

Software Engineering & Project Management Lab Experiment No: - 05

Aim: 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:

Programming in Jenkins:

Continuous Integration is a software development practice where members of a team integrate their work frequently, usually each person integrates at least daily leading to multiple integrations per day. Each integration is verified by an automated build (including test) to detect integration errors as quickly as possible.” In simple way, Continuous integration (CI) is the practice of frequently building and testing each change done to your code automatically.

Jenkins is a self-contained, open-source automation server which can be used to automate all sorts of tasks related to building, testing, and delivering or deploying software.

Our first job will execute the shell commands. The freestyle project provides enough options and features to build the complex jobs that you will need in your projects.

Example 1

Example 1.1: Deploying a freestyle app in Jenkins

Creating a job:

Start building your software project

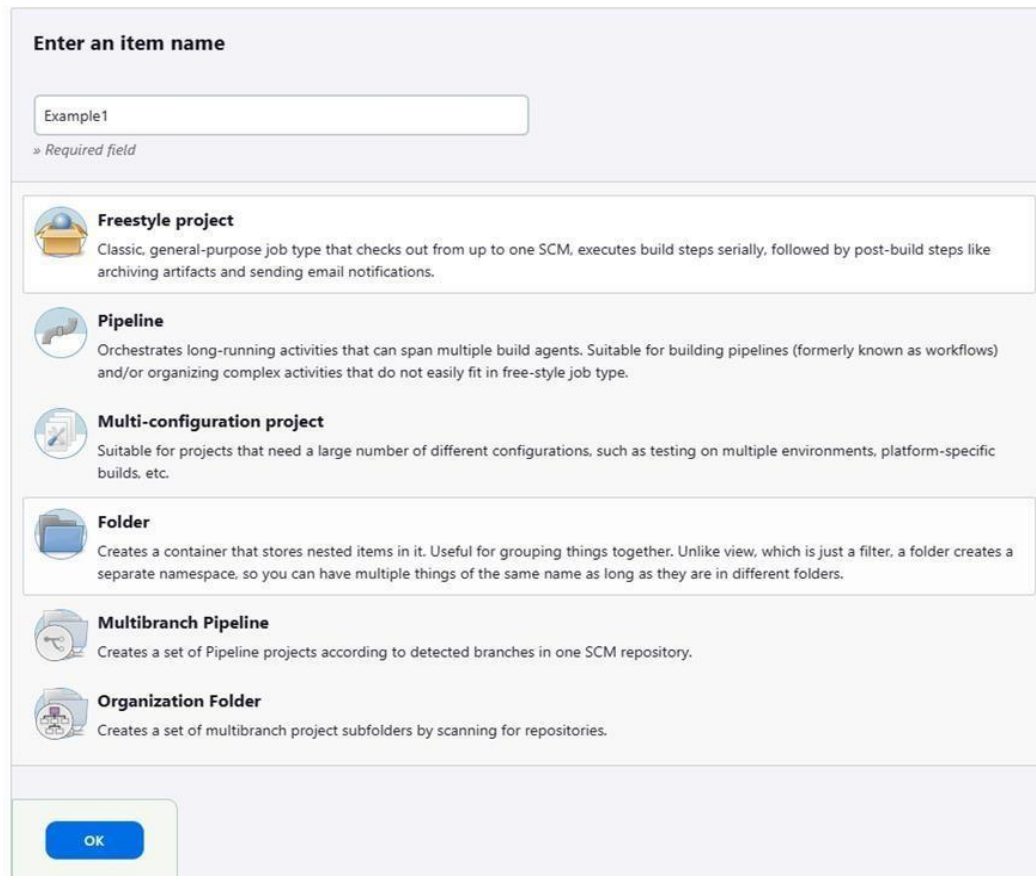
Create a job



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Naming the job and setting it as freestyle:



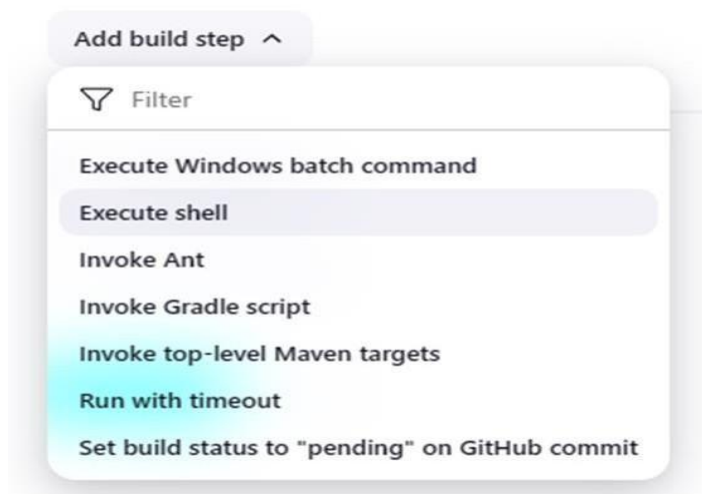
The screenshot shows the 'Enter an item name' dialog in Jenkins. At the top, there is a text input field containing 'Example1' and a label '» Required field'. Below this, there is a list of job types, each with an icon and a description:

- 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**: Creates a set of multibranch project subfolders by scanning for repositories.

At the bottom left of the dialog is a blue 'OK' button.

Selecting build type as “Execute shell”:

Build Steps



The screenshot shows the 'Add build step' dropdown menu in Jenkins. The menu is open, showing a list of build steps. The first option is 'Filter', which is currently selected. Below it, there is a list of other build steps:

- Execute Windows batch command
- Execute shell
- Invoke Ant
- Invoke Gradle script
- Invoke top-level Maven targets
- Run with timeout
- Set build status to "pending" on GitHub commit

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Entering a simple command for the shell execution:

Build Steps

≡ Execute shell ?

Command

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

```
echo "Hello TSEC"
```

Advanced ▾

Applying and saving the project configuration:

✓ Saved

Save

Apply

Building the project:

▶ Build Now

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Console output (after building):

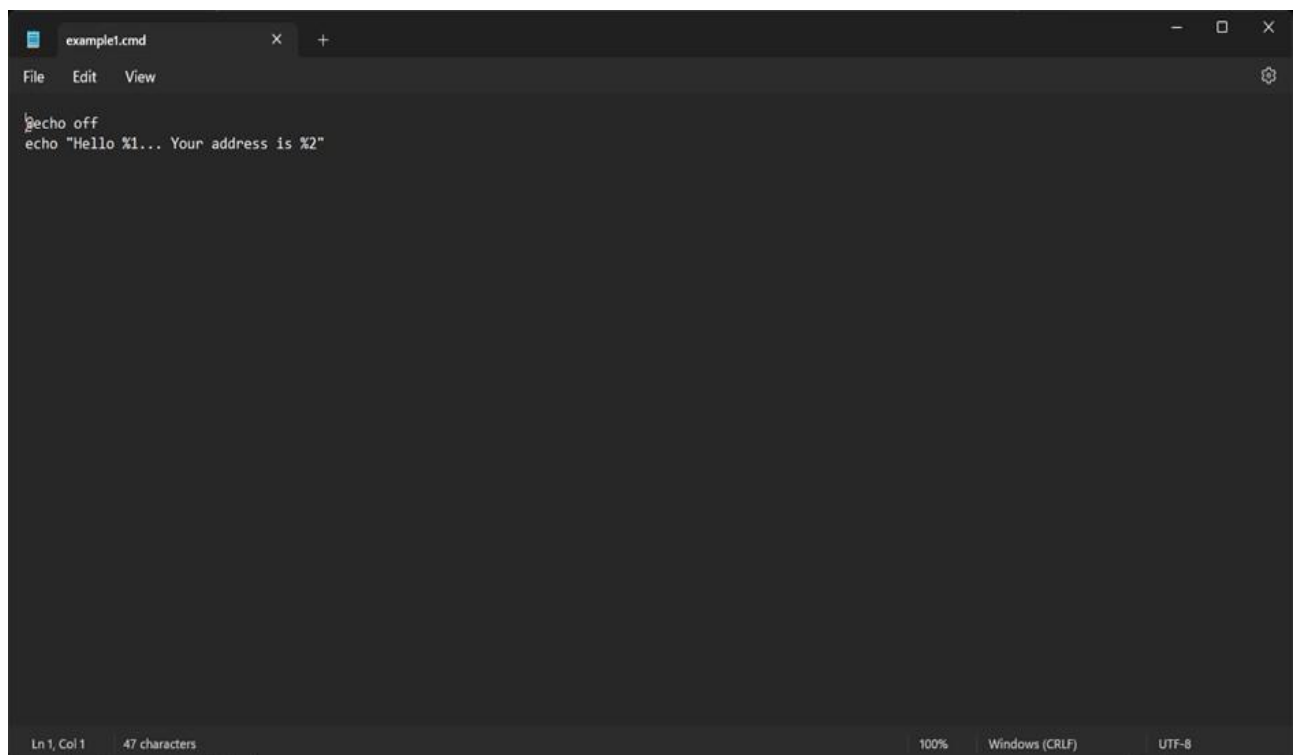


The screenshot shows the Jenkins 'Console Output' tab for a build. The output text is as follows:

```
Started by user Siddhant Chatur  
Running as SYSTEM  
Building in workspace C:\ProgramData\Jenkins\jenkins\workspace\Example1  
[Example1] $ "C:\Program Files\Git\bin\sh.exe" -xc C:\WINDOWS\TEMP\jenkins1558385253438646095.sh  
+ echo 'Hello TSEC'  
Hello TSEC  
Finished: SUCCESS
```

Example 1.2: Taking parameters through files

Contents of script example1.cmd:



The screenshot shows a text editor window titled 'example1.cmd'. The content of the file is:

```
@echo off  
echo "Hello %1... Your address is %2"
```

The status bar at the bottom indicates 'Ln 1, Col 1' and '47 characters'.

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Executing script example1.cmd on the terminal:

```
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

≡ Execute Windows batch command ?

Command

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

C:\Admin\Academics\TSEC\Start3\SEPM\example1.cmd Siddhant Goregaon

Advanced ▾

Add build step ▾

Console output after building the modified project:

Status

Changes

Console Output

View as plain text

Edit Build Information

Delete build *4*

Previous Build

✓ Console Output

Started by user Siddhant Chetkar
Running as SYSTEM
Building in workspace C:\ProgramData\Jenkins\jenkins\workspace\example1
[example1] \$ cmd /c call C:\WINDOWS\TEMP\Jenkins707989983181631150.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

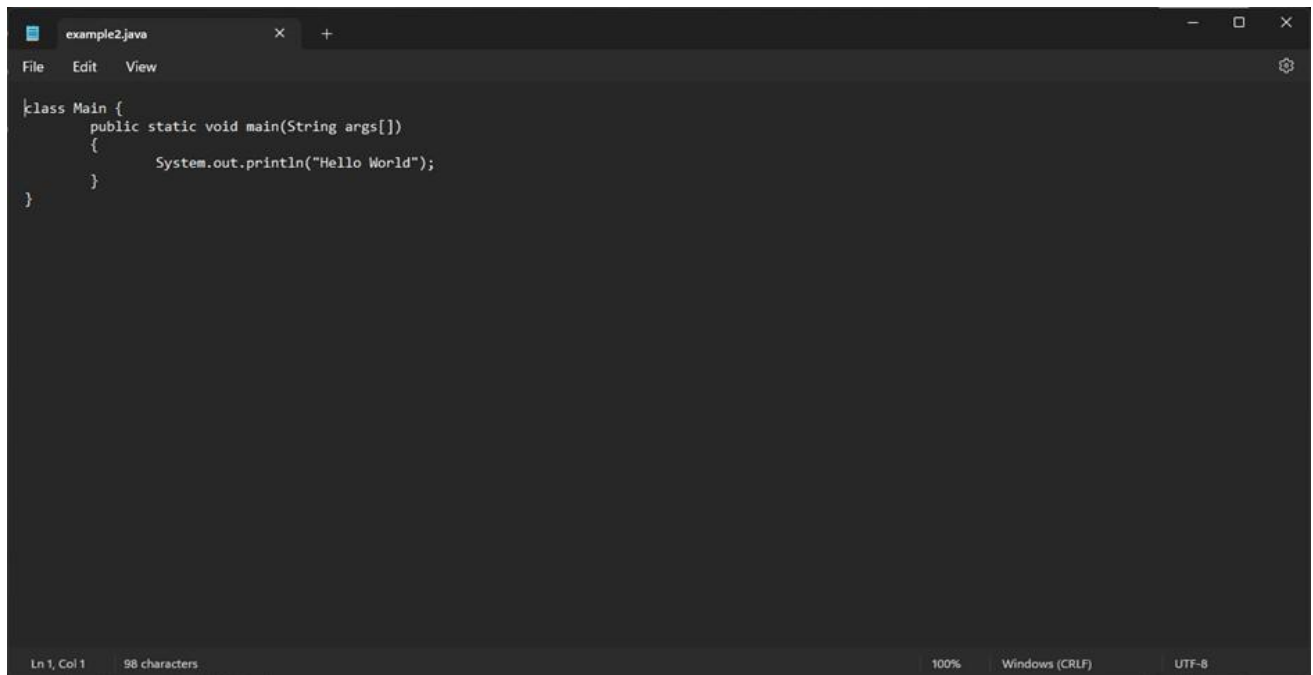
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Example 2

Example 2.1: Running a Java program under Jenkins

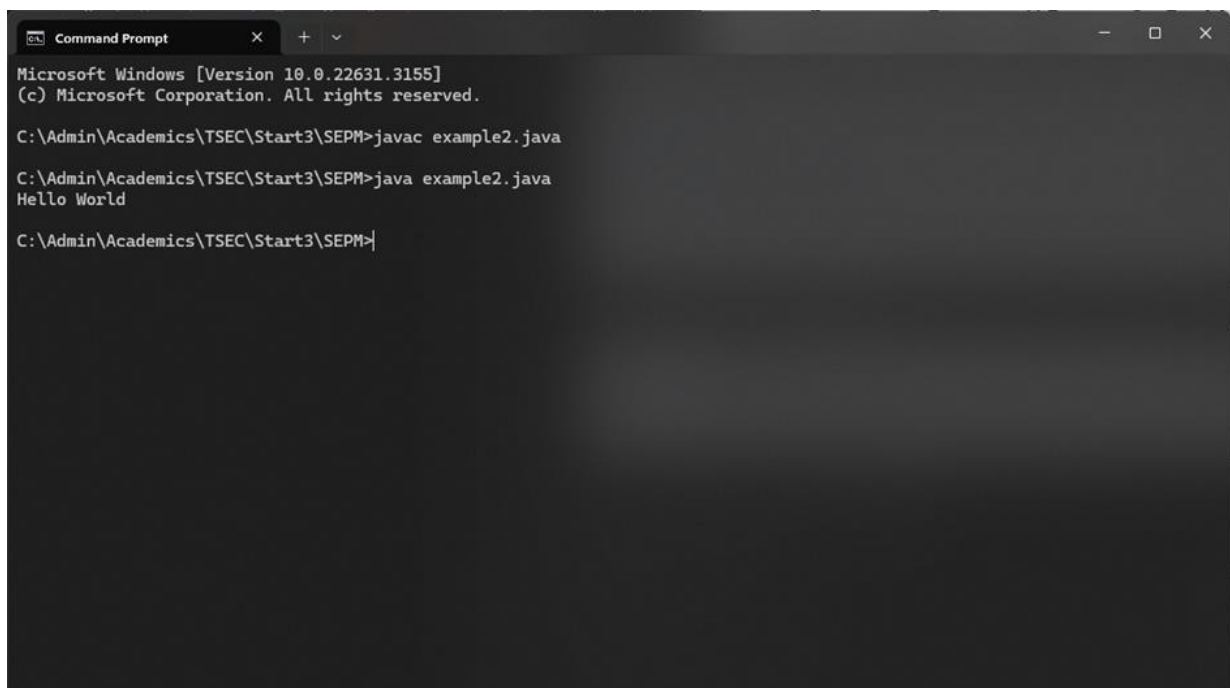
Creating a simple Java program:

A screenshot of an IDE window titled 'example2.java'. The code is as follows:

```
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:

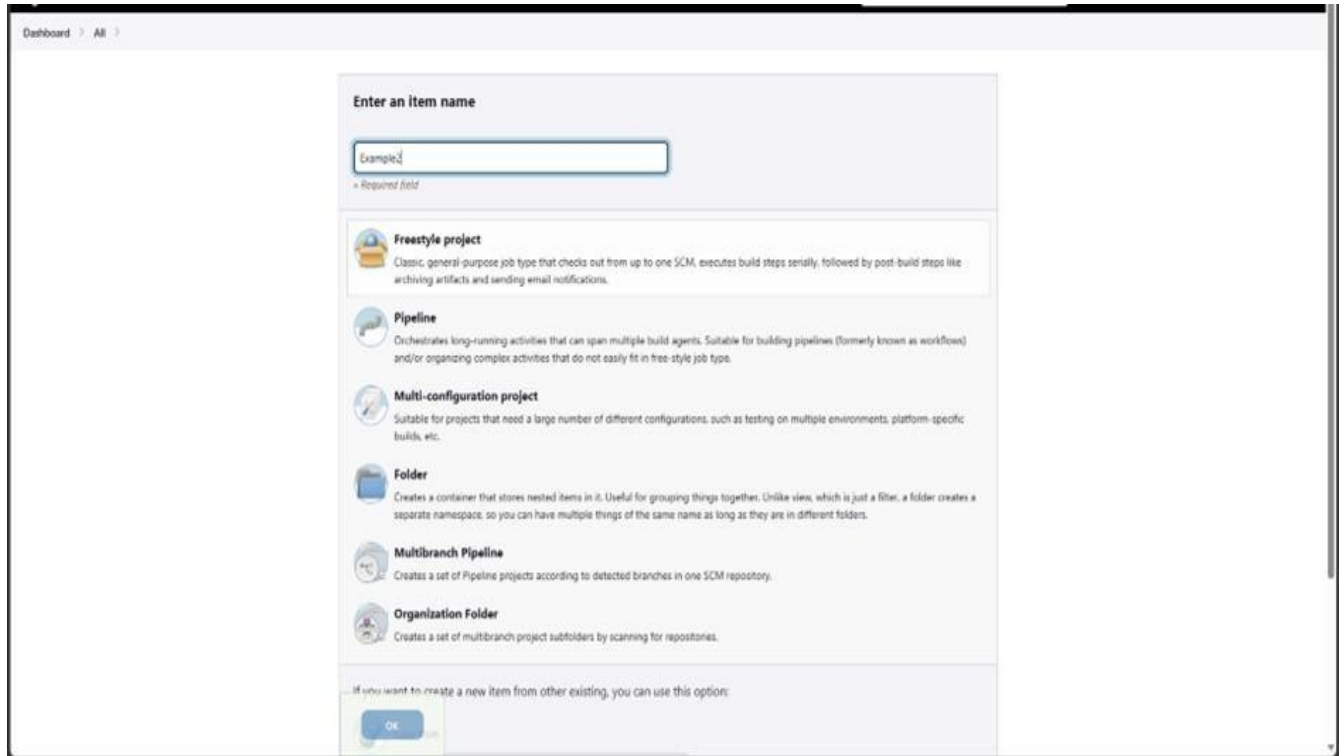
A screenshot of a Windows Command Prompt window. The text shown is:

```
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>|
```

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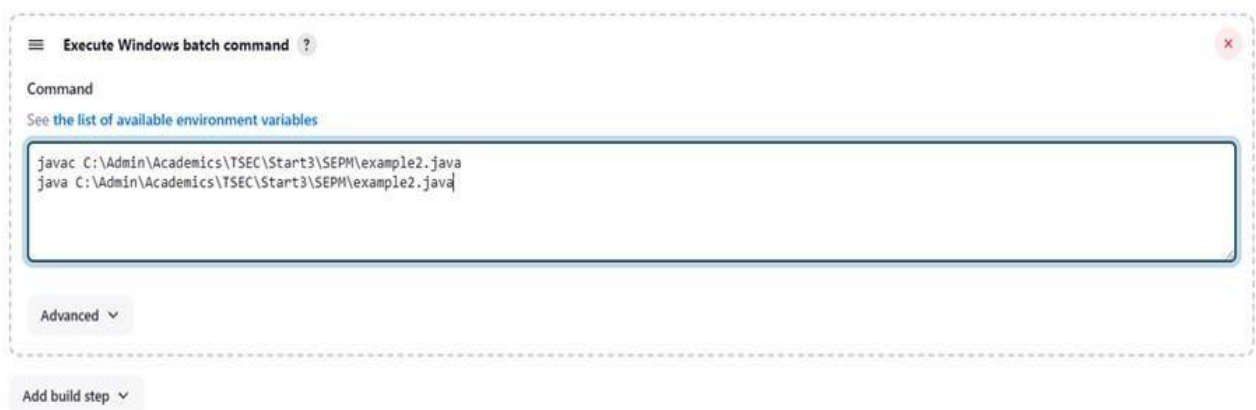
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Creating a new freestyle project:



Configure new project:

Build Steps



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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\workspace\Example2
[Example2] $ cmd /c call C:\WINDOWS\TEMP\Jenkins15296462484398614135.bat

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

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

C:\ProgramData\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


**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**
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:

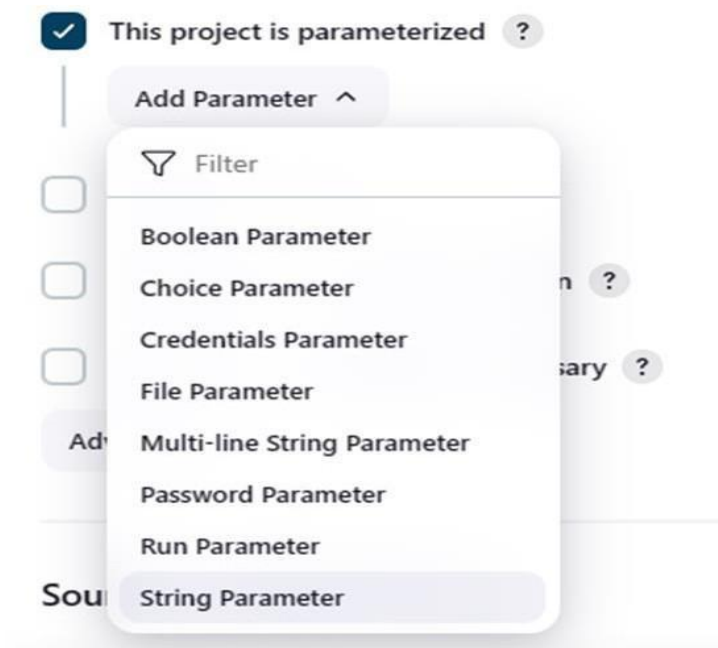
OK

Copy from

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Enabling parameterisation and adding a String parameter:



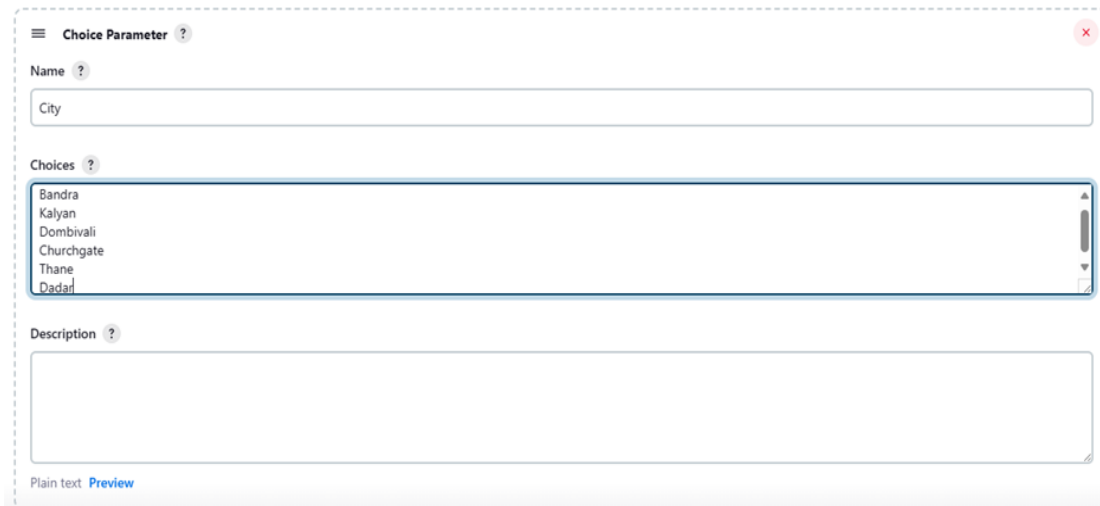
Configuring the string parameter as Fname:

A screenshot of the Jenkins 'String Parameter' configuration form. The form is titled 'String Parameter' with a help icon and a close button. It contains the following 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.

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



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
```

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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 ▾

Entering parameters for build:

Project Example3

This build requires parameters:

Fname

Aditya

City

Bandra



Build

Cancel

Console output after building:

Console Output

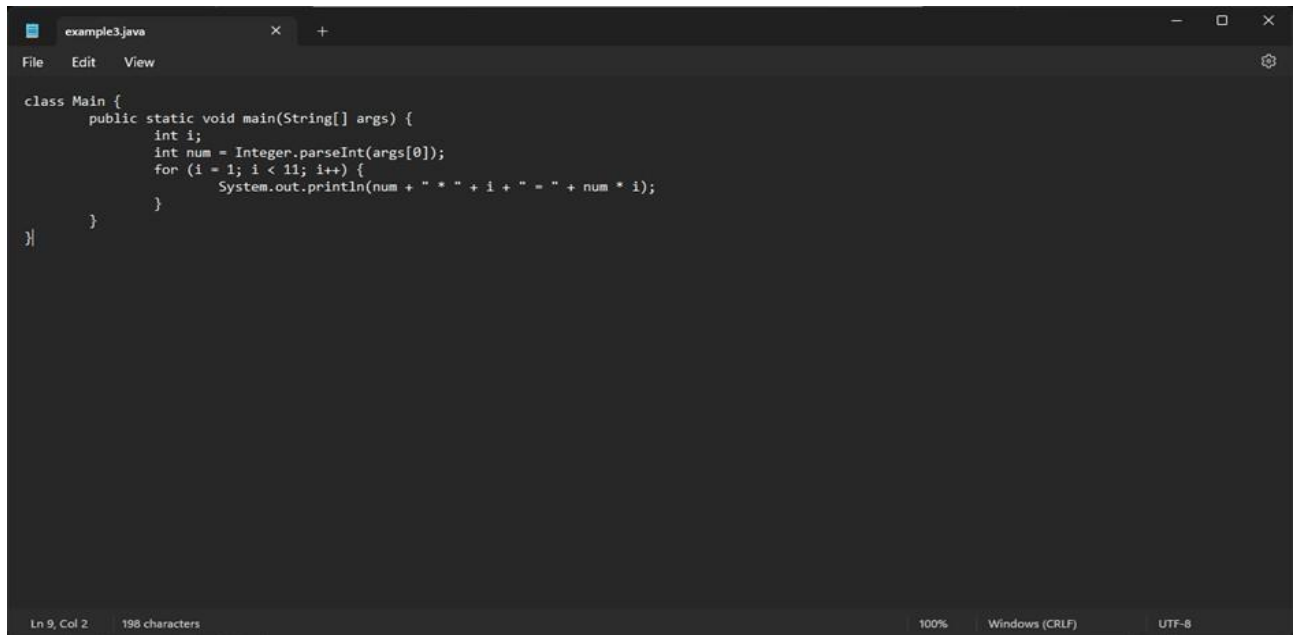
```
Started by user Siddhant Chetlur
Running as SYSTEM
[EnvInject] - Loading node environment variables.
Building in workspace C:\ProgramData\Jenkins\jenkins\workspace\Example3
[Example3] $ cmd /c call C:\WINDOWS\TEMP\jenkins14094536165190986151.bat
C:\ProgramData\Jenkins\jenkins\workspace\Example3>C:\Admin\Academics\TSEC\Start3\SEPM\example3.cmd Siddhant Bandra
Hello your name is Siddhant and your city is Bandra
Finished: SUCCESS
```

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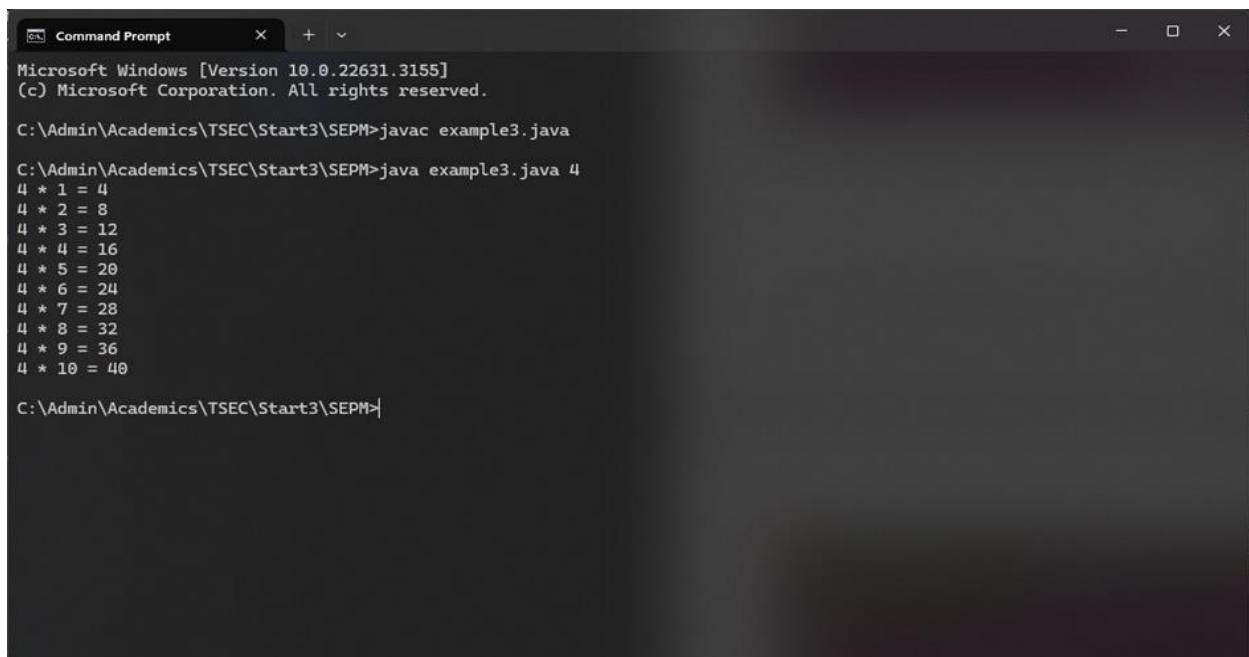
Example 3.2: Running a Java program with parameters

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:



```
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>
```

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Creating a new freestyle project:

Enter an item name

Example4

» 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**
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

Parameterise the project by adding a string parameter as follows:

☒ This project is parameterized ?

String Parameter ?

Name ?

num

Default Value ?

Description ?

Plain text [Preview](#)

☐ Trim the string ?

Add Parameter

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Configure the build steps:

Build Steps

The screenshot shows the 'Execute Windows batch command' build step configuration in Jenkins. The 'Command' field contains the following text:

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

Below the command field is an 'Advanced' dropdown menu. At the bottom of the configuration area is an 'Add build step' button.

Entering the parameter for the build:

Project Example4

This build requires parameters:

num

The screenshot shows a text input field for the parameter 'num'. The value '25' has been entered into the field.

The screenshot shows two buttons: a green 'Build' button with a play icon and a grey 'Cancel' button.

Console output after building:

Console Output

The screenshot shows the Jenkins console output for the build. The output is as follows:

```
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
```

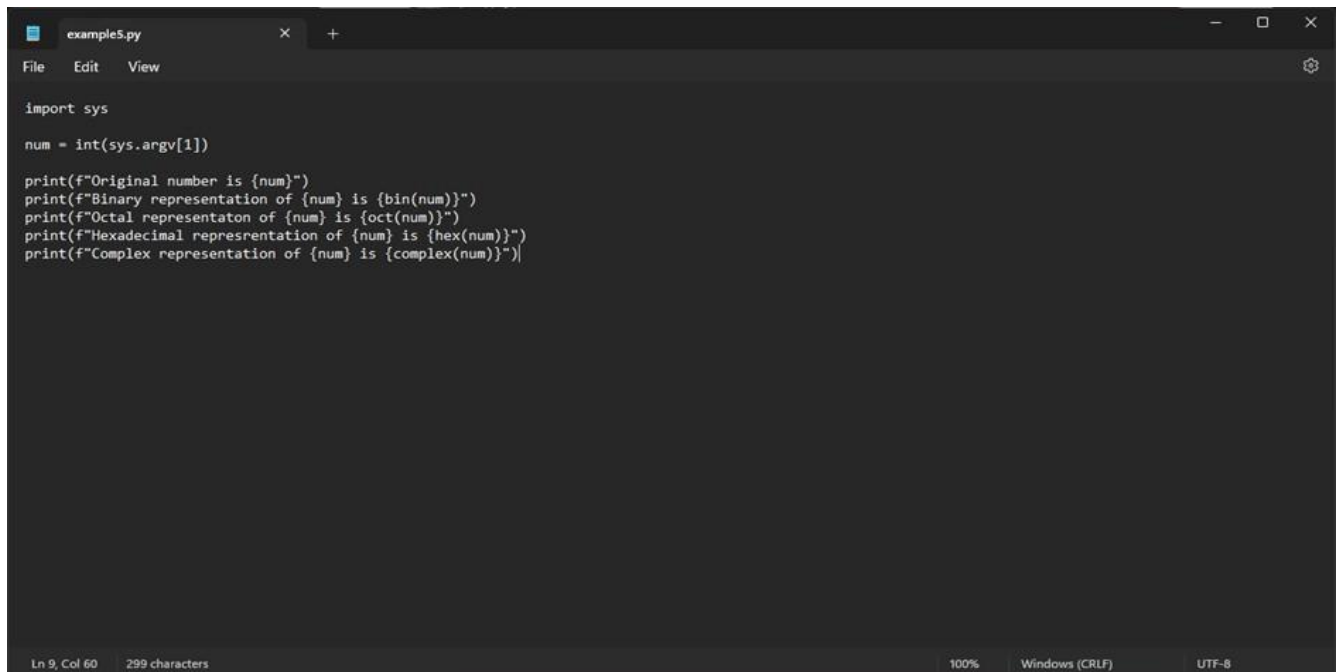
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Example 5

Example 5.1: Running a Python program

Creating a simple Python script:



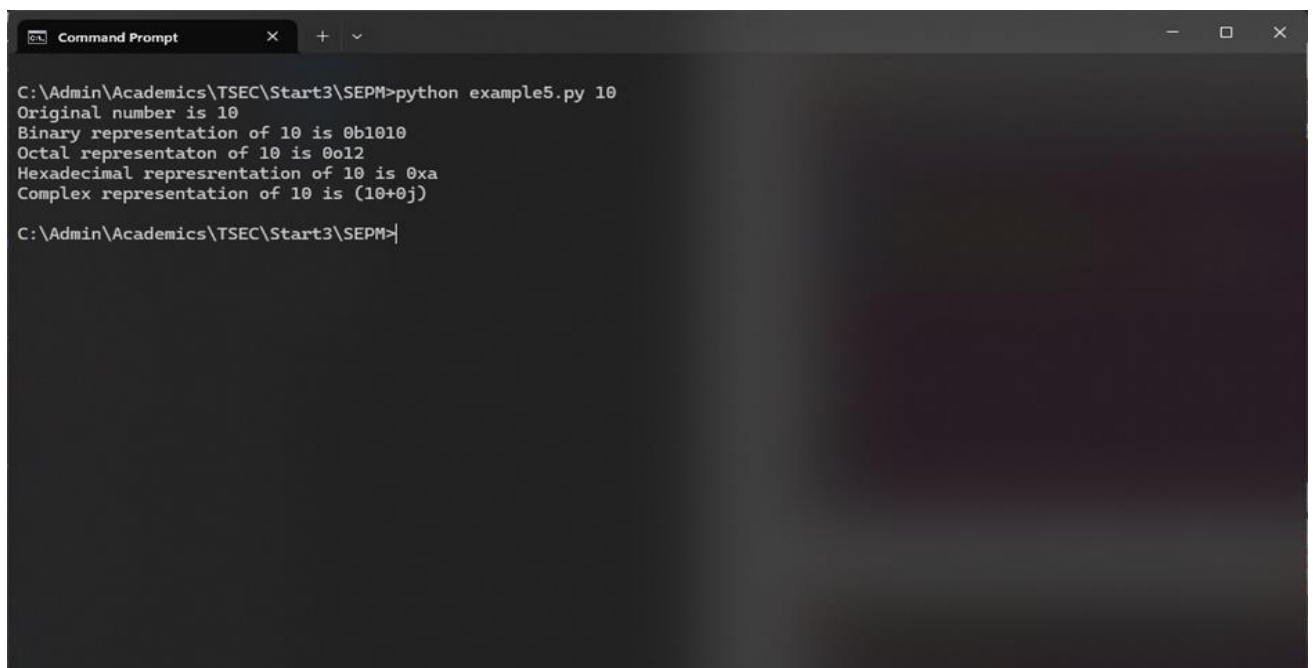
```
example5.py
File Edit View
import sys

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:

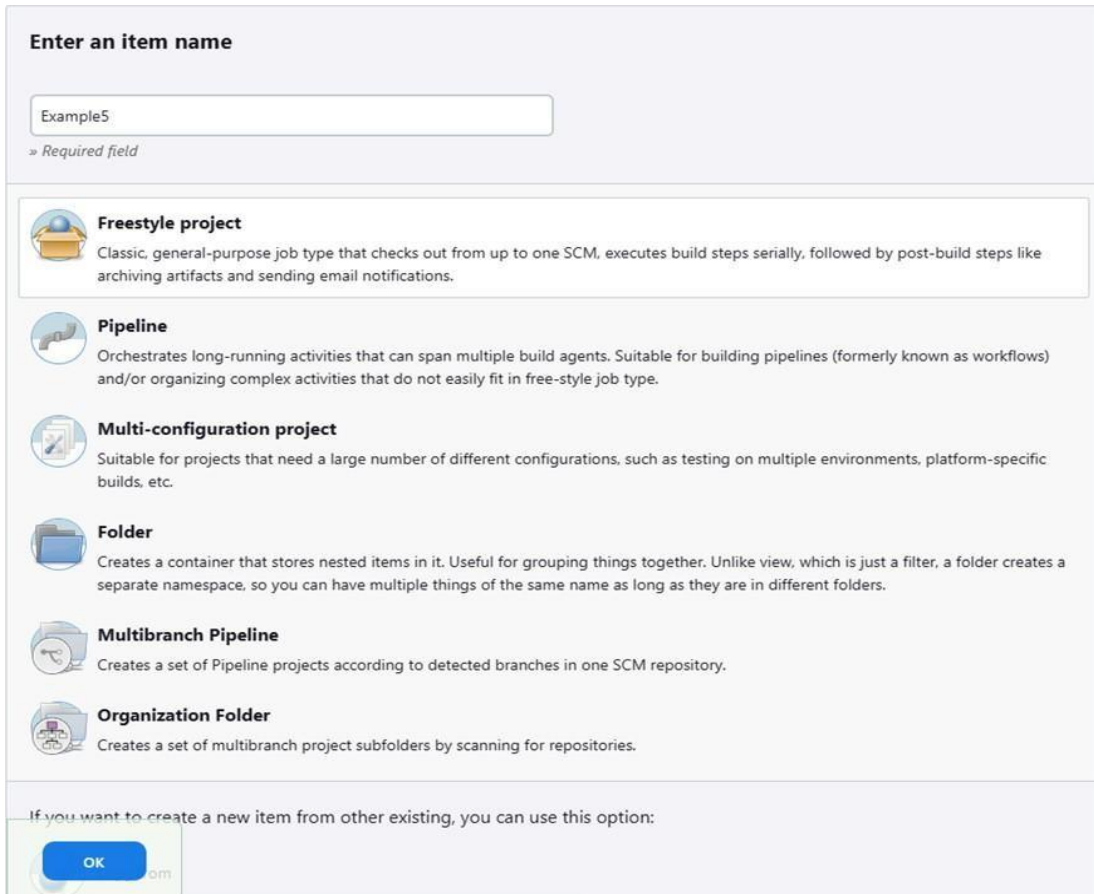


```
Command Prompt
C:\Admin\Academics\TSEC\Start3\SEPM>python example5.py 10
Original number is 10
Binary representation of 10 is 0b1010
Octal representation of 10 is 0o12
Hexadecimal representation of 10 is 0xa
Complex representation of 10 is (10+0j)
C:\Admin\Academics\TSEC\Start3\SEPM>|
```

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Creating a new freestyle project:



The screenshot shows the Jenkins 'Enter an item name' dialog box. At the top, there is a text input field with 'Example5' and a '» Required field' link below it. Below this, there is a list of project types, each with an icon and a description:

- 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.
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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.

At the bottom, there is a text box with the message 'If you want to create a new item from other existing, you can use this option:' and an 'OK' button.

Parameterising the project with a string parameter as follows:



The screenshot shows the Jenkins 'String Parameter' configuration dialog box. At the top, there is a checkbox labeled 'This project is parameterized' which is checked. Below this, there is a section titled 'String Parameter' with a red 'X' icon in the top right corner. Inside this section, there are three input fields:

- Name**: A text input field with the value 'num'.
- Default Value**: A text input field.
- Description**: A text area.

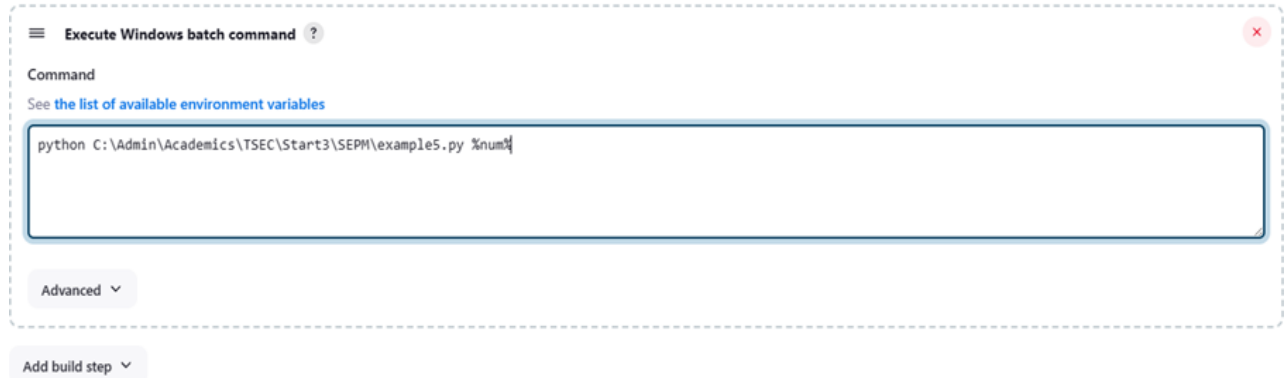
Below these fields, there is a 'Plain text' label and a 'Preview' link. At the bottom, there is a checkbox labeled 'Trim the string' which is unchecked. Below this, there is an 'Add Parameter' button with a dropdown arrow.

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Configuring the build steps:

Build Steps



The screenshot shows the Jenkins configuration interface for a build step titled "Execute Windows batch command". It includes a "Command" field with the text: `python C:\Admin\Academics\TSEC\Start3\SEPM\example5.py %num%`. Below the command field is an "Advanced" dropdown menu. At the bottom, there is an "Add build step" button.

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

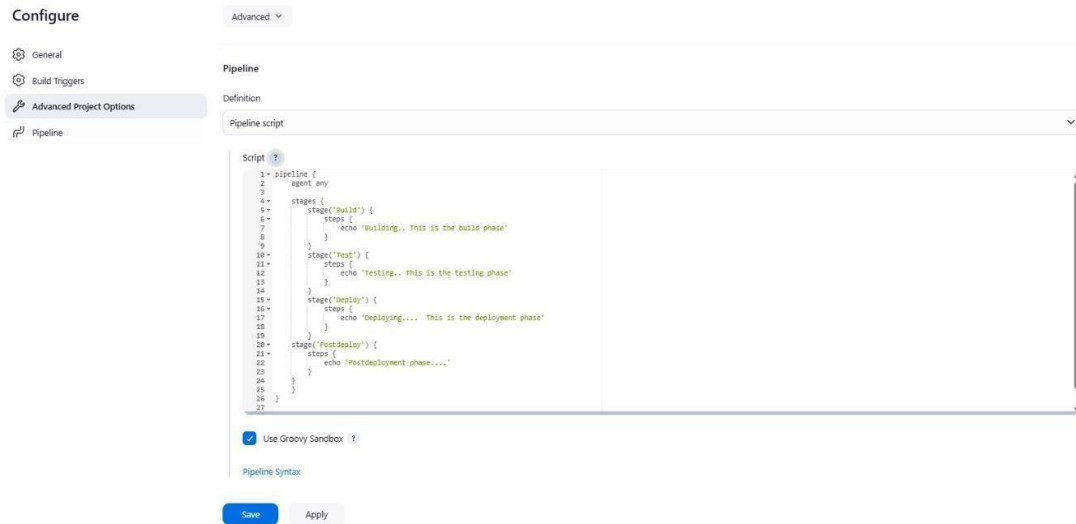
C:\ProgramData\Jenkins\.jenkins\workspace\Example5>python C:\Admin\Academics\TSEC\Start3\SEPM\example5.py 10
Original number is 10
Binary representation of 10 is 0b1010
Octal representation of 10 is 0o12
Hexadecimal representation of 10 is 0xa
Complex representation of 10 is (10+0j)

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

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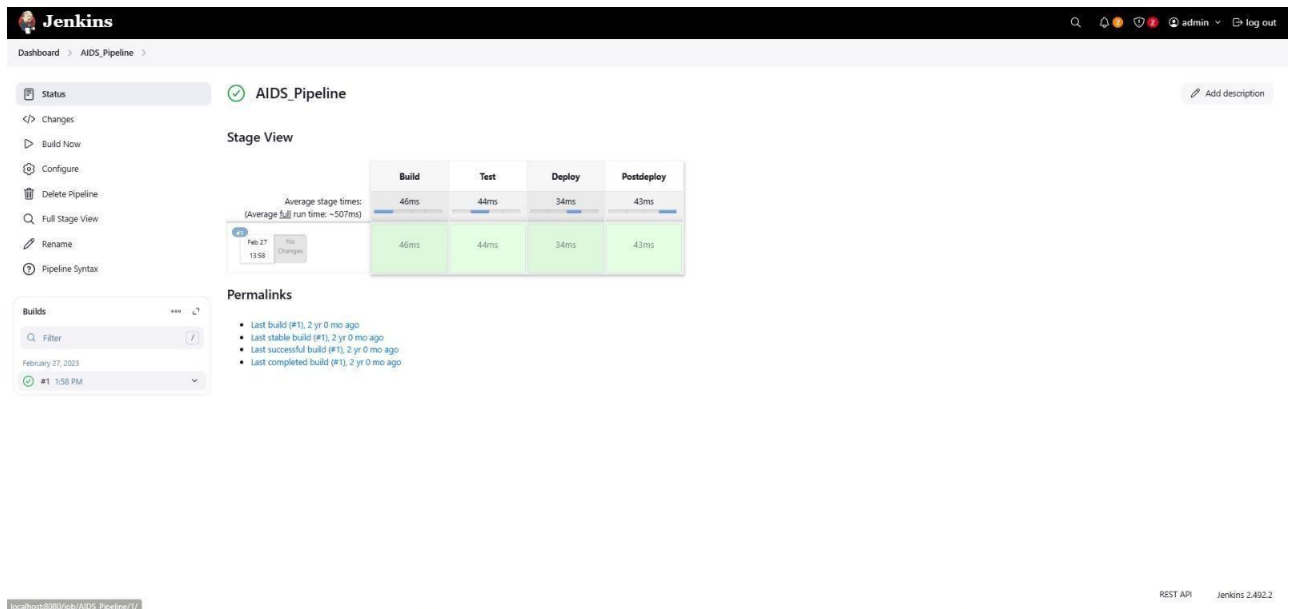
Some Screenshots:



The screenshot shows the Jenkins 'Configure' page for a pipeline. The 'Pipeline' tab is selected. The 'Definition' section shows a 'Pipeline script' definition. The script is as follows:

```
1 pipeline {
2   agent any
3
4   stages {
5     stage('Build') {
6       steps {
7         echo 'Building.. this is the build phase'
8       }
9     }
10    stage('Test') {
11      steps {
12        echo 'Testing.. this is the testing phase'
13      }
14    }
15    stage('Deploy') {
16      steps {
17        echo 'Deploying.... This is the deployment phase'
18      }
19    }
20    stage('Postdeploy') {
21      steps {
22        echo 'Postdeployment phase....'
23      }
24    }
25  }
26 }
27
```

Below the script, there is a checkbox for 'Use Groovy Sandbox' which is checked. At the bottom, there are 'Save' and 'Apply' buttons.



The screenshot shows the Jenkins 'Status' page for the 'AIDS_Pipeline'. The 'Stage View' section displays a table with stage execution times:

	Build	Test	Deploy	Postdeploy
Average stage times: (Average full run time: ~507ms)	46ms	44ms	34ms	43ms
#1 Feb 27 13:58 No Changes	46ms	44ms	34ms	43ms

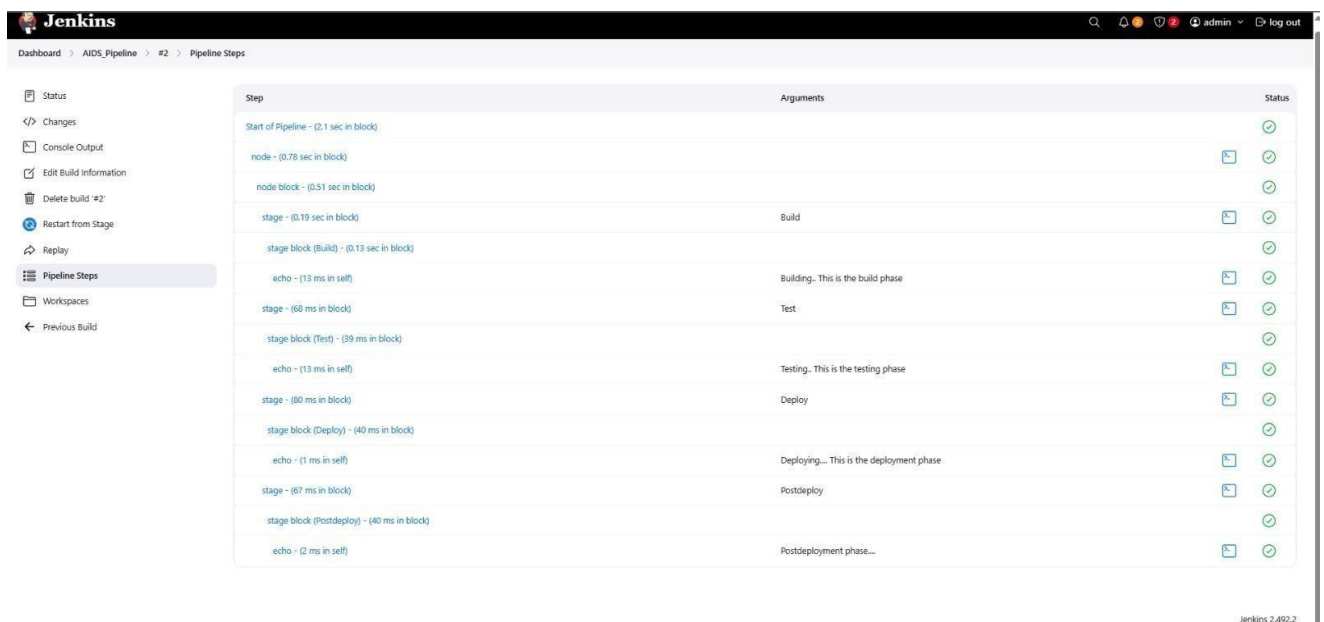
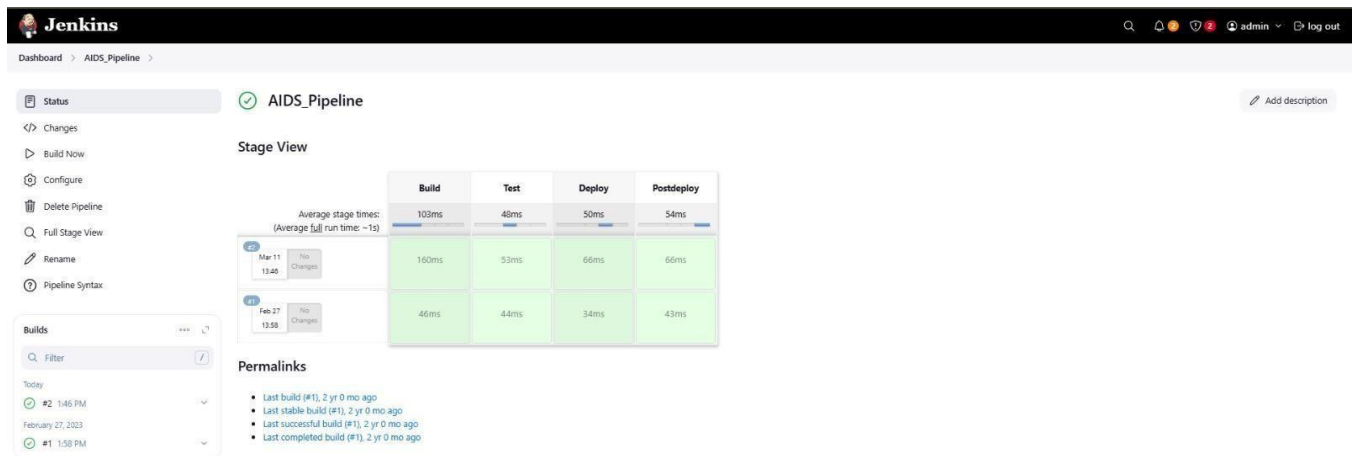
The 'Permalinks' section lists the following links:

- Last build (#1), 2 yr 0 mo ago
- Last stable build (#1), 2 yr 0 mo ago
- Last successful build (#1), 2 yr 0 mo ago
- Last completed build (#1), 2 yr 0 mo ago

The bottom of the page shows the local host address: localhost:8080/jenkins/AIDS_Pipeline/1/.

Software Engineering & Project Management Lab Experiment No: - 05

Aim: 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



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The screenshot shows the Jenkins 'Console Output' for a pipeline build. The left sidebar contains navigation links: Status, Changes, Console Output (selected), View as plain text, Edit Build Information, Delete build #2, Restart from Stage, Replay, Pipeline Steps, Workspaces, and Previous Build. The main console area displays the following log:

```
Started by user admin
[Pipeline] Start of Pipeline
[Pipeline] node
Running on Jenkins in C:\ProgramData\Jenkins\jenkins\workspace\AIDS_Pipeline
[Pipeline] {
[Pipeline] stage
[Pipeline] { (Build)
[Pipeline] echo
Building.. This is the build phase
[Pipeline] }
[Pipeline] // stage
[Pipeline] stage
[Pipeline] { (Test)
[Pipeline] echo
Testing.. This is the testing phase
[Pipeline] }
[Pipeline] // stage
[Pipeline] stage
[Pipeline] { (Deploy)
[Pipeline] echo
Deploying.... This is the deployment phase
[Pipeline] }
[Pipeline] // stage
[Pipeline] stage
[Pipeline] { (Postdeploy)
[Pipeline] echo
Postdeployment phase....
[Pipeline] }
[Pipeline] // stage
[Pipeline] }
[Pipeline] // node
[Pipeline] End of Pipeline
Finished: SUCCESS
```

REST API Jenkins 2.492.2

The screenshot shows the 'Stage Logs (Build)' page in Jenkins. It displays a table of stage times for three builds. The table has columns for Build, Test, Deploy, and Postdeploy. The first two columns are highlighted in green. The table shows the following data:

Build	Test	Deploy	Postdeploy
91ms	50ms	51ms	58ms
69ms	53ms	54ms	67ms
160ms	53ms	66ms	66ms
46ms	44ms	34ms	43ms

Permalinks

- Last build (#3), 27 ms ago
- Last stable build (#2), 1 min 40 sec ago
- Last successful build (#2), 1 min 40 sec ago
- Last completed build (#2), 1 min 40 sec ago

Conclusion: Thus, we have successfully Build the pipeline of jobs using Maven / Gradle / Ant in Jenkins, created a pipeline script to Test and deploy an application over the tomcat server.