

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:

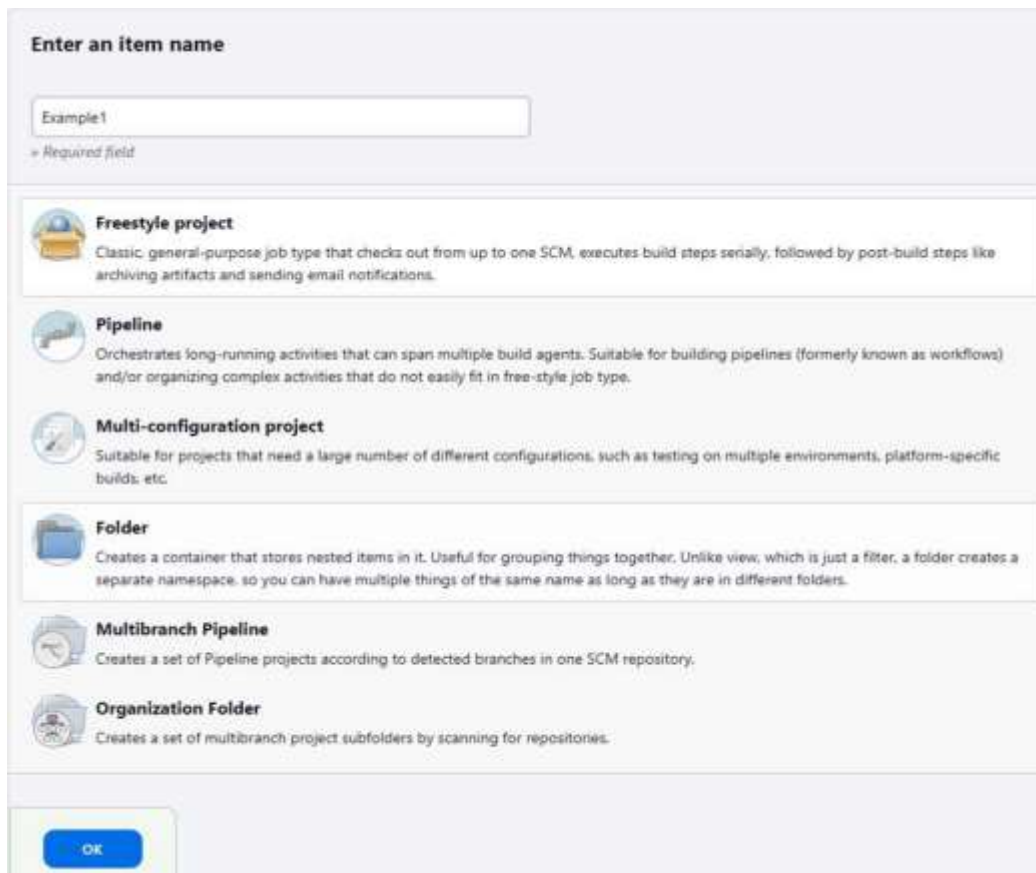
Start building your software project



Naming the job and setting it as freestyle:

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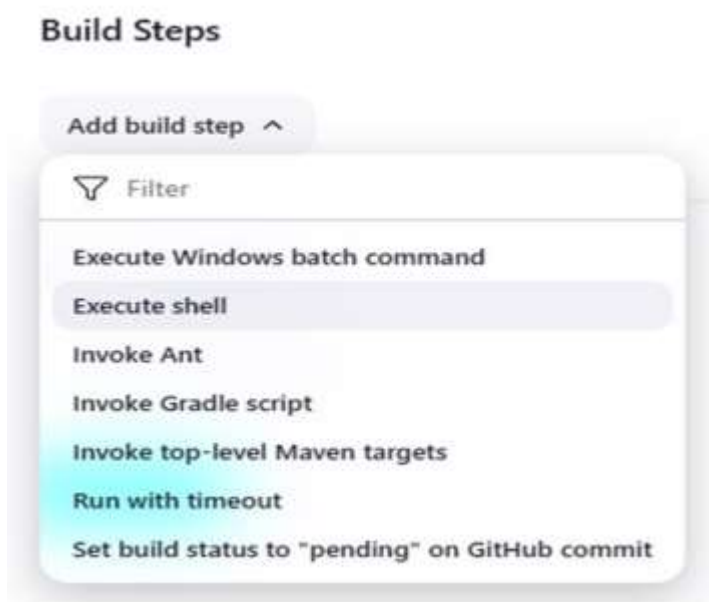


The screenshot shows the 'New Item' dialog in Jenkins. At the top, there is a text input field labeled 'Enter an item name' with the placeholder text 'Example1' and a note '* Required field'. Below this, there is a list of project types, each with an icon and a description:

- 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.
- 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, there is a blue 'OK' button.

Selecting build type as “Execute shell”:



The screenshot shows the 'Build Steps' dropdown menu in Jenkins. The menu is open, displaying a list of build steps. The first option is 'Add build step' with a chevron icon. Below it is a search bar labeled 'Filter'. The list of build steps includes:

- Execute Windows batch command
- Execute shell** (highlighted)
- 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:

Save

Apply

✓ Saved

Building the project:

▶ Build Now

Console output (after building):

Status

Changes

Console Output

View as plain text

Edit Build Information

Delete build #1

✓ Console Output

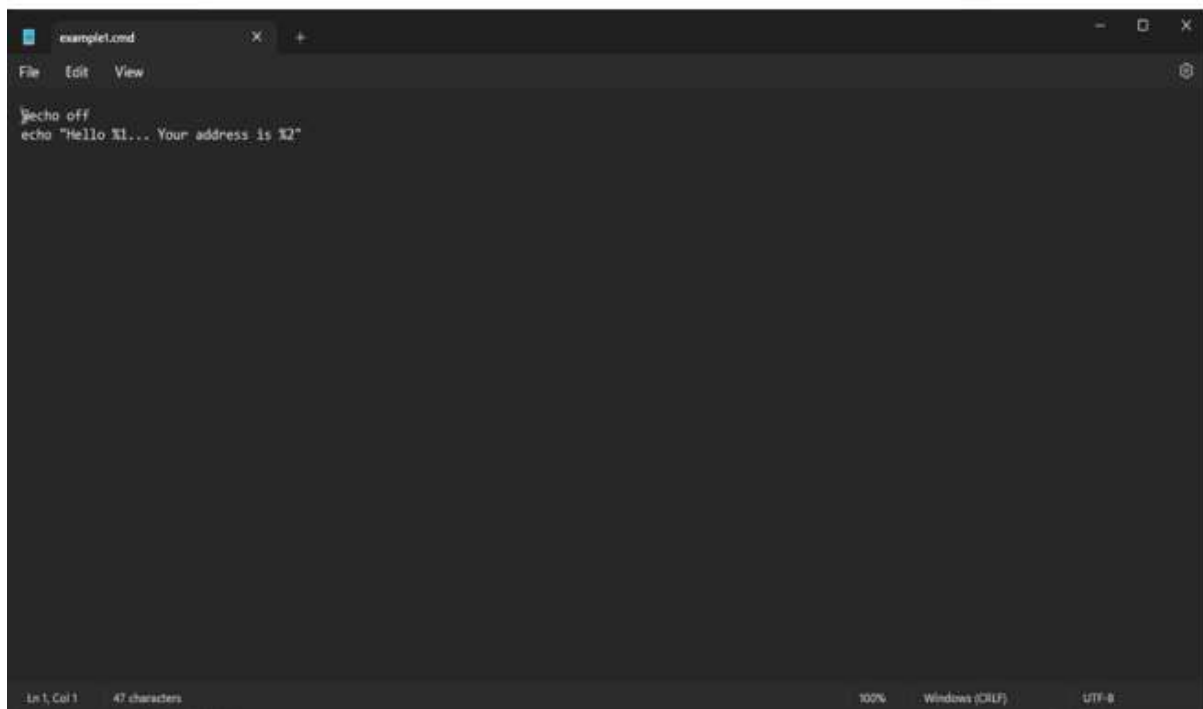
Started by user: Siddhant Chatur
Running as SYSTEM
Building in workspace C:\ProgramData\Jenkins\workspace\Example1
[Example1] \$ "C:\Program Files\Git\bin\cmd.exe" -xc C:\WINDOWS\TEMP\jenkins3380388253435648985.sh
+ echo "Hello TSEC"
Hello TSEC
Finished: SUCCESS

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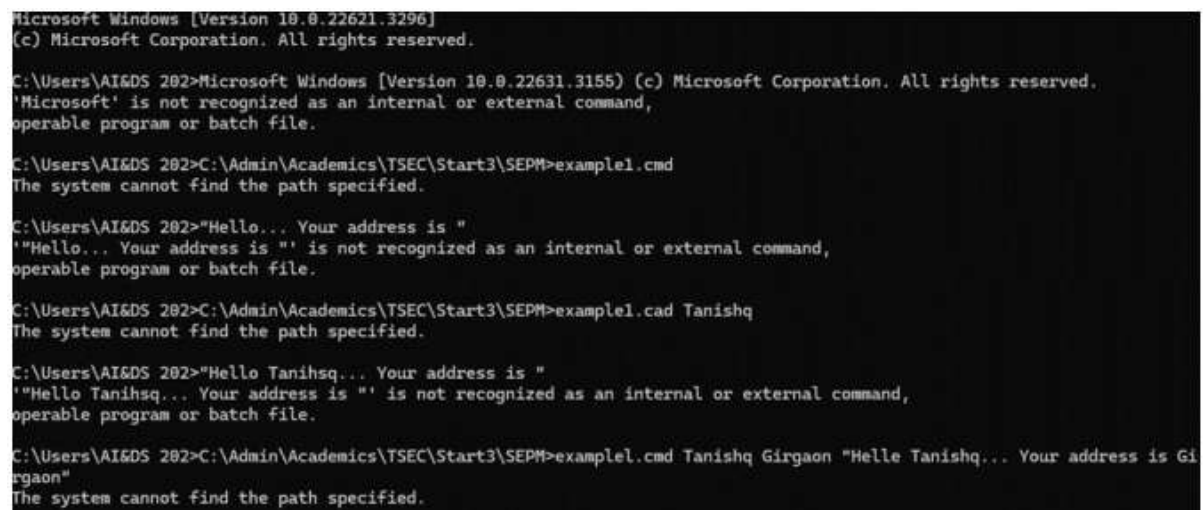
Example 1.2: Taking parameters through files

Contents of script example1.cmd:



```
example1.cmd
File Edit View
echo off
echo "Hello %1... Your address is %2"
```

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.cmd Tanishq
The system cannot find the path specified.

C:\Users\AI&DS 202>"Hello Tanishq... Your address is "
'Hello Tanishq... 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:

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Build Steps

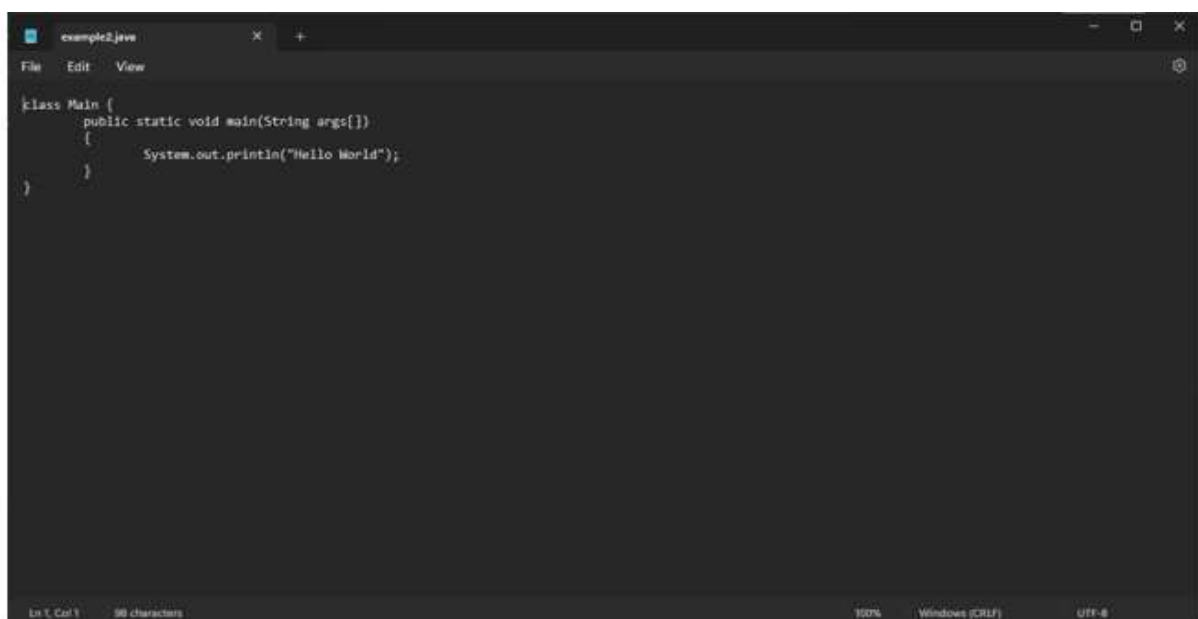


Console output after building the modified project:



Example 2

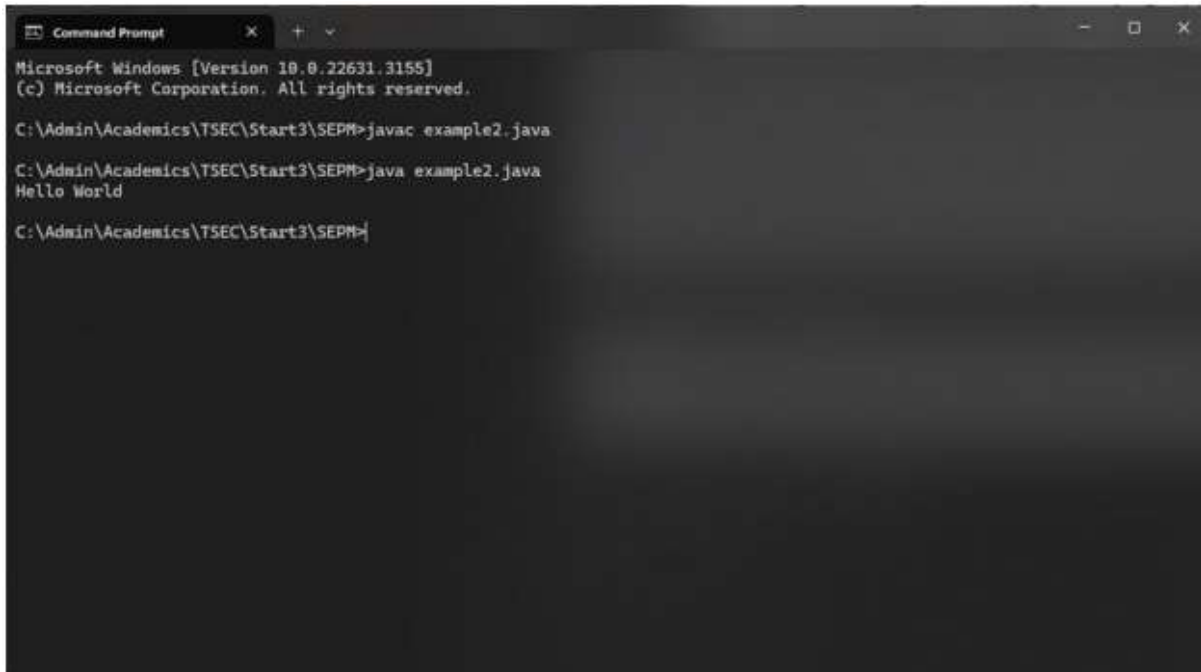
Example 2.1: Running a Java program under Jenkins



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Compiling and running the program on the terminal:



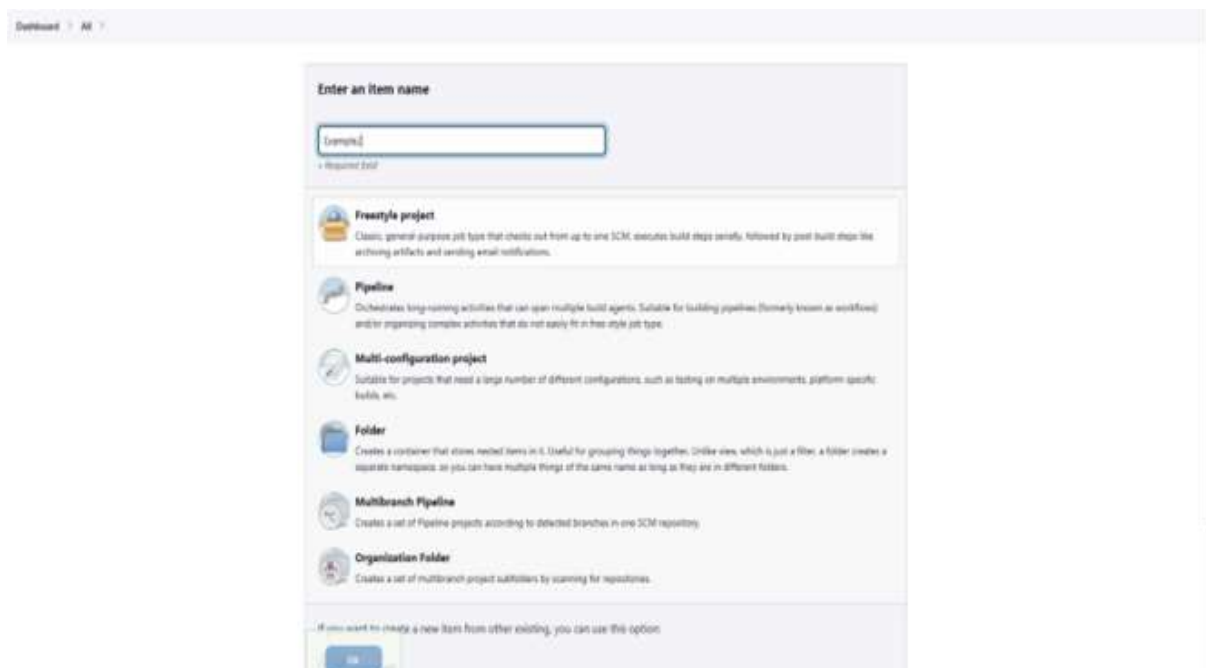
```
Microsoft Windows [Version 10.0.22631.3155]
(c) Microsoft Corporation. All rights reserved.

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

C:\Admin\Academics\TSEC\Start3\SEPM>java example2.java
Hello World

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

Creating a new freestyle project:



Configure new project:

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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 Chatur
Running as SYSTEM
[EnvInject] - Loading node environment variables.
Building in workspace C:\ProgramData\Jenkins\jenkins\workspace\Example2
[Example2] $ cmd /c call C:\WINDOWS\TEMP\jenkins1520646248498834135.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

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Creating a new freestyle project:

Enter an item name

Example3

* 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

Enabling parameterisation and adding a String parameter:

☒ This project is parameterized ?

Add Parameter ^

- Filter
- Boolean Parameter
- Choice Parameter
- Credentials Parameter
- File Parameter
- Multi-line String Parameter
- Password Parameter
- Run Parameter
- String Parameter

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Configuring the string parameter as Fname:



The screenshot shows the Jenkins 'String Parameter' configuration dialog. It has a title bar 'String Parameter' with a help icon. The 'Name' field is labeled 'Fname'. The 'Default Value' field is empty. The 'Description' field is empty. At the bottom, there is a 'Plain text' label, a 'Preview' link, and a checkbox labeled 'Trim the string' which is currently unchecked.

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



The screenshot shows the Jenkins 'Choice Parameter' configuration dialog. It has a title bar 'Choice Parameter' with a help icon. The 'Name' field is labeled 'City'. The 'Choices' field is a list box containing the following items: 'Bandra', 'Kalyan', 'Dombivli', 'Churchgate', 'Thane', and 'Dadar'. The 'Description' field is empty. At the bottom, there is a 'Plain text' label and a 'Preview' link.

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

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```
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.

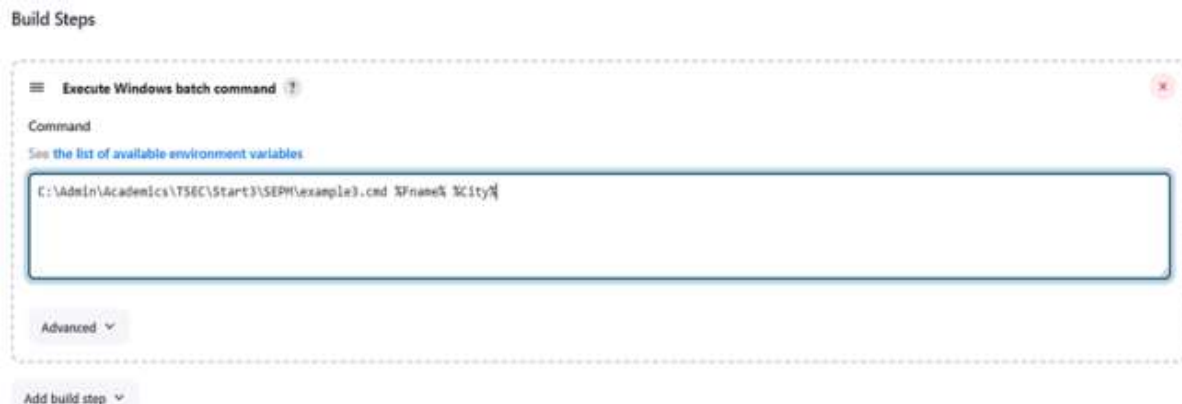
C:\Users\AI&DS 202>Hello your name is Tanishq and your city is
'Hello' is not recognized as an internal or external command,
operable program or batch file.

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



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Entering parameters for build:

Project Example3

This build requires parameters:

fname

Aditya

City

Bandra

Build

Cancel

Console output after building:

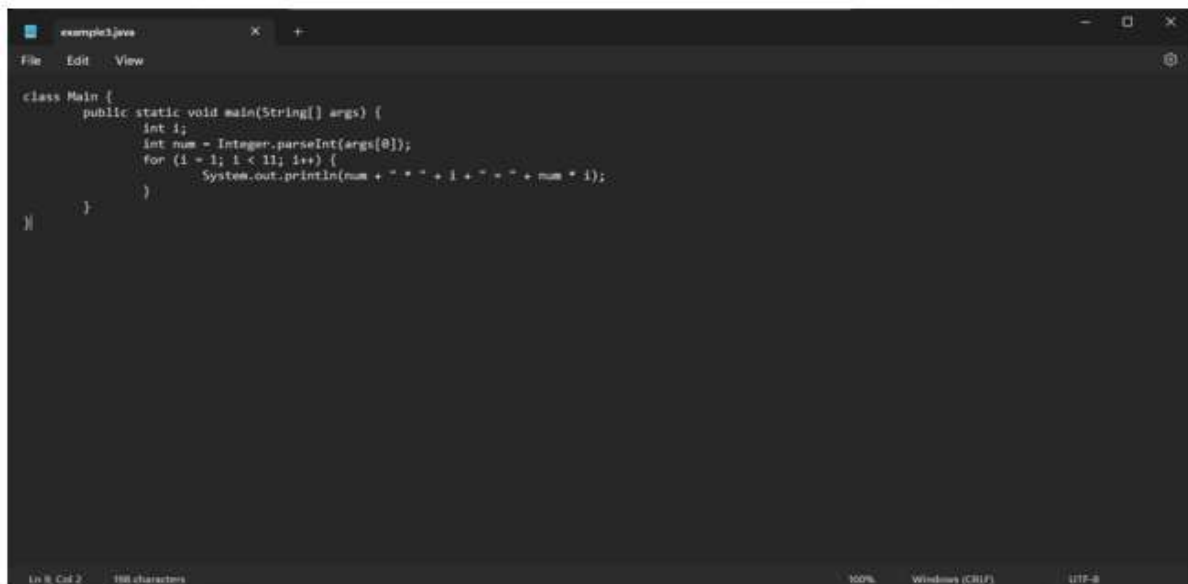
Console Output

```
Started by user Siddhant Chetiar
Running as SYSTEM
[Example3] - loading node environment variables.
Building in workspace C:\ProgramData\Jenkins\jenkins\workspace\Example3
[Example3] $ cd /v call C:\UD0000\TEMP\jenkins2409453410534946131.bat

C:\ProgramData\Jenkins\jenkins\workspace\Example3>C:\Admin\Academics\TSC\Start\SDP\Example3.cmd Siddhant Randra
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:

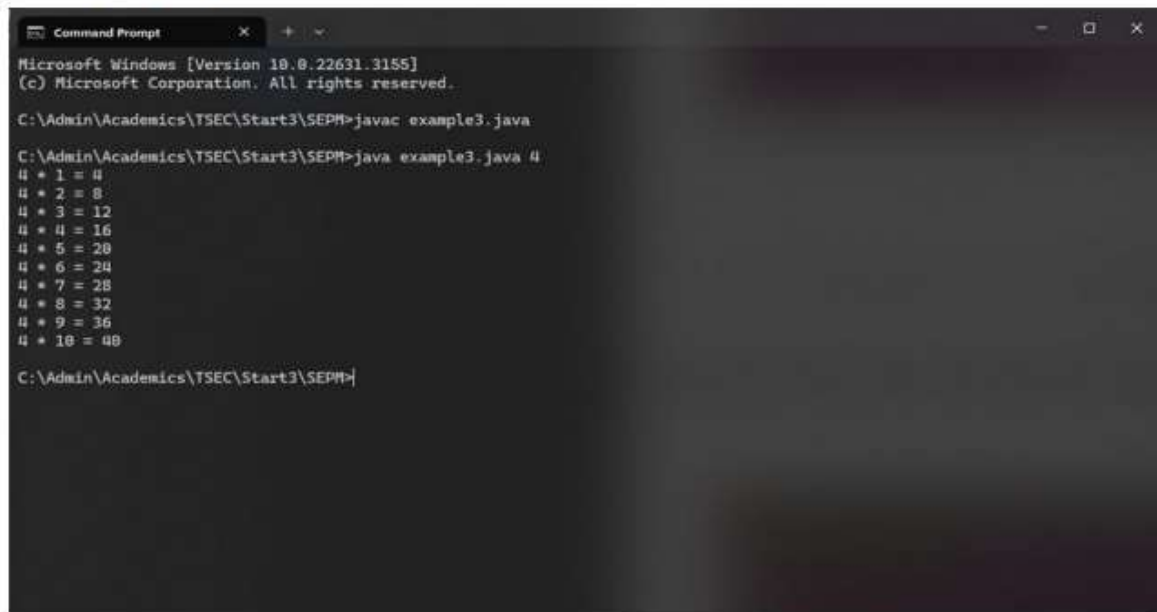


```
class Main {
    public static void main(String[] args) {
        int i;
        int num = Integer.parseInt(args[0]);
        for (i = 1; i < 11; i++) {
            System.out.println(num + " * " + i + " = " + num * i);
        }
    }
}
```

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Testing the program on the terminal:



```
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>
```


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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

Cancel

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Parameterise the project by adding a string parameter as follows:



The screenshot shows the Jenkins configuration page for a String Parameter. At the top, a checkbox labeled "This project is parameterized" is checked. Below it, a section titled "String Parameter" contains the following fields:

- Name:** A text box containing the value "num".
- Default Value:** An empty text box.
- Description:** A large empty text area.
- Plain text:** A checkbox that is unchecked, with a "Preview" link next to it.
- Trim the string:** A checkbox that is unchecked.

At the bottom of the section is a button labeled "Add Parameter".

Configure the build steps:

Build Steps



The screenshot shows the configuration for a build step titled "Execute Windows batch command". 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 step configuration is a button labeled "Add build step".

Entering the parameter for the build:

Project Example4

This build requires parameters:



The screenshot shows the Jenkins interface for entering a parameter value. The parameter name "num" is displayed above a text input field. The field contains the value "25". Below the input field are two buttons: a green "Build" button and a grey "Cancel" button.

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Console output after building:

✓ Console Output

```
Started by user Siddhant Oetliar
Running as SYSTEM
[two2jett] - loading node environment variables.
Building in workspace C:\ProgramData\Jenkins\jenkins\workspace\Example4
[Example4] $ cmd /c call C:\WINDOWS\TEMP\jenkins5515685770813247708.bat

C:\ProgramData\Jenkins\jenkins\workspace\Example4>javac C:\Admin\Academics\TSEC\Start3\SEPH\Example3.java

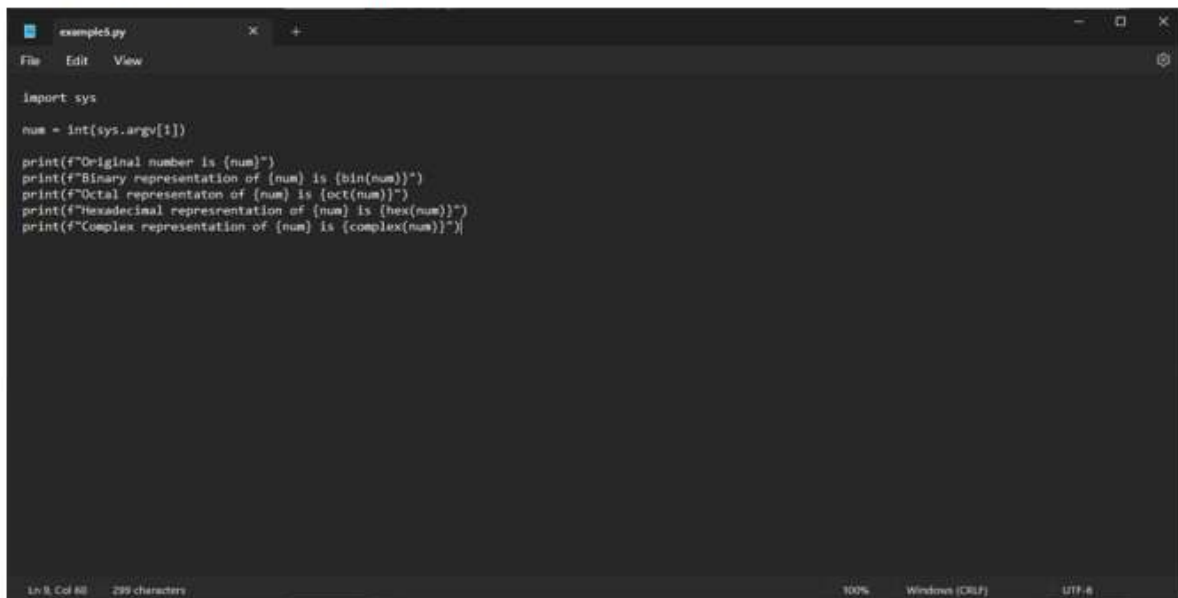
C:\ProgramData\Jenkins\jenkins\workspace\Example4>java C:\Admin\Academics\TSEC\Start3\SEPH\Example3.java 25
25 * 1 = 25
25 * 2 = 50
25 * 3 = 75
25 * 4 = 100
25 * 5 = 125
25 * 6 = 150
25 * 7 = 175
25 * 8 = 200
25 * 9 = 225
25 * 10 = 250

C:\ProgramData\Jenkins\jenkins\workspace\Example4>exit #
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])

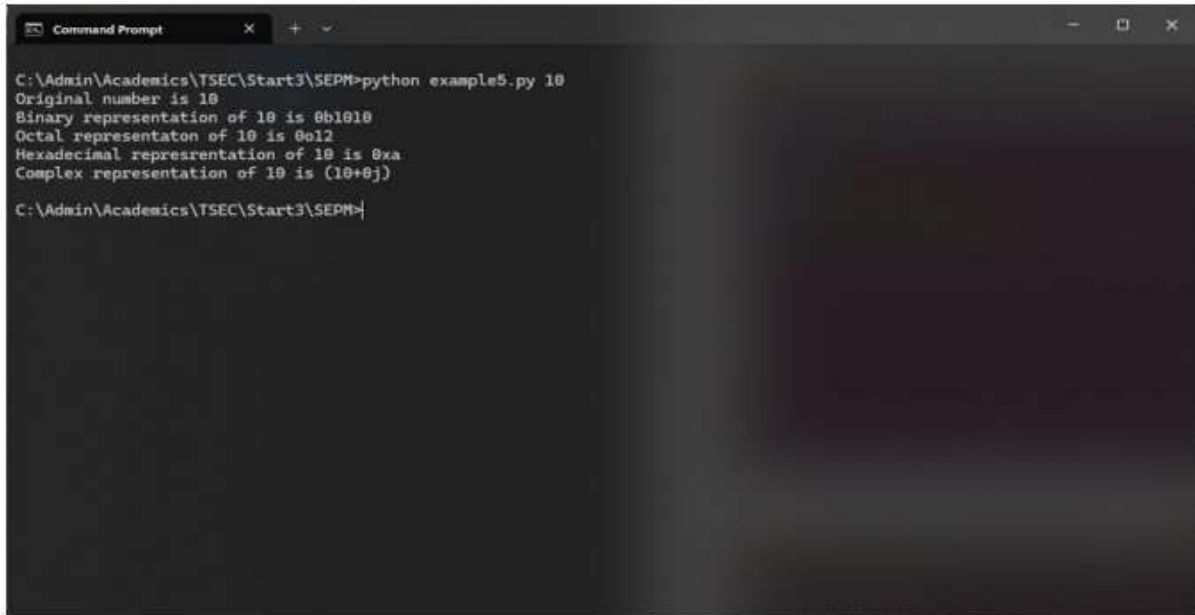
print(f"Original number is {num}")
print(f"Binary representation of {num} is {bin(num)}")
print(f"Octal representation of {num} is {oct(num)}")
print(f"Hexadecimal representation of {num} is {hex(num)}")
print(f"Complex representation of {num} is {complex(num)}")

Ln 8, Col 80 289 characters 100% Windows (CRLF) UTF-8
```

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Running the Python script on the terminal:

A screenshot of a Windows Command Prompt window. The title bar reads "Command Prompt". The command prompt shows the following text:

```
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 'Create new item' dialog in Jenkins. At the top, there is a text input field labeled 'Enter an item name' with the placeholder text 'Example5'. Below the input field, it says '* Required field'. The main area of the dialog lists several project types with icons and descriptions:

- 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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- 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 note: 'If you want to create a new item from other existing, you can use this option:' followed by a blue 'OK' button.

Parameterising the project with a string parameter as follows:

The screenshot shows the 'Add Parameter' dialog in Jenkins. 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 placeholder text 'name'.
- Default Value**: A text input field.
- Description**: A text area.

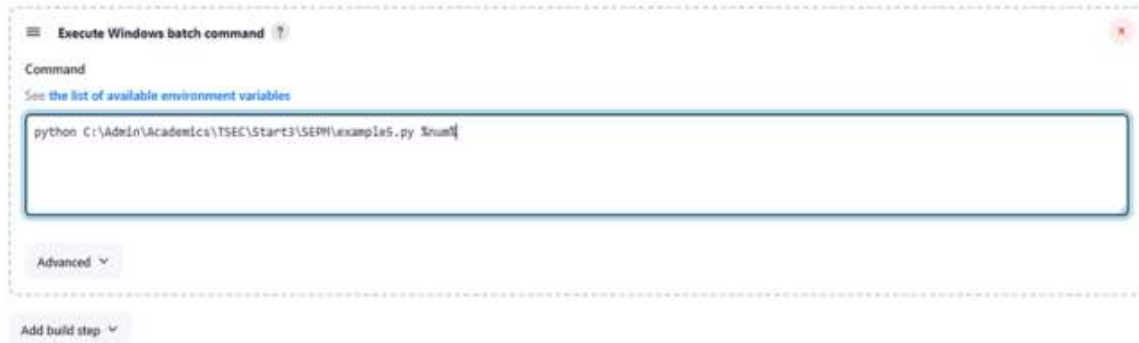
Below the input fields, there is a link 'Plain text Preview'. At the bottom, there is a checkbox labeled 'Trim the string' which is unchecked. At the very bottom, there is a button labeled 'Add Parameter'.

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Configuring the build steps:

Build Steps



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

Setting the parameter for the build:

Project Example5

This build requires parameters:

num

10

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] $ cd /c: call C:\MTOOLS\TOOLS\jenkins\1157306493194478222.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 001010
Octal representation of 10 is 012
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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Configure

General

Build Triggers

Advanced Project Options

Pipeline

Advanced

Pipeline

Definition

Pipeline script

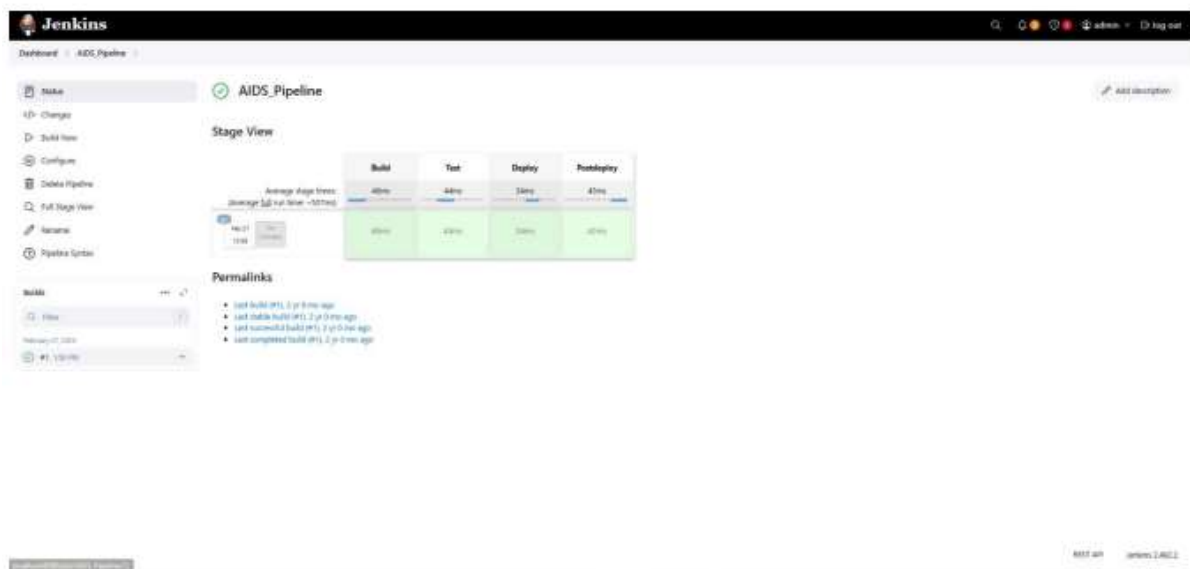
```
script {
  1+ checkout {
  2+   agent any
  3+ }
  4+
  5+ stages {
  6+   stage('Build') {
  7+     steps {
  8+       echo 'Building... this is the build phase'
  9+     }
  10+   }
  11+   stage('Test') {
  12+     steps {
  13+       echo 'Testing... this is the testing phase'
  14+     }
  15+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

☒ Use OpenJDK sandbox

Pipeline options

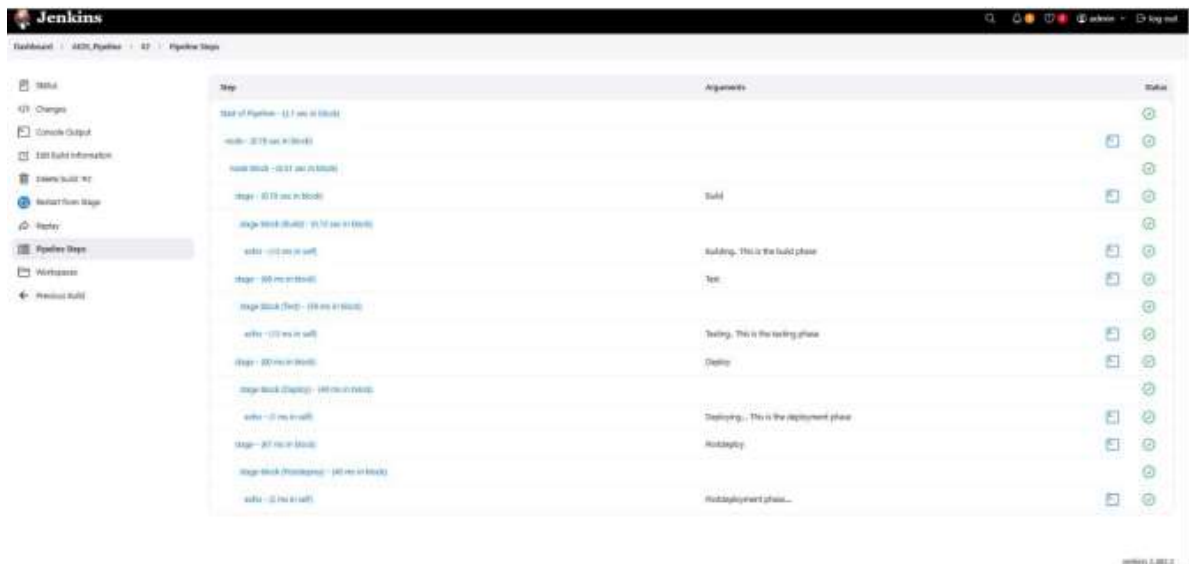
Save

Apply



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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



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.