchestrates long-running activities that can span multiple build agents. Suitable for building pipelines (formerly known as workflows) and/or organizing complex activities that do not easily fit in free-style job type.
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- Folder**
Creates a container that stores nested items in it. Useful for grouping things together. Unlike view, which is just a filter, a folder creates a separate namespace, so you can have multiple things of the same name as long as they are in different folders.
- Multibranch Pipeline**
Creates a set of Pipeline projects according to detected branches in one SCM repository.
- Organization Folder**
Creates a set of multibranch project subfolders by scanning for repositories.

If you want to create a new item from other existing, you can use this option:

OK

Configure new project:

Build Steps

Execute Windows batch command ?

Command

See [the list of available environment variables](#)

```
javac C:\Admin\Academics\TSEC\Start3\SEPM\example2.java
java C:\Admin\Academics\TSEC\Start3\SEPM\example2.java
```

Advanced ▾

Add build step ▾

Console output after building:

Console Output

```
Started by user Siddhant Chetlur
Running as SYSTEM
[EnvInject] - Loading node environment variables.
Building in workspace C:\ProgramData\Jenkins\jenkins\workspace\Example2
[Example2] $ cmd /c call C:\WINDOWS\TEMP\jenkins15296462484398614135.bat

C:\ProgramData\Jenkins\jenkins\workspace\Example2>javac C:\Admin\Academics\TSEC\Start3\SEPM\example2.java

C:\ProgramData\Jenkins\jenkins\workspace\Example2>java C:\Admin\Academics\TSEC\Start3\SEPM\example2.java
Hello World


C:\ProgramData\Jenkins\jenkins\workspace\Example2>exit 0
Finished: SUCCESS
```


Example 3 Example 3.1: Parameterise build


Creating a new freestyle project:


Enter an item name


» Required field


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**Multibranch Pipeline**
Creates a set of Pipeline projects according to detected branches in one SCM repository.

**Organization Folder**
Creates a set of multibranch project subfolders by scanning for repositories.

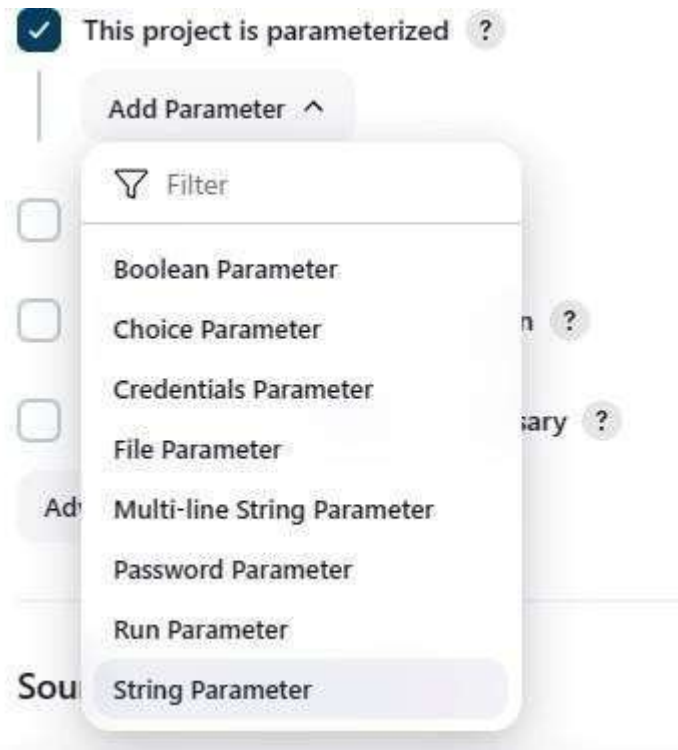
If you want to create a new item from other existing, you can use this option:

OK

Create from

Enabling parameterisation and adding a String parameter:

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Configuring the string parameter as Fname:

A screenshot of a configuration form for a 'String Parameter'. The form has a title bar with a hamburger menu icon, the text 'String Parameter', and a close button. It contains three main input fields: 'Name' with the value 'Fname', 'Default Value' (empty), and 'Description' (empty). Below these fields, there is a 'Plain text' label and a 'Preview' link. At the bottom, there is a checkbox labeled 'Trim the string' which is currently unchecked. The entire form is enclosed in a dashed border.

Adding a choice parameter and configuring it as City with the following choices:

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Choice Parameter ?

Name ?

City

Choices ?

- Bandra
- Kalyan
- Dombivali
- Churchgate
- Thane
- Dadar

Description ?

Plain text [Preview](#)

Creating a script which takes 2 arguments for name and city:

```
C:\Users\AI&DS 202>Microsoft Windows [Version 10.0.22631.3155] (c) Microsoft Corporation. All rights reserved.
'Microsoft' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\AI&DS 202>C:\Admin\Academics\TSEC\Start3\SEPH>example3.cnd
The system cannot find the path specified.

C:\Users\AI&DS 202>Hello your name is and your city is
'Hello' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\AI&DS 202>C:\Admin\Academics\TSEC\Start3\SEPH example3.cmd Tanishq
The system cannot find the path specified.

C:\Users\AI&DS 202>Hello your name is Tanishq and your city is
'Hello' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\AI&DS 202>C:\Admin\Academics\TSEC\Start3\SEPM>example3.cmd Tansishq Bandra
The system cannot find the path specified.

C:\Users\AI&DS 202>Hello your name is Tanishq and your city is Bandra
'Hello' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\AI&DS 202>C:\Admin\Academics\TSEC\Start3\SEPH|
```

Configuring build steps:

Build Steps

Execute Windows batch command ?

Command

See [the list of available environment variables](#)

C:\Admin\Academics\TSEC\Start3\SEPM\example3.cmd %Fname% %City%

Advanced ▾

Add build step ▾

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Entering parameters for build:

Project Example3

This build requires parameters:

Fname

City

Console output after building:

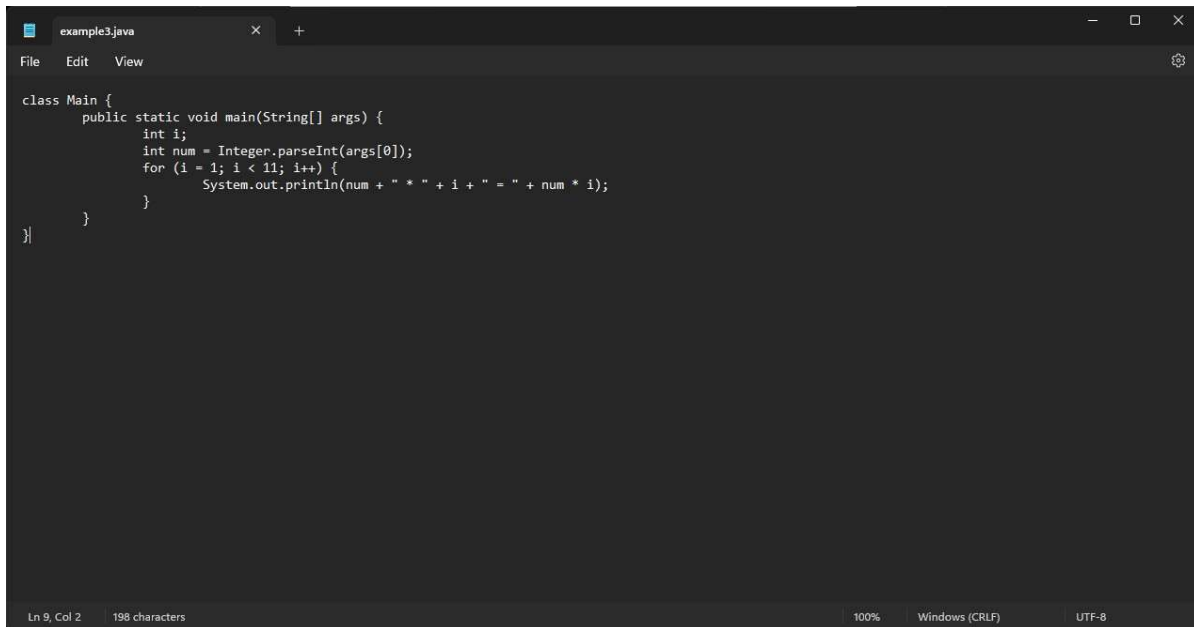
✓ Console Output

```
Started by user Siddhant Chetlur
Running as SYSTEM
[EnvInject] - Loading node environment variables.
Building in workspace C:\ProgramData\Jenkins\jenkins\workspace\Example3
[Example3] $ cmd /c call C:\WINDOWS\TEHP\jenkins14094536165150906151.bat

C:\ProgramData\Jenkins\jenkins\workspace\Example3>C:\Admin\Academics\TSEC\Start3\SEPM\example3.cmd Siddhant Bandra
Hello your name is Siddhant and your city is Bandra
Finished: SUCCESS
```

Example 3.2: Running a Java program with parameters

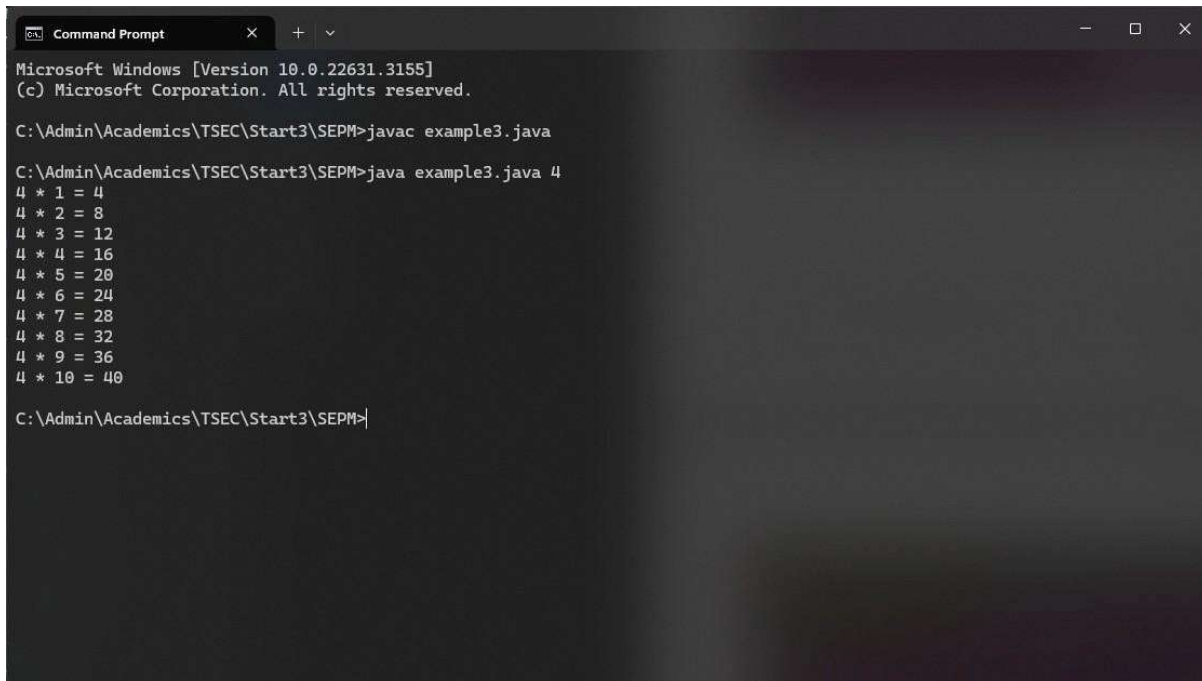
Creating a Java program with an input argument:



```
class Main {
    public static void main(String[] args) {
        int i;
        int num = Integer.parseInt(args[0]);
        for (i = 1; i < 11; i++) {
            System.out.println(num + " * " + i + " = " + num * i);
        }
    }
}
```

Testing the program on the terminal:

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```
Command Prompt
Microsoft Windows [Version 10.0.22631.3155]
(c) Microsoft Corporation. All rights reserved.

C:\Admin\Academics\TSEC\Start3\SEPM>javac example3.java

C:\Admin\Academics\TSEC\Start3\SEPM>java example3.java 4
4 * 1 = 4
4 * 2 = 8
4 * 3 = 12
4 * 4 = 16
4 * 5 = 20
4 * 6 = 24
4 * 7 = 28
4 * 8 = 32
4 * 9 = 36
4 * 10 = 40


C:\Admin\Academics\TSEC\Start3\SEPM>
```


Creating a new freestyle project:


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Enter an item name


» Required field


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Classic, general-purpose job type that checks out from up to one SCM, executes build steps serially, followed by post-build steps like archiving artifacts and sending email notifications.

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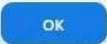
**Multi-configuration project**
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If you want to create a new item from other existing, you can use this option:





Parameterise the project by adding a string parameter as follows:

☒ This project is parameterized ?

String Parameter ?

Name ?

Default Value ?

Description ?

Plain text [Preview](#)

☐ Trim the string ?

Add Parameter ▾

Configure the build steps:

Build Steps

Execute Windows batch command ?

Command

See [the list of available environment variables](#)

```
javac C:\Admin\Academics\TSEC\Start3\SEPM\example3.java
java C:\Admin\Academics\TSEC\Start3\SEPM\example3.java %num%
```

Advanced ▾

Add build step ▾

Entering the parameter for the build:

Project Example4

This build requires parameters:

num

▶ Build

Cancel

Console output after building:

✓ Console Output

```
Started by user Siddhant Chetlur
Running as SYSTEM
[EnvInject] - Loading node environment variables.
Building in workspace C:\ProgramData\Jenkins\jenkins\workspace\Example4
[Example4] $ cmd /c call C:\WINDOWS\TEMP\jenkins15119185770823247708.bat

C:\ProgramData\Jenkins\jenkins\workspace\Example4>javac C:\Admin\Academics\TSEC\Start3\SEPM\example3.java

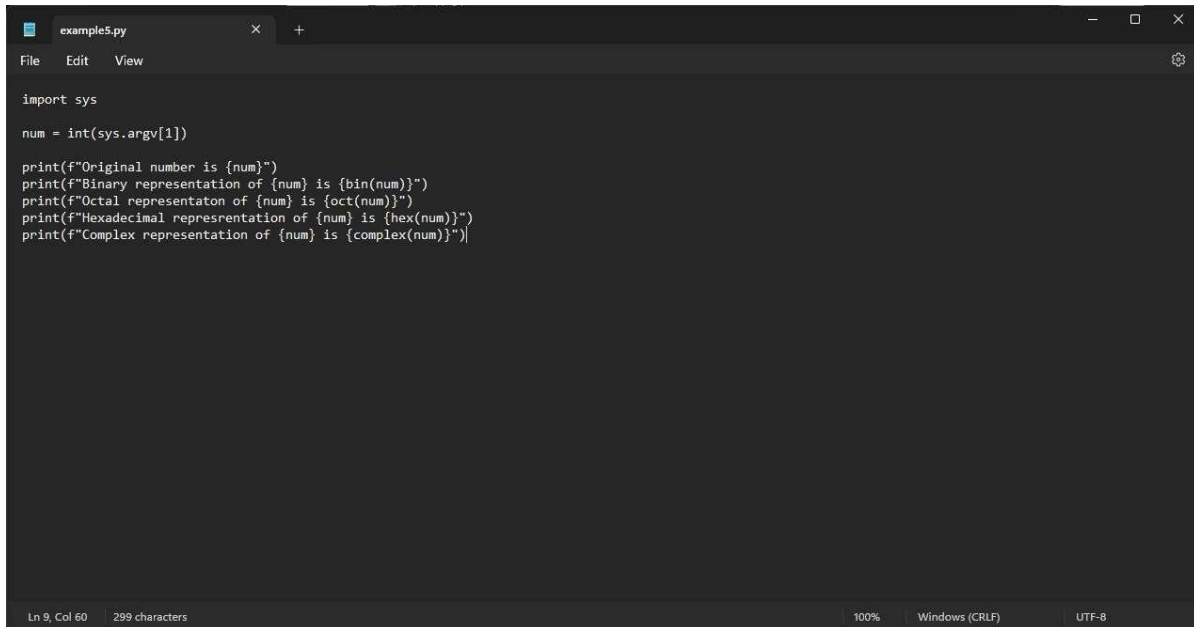
C:\ProgramData\Jenkins\jenkins\workspace\Example4>java C:\Admin\Academics\TSEC\Start3\SEPM\example3.java 25
25 * 1 = 25
25 * 2 = 50
25 * 3 = 75
25 * 4 = 100
25 * 5 = 125
25 * 6 = 150
25 * 7 = 175
25 * 8 = 200
25 * 9 = 225
25 * 10 = 250

C:\ProgramData\Jenkins\jenkins\workspace\Example4>exit 0
Finished: SUCCESS
```


Example 5

Example 5.1: Running a Python program Creating a simple

Python script:



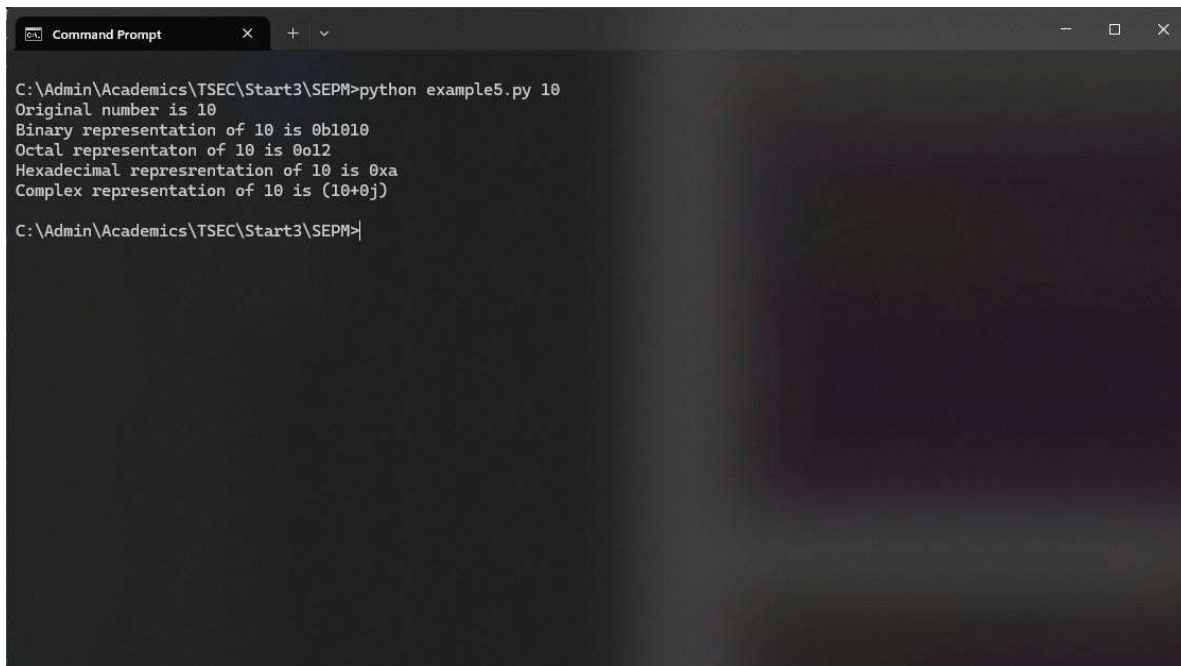
```
example5.py
File Edit View
import sys

num = int(sys.argv[1])

print(f"Original number is {num}")
print(f"Binary representation of {num} is {bin(num)}")
print(f"Octal representation of {num} is {oct(num)}")
print(f"Hexadecimal representation of {num} is {hex(num)}")
print(f"Complex representation of {num} is {complex(num)}")

Ln 9, Col 60 299 characters 100% Windows (CRLF) UTF-8
```

Running the Python script on the terminal:




```
Command Prompt
C:\Admin\Academics\TSEC\Start3\SEPM>python example5.py 10
Original number is 10
Binary representation of 10 is 0b1010
Octal representation of 10 is 0o12
Hexadecimal representation of 10 is 0xa
Complex representation of 10 is (10+0j)
C:\Admin\Academics\TSEC\Start3\SEPM>
```


Creating a new freestyle project:


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Enter an item name


» Required field


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If you want to create a new item from other existing, you can use this option:

Parameterising the project with a string parameter as follows:

☒ This project is parameterized ?

String Parameter ?

Name ?

Default Value ?

Description ?

Plain text [Preview](#)

☐ Trim the string ?

Add Parameter ▾

Configuring the build steps:

Build Steps

Execute Windows batch command ?

Command

See [the list of available environment variables](#)

```
python C:\Admin\Academics\TSEC\Start3\SEPM\example5.py %num%
```

Advanced ▾

Add build step ▾

Setting the parameter for the build:
Project Example5

This build requires parameters:

num

▶ Build

Cancel

Console output after building:

✓ Console Output

```
Started by user Siddhant Chetlur
Running as SYSTEM
[EnvInject] - Loading node environment variables.
Building in workspace C:\ProgramData\Jenkins\jenkins\workspace\Example5
[Example5] $ cmd /c call C:\WINDOWS\TEMP\jenkins11157306491994478222.bat

C:\ProgramData\Jenkins\jenkins\workspace\Example5>python C:\Admin\Academics\TSEC\Start3\SEPM\example5.py 10
Original number is 10
Binary representation of 10 is 0b1010
Octal representation of 10 is 0o12
Hexadecimal representation of 10 is 0xa
Complex representation of 10 is (10+0j)

C:\ProgramData\Jenkins\jenkins\workspace\Example5>exit 0
Finished: SUCCESS
```

Conclusion

This experiment demonstrated how to automate a software build and deployment process using Jenkins. By integrating Maven, Gradle, or Ant, we streamlined the compilation and testing of applications, while Jenkins facilitated continuous deployment to a Tomcat server.