

Aim : To understand DevOps : Principles , practices
DevOps Engineer role and responsibility

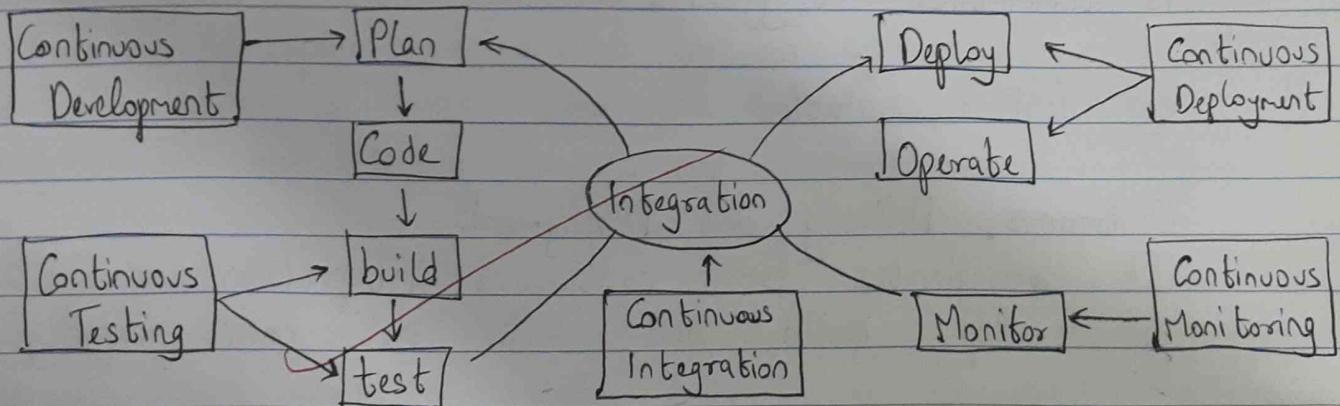
What is DevOps ?

DevOps is a collaborative approach where teams work together to build and deliver secure software efficiently . It combines software development (dev) and operations (ops) to decide how to accelerate through automations , collaboration , fast feedback and iterative improvement .

Core Principle :

1. Develop and test in production like environments
2. Deploy builds frequently
3. Continuously validate operational quality .

DevOps practices :



Continuous Development

This is the phase that involves planning and versioning and managing build of the software applications functionality

eg. git, github, maven, etc.

Continuous Testing

It is executing automated tests, continuously and repeatedly against the code base and the various deployment environments. It is a software testing methodology which focuses on achieving continuous quality and improvement

eg. Bamboo,

Continuous Integration

It refers to the build and unit testing stages of the software releases process. Every revision that is committed triggers an automated build and test

eg. Jenkins, circled

Continuous Delivery and Deployment

It originates from continuous integration, a method to develop, build and test new code rapidly

with automation so that only code that is known to be good becomes part of a software product.

Infrastructure management

Without automation, building and maintaining large scale modern IT systems can be a resource-intensive undertaking and can lead to increased risk due to manual error configuration and resource management is an automated method for maintaining computer systems and software in an unknown consistent state.

Configuration Management

Infrastructure as code is the practise of describing all software runtime environment and networking setting used parameters in simple textual format. that can be stored in your version control system and version on request.

Microservice Architecture

Dockers is a tool designed to make it easier to create, deploy and user application by using containers. Containers allows a developer to package up an application with all of the parts it needs such as libraries used other dependencies and deploy it as one package.

Cloud Base DevOps

DevOps automation is becoming cloud centric. Most public and private cloud computing provides support. DevOps systematically

on their platform, including continuous integration and continuous development tools.

e.g. Amazon Web Service, amazon lambda, google cloud

DevOps Engineer Roles:

- Implement development, testing and automation tools
- Set up infrastructure and tools
- Code review and responsibilities
- Bug fixing and trouble shooting
- Build and maintain CI/CD pipelines
- Security implementation and monitoring.

Management Responsibilities

- Understand customer requirements and API's
- Plan team initiatives and activities.
- Manage Stakeholders
- Define development and Operational processes
- Coordinate team communication
- Monitor Customer experience
- Provide Periodic progress reports.
- Mentor Team Members.

A devOps engineer manages a company's IT infrastructure, bridging development, and operation.

Notes
A

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EXPERIMENT 2

TO UNDERSTAND VERSION CONTROL SYSTEM / SOURCE CODE

MANAGEMENT, INSTALL GIT AND CREATE A GITHUB ACCOUNT

THEORY:

What Is Version Control?

A version control system, also known as source control or revision control, tracks changes made to files over time, allowing users to retrieve specific versions when needed. While it can be applied in various scenarios, it is most commonly used in software development.

What is Git?

- Git is a free and open-source distributed version control system designed to handle projects of all sizes with speed and efficiency.
- It enables collaborative software development, allowing multiple developers to modify source code while tracking changes.
- Git was initially designed and developed by Linus Torvalds for Linux kernel development in 2005.
- Every Git working directory is a full-fledged repository with complete history and version tracking, independent of network access or a central server.
- Git enables teams to work on the same files simultaneously, resolving conflicts and maintaining version history.

What Is GitHub?

GitHub is a web-based platform that hosts software development projects and integrates with Git for version control. It provides a user-friendly interface and collaborative tools to enhance project management.

- It allows developers to create, manage, and access repositories remotely.
- GitHub is essentially a collection of repositories that store project files and enable seamless collaboration.

Use of Version Control Software

- Allows users to track different versions of a project and revert changes when necessary.
- Helps in comparing versions, debugging, and recovering lost data.

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- Saves changes as patch files that can be applied to previous versions.
- Stores all versions on a central server, where developers can check out and update their work.

Use Cases of GitHub

1. Version Control – Allows developers to revert to previous versions when changes affect the project negatively.
2. Collaboration & Code Review – Enables teams to review each other's code, improving productivity and efficiency.
3. Issue Tracking – Developers can assign issues to team members and track progress.
4. Open-Source Development – GitHub is widely used for open-source projects, allowing public contributions.

Characteristics of Git

1. Strong Support for Non-Linear Development □ Supports rapid branching and merging.
 - Changes are merged frequently.
 - Lightweight branches make development faster.
2. Distributed Development
 - Every developer gets a local copy of the repository.
 - Changes can be merged efficiently between repositories.
3. Compatibility with Existing Systems
 - Git supports CVS server emulation, allowing existing CVS clients to access Git repositories.
4. Efficient Handling of Large Projects
 - Faster and more scalable than other version control systems.
 - Fetching data from a local repository is quicker than from a remote server.
5. Data Assurance
 - Git stores history in a way that ensures integrity—old versions cannot be changed unnoticed.
6. Automatic Garbage Collection
 - Git performs automatic garbage collection when enough loose objects are created.
 - Can be explicitly triggered using `git gc --prune`.
7. Periodic Explicit Object Packing
 - Git stores objects as separate files, later compressed into a packfile.
 - This improves performance but is computationally expensive.

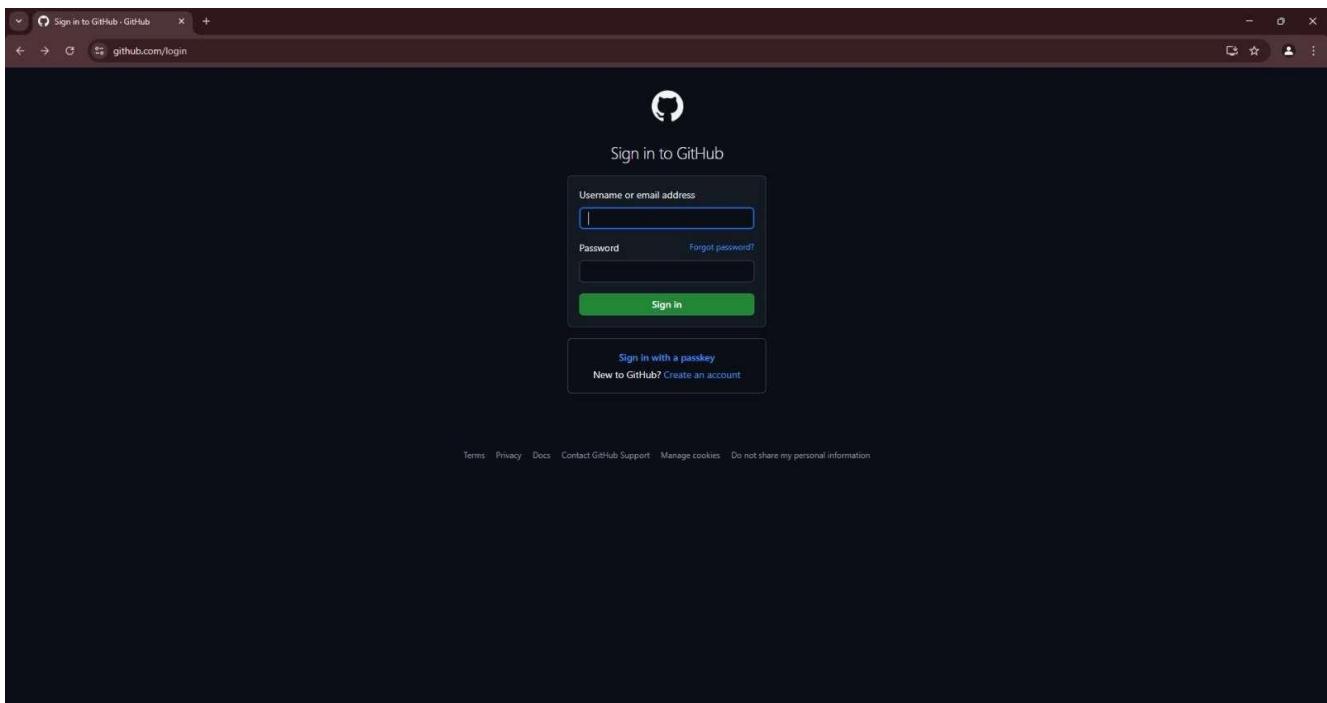
How Does Git Work?

- A Git repository is a key-value store where all objects are indexed by their SHA-1 hash.
- Objects include commits, files, tags, and tree nodes.
- Git works by taking snapshots of files at different points in time.

Steps to Creating a GitHub Account

1. Open a web browser and go to [GitHub Signup](#).

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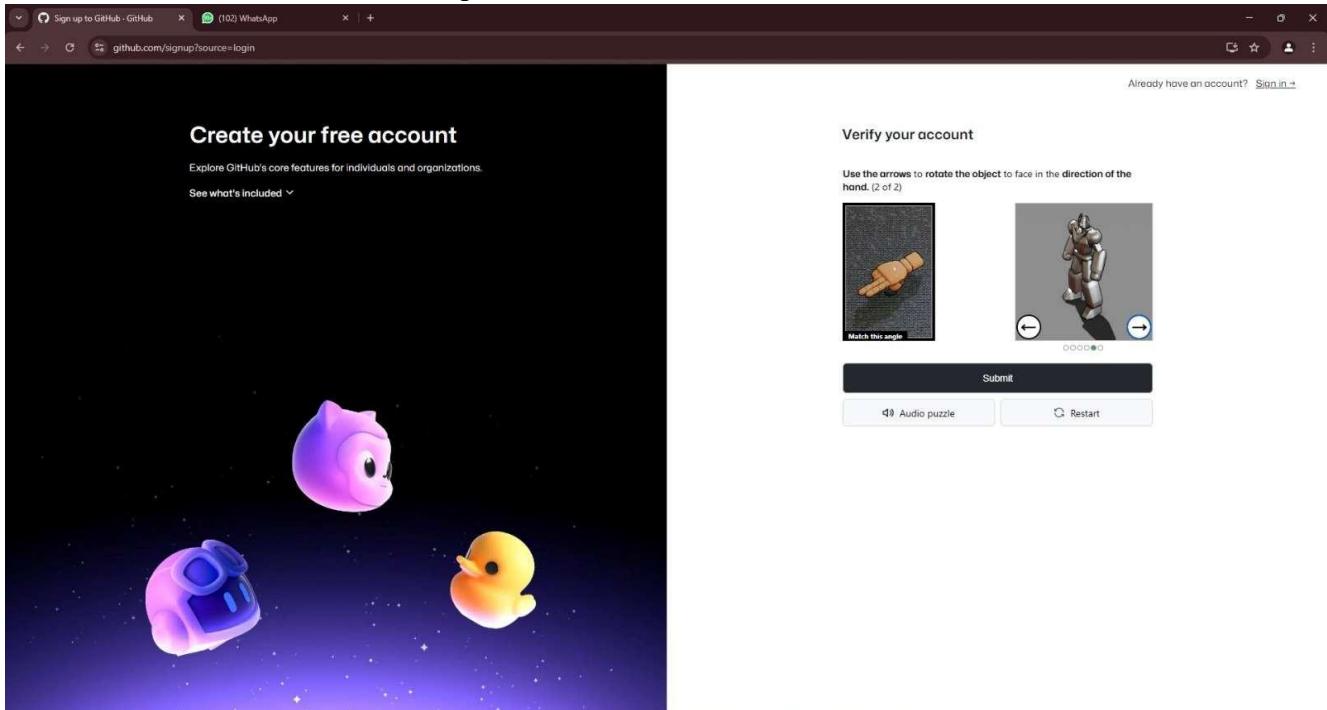


2. Enter a unique username. Provide a valid email address. Create a strong password.

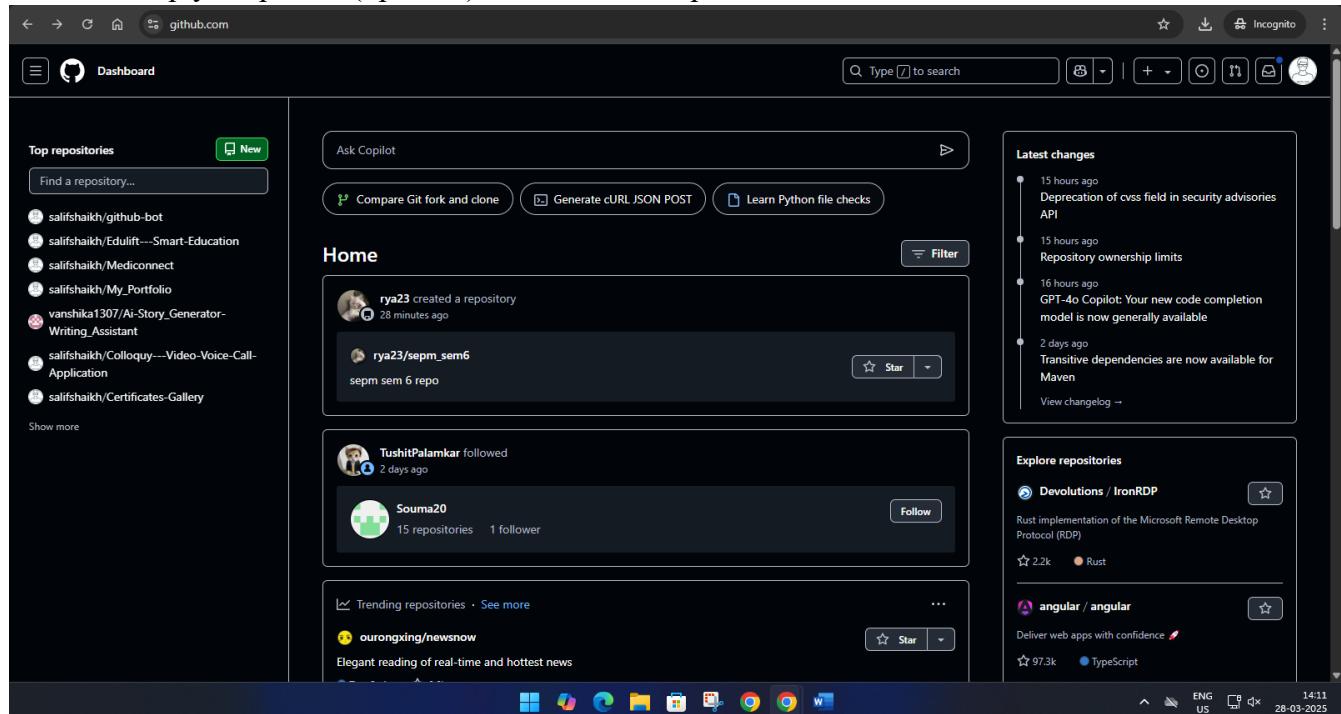
A screenshot of the GitHub sign-up page. On the left, there is a "Create your free account" section with a sub-section "Explore GitHub's core features for individuals and organizations." and a "See what's included" link. It features a cartoon illustration of three GitHub mascots (Octocat, Ducky, and Porg) against a starry background. On the right, the "Sign up to GitHub" form is displayed. It includes fields for "Email" (containing "shaikhsalif50@gmail.com"), "Password" (containing "Password"), "Username" (containing "salifshaikh"), and "Your country" (containing "India"). A note below the country field states: "For compliance reasons, we're required to collect country information to send you occasional updates and announcements." There is also a checkbox for "Email preferences" and a link "Receive occasional product updates and announcements". At the bottom of the form is a "Continue >" button. The status bar at the bottom of the browser window shows "By creating an account, you agree to the Terms of Service. For more", "ENG US", "14:10", and the date "28-03-2025".

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3. Click "Create account". Complete the CAPTCHA verification.



4. Choose your email preferences and click "Continue".
5. Verify your email by clicking the link sent to your registered email address.
6. Set up your profile (optional) and Select Free plan



7. Your GitHub account is now ready to use!

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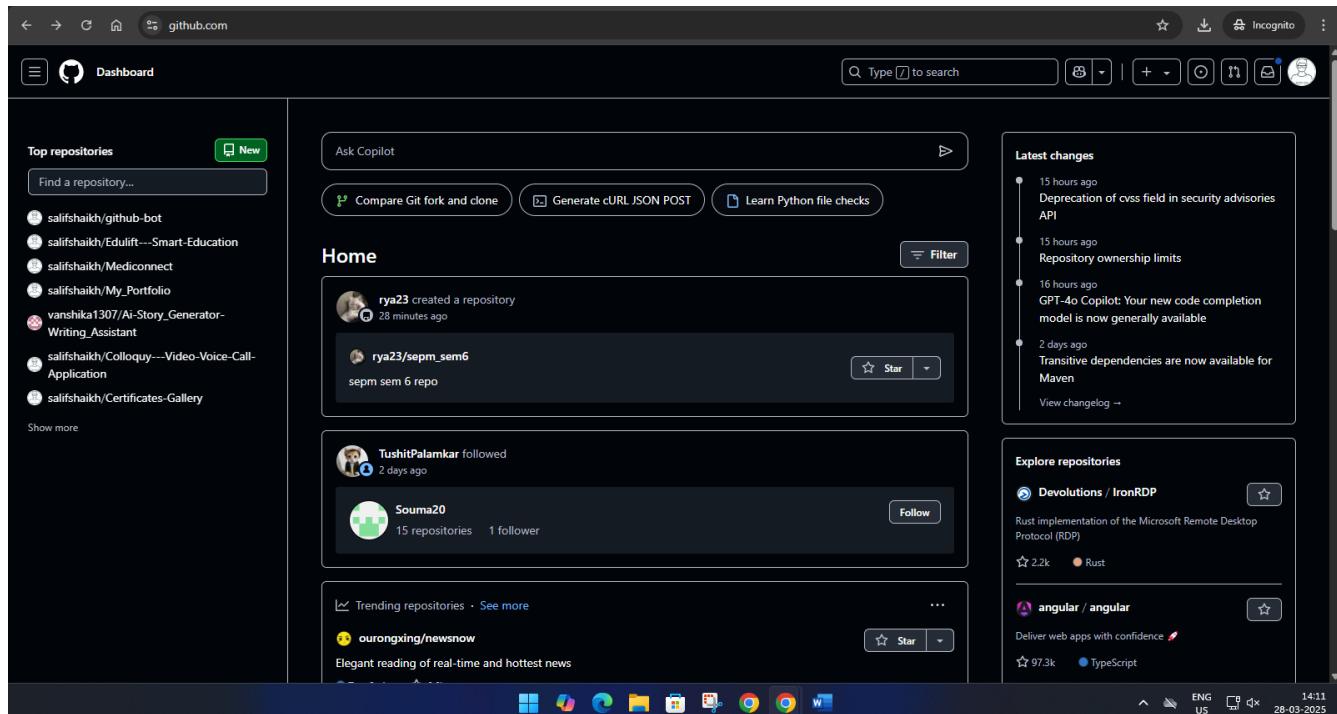
Steps to Create a Repository on GitHub

1. Log in to GitHub:

- o Go to [GitHub](#) and sign in to your account.

2. Navigate to Repositories:

- o Click on your profile icon (top-right corner) and select "Your repositories" from the dropdown.
- o Alternatively, click on the "+" icon in the top-right corner and select "New repository".



3. Create a New Repository:

- o Enter a repository name (e.g., my-project).
- o Optionally, add a description.
- o Choose the visibility:
 - Public (anyone can see your repository).
 - Private (only you and collaborators can access it).

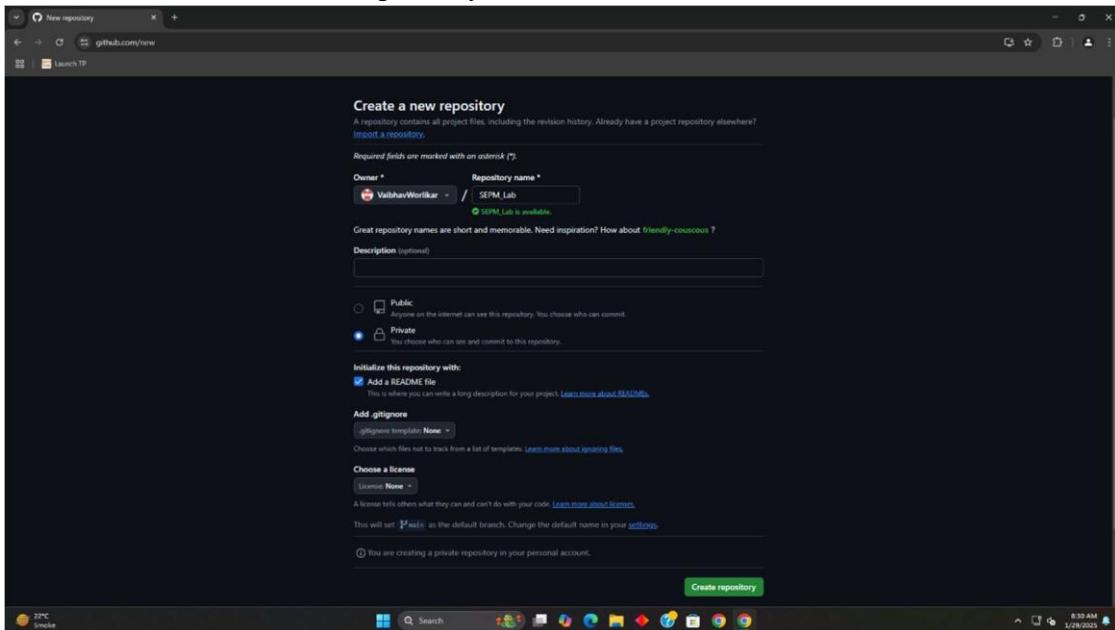
4. Initialize the Repository (Optional):

- o You can check "Add a README file" to include a basic introduction.
- o Optionally, add a .gitignore file for excluding certain files from tracking.
- o Choose a license if needed.

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5. Create the Repository:

- o Click the "Create repository" button.



6. Set Up Locally (Optional):

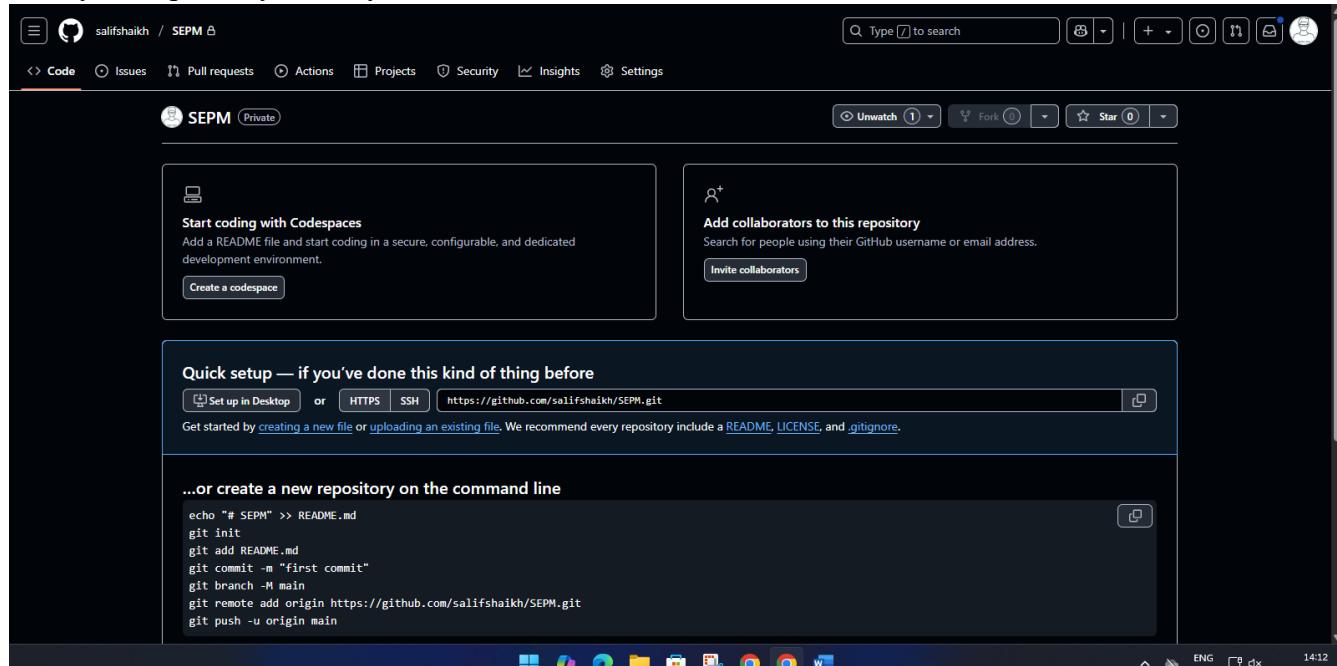
- o Copy the repository URL and use Git to clone it:
- o `git clone https://github.com/your-username/your-repository.git`
- o Navigate to the folder and start working on your project!

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Now your repository is ready to use! ☐



EXPERIMENT 3

TO PERFORM VARIOUS GIT OPERATIONS ON LOCAL AND REMOTE REPOSITORIES USING GIT CHEAT SHEET

Theory:

Git is a distributed version control system that allows developers to track changes, collaborate, and manage source code efficiently. Git provides numerous commands to handle local and remote repositories.

1. Setting Up Git

Before performing Git operations, configure Git with your details:

```
git config --global user.name "Your Name"
```

```
git config --global user.email "your.email@example.com"
```

 Verify the configuration:

```
git config --list
```

2. Initializing a Git Repository To create a new Git repository: git init

This initializes a new repository in the current directory.

3. Cloning a Repository To clone a remote repository: git clone <repository_url>

Example:

```
git clone https://github.com/your-username/repository.git
```

4. Staging and Committing Changes

- To check the status of the working directory:
`git status`
- To add files to the staging area:
`git add <file_name>` or to add all changes:
`git add .`

`git add .`

- To commit changes with a message:
`git commit -m "Your commit message"`
- `git commit -m "Your commit message"`

5. Viewing Commit History To view commit logs:

```
git log
```

For a compact version:

```
git log --oneline
```

6. Branching in Git

- To create a new branch:
`git branch <branch_name>`
- To switch to another branch: `git checkout <branch_name>`

- To create and switch to a new branch simultaneously:
- `git checkout -b <branch_name>` □ To view all branches:
- `git branch`

7. Merging Branches

- First, switch to the main branch:
 - `git checkout main`
 - Merge a branch into the main branch:
 - `git merge <branch_name>`
8. Pushing Changes to Remote Repository □ To push changes to GitHub: □ `git push origin <branch_name>` □ If pushing for the first time:
- `git push --set-upstream origin <branch_name>`

9. Pulling Changes from Remote Repository To fetch and merge changes from a remote repository:

`git pull origin <branch_name>`

10. Handling Merge Conflicts If

a merge conflict occurs:

1. Open conflicting files and resolve issues manually.
2. Add resolved files to the staging area:
3. `git add <file_name>`
4. Commit the resolved changes:
5. `git commit -m "Resolved merge conflict"`

11. Undoing Changes

- To undo changes before staging:
- `git checkout -- <file_name>` □ To unstage a file:
- `git reset HEAD <file_name>`
- To revert the last commit:
- `git revert HEAD`

12. Deleting a Branch

- To delete a local branch: □ `git branch -d <branch_name>` □ To delete a remote branch:
- `git push origin --delete <branch_name>`

13. Creating and Using a .gitignore File

A `.gitignore` file is used to ignore specific files or directories:

```
echo "node_modules/" >> .gitignore
git add .gitignore git commit -m
"Added .gitignore file"
```

14. Checking Differences in Files

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- To compare working directory changes:
- git diff
- To compare staged changes:
- git diff --staged

15. Stashing Changes

To temporarily save uncommitted changes:

git stash

To apply the stashed changes:

git stash apply

Output:

```
Microsoft Windows [Version 10.0.26100.3476]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Lab805_4>git config --global user.name "salifshaikh"

C:\Users\Lab805_4>git config --global user.name shaikhsalif50@gmail.com

C:\Users\Lab805_4>git config --global --list
core.editor="C:\Users\Lab805_4\AppData\Local\Programs\Microsoft VS Code\bin\code" --w
ait
user.name=shaikhsalif50@gmail.com

C:\Users\Lab805_4>cat~/.gitconfig
'cat~' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\Lab805_4>git-demo-project1234
'git-demo-project1234' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\Lab805_4>git init
Initialized empty Git repository in C:/Users/Lab805_4/.git/

C:\Users\Lab805_4>ls -a
'ls' is not recognized as an internal or external command,
operable program or batch file.

C:\Users\Lab805_4>
```

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Conclusion

This experiment demonstrated various Git operations, including repository initialization, branching, merging, pushing, pulling, and resolving conflicts. These commands help in efficient version control and collaboration in software development projects.

EXPERIMENT 4

TO UNDERSTAND CONTINUOUS INTEGRATION, INSTALL AND CONFIGURE JENKINS WITH MAVEN / ANT / GRADLE TO SETUP A BUILD JOB

Theory:

1. Introduction to Continuous Integration (CI)

Continuous Integration (CI) is a software development practice where developers frequently integrate code changes into a shared repository. Each integration is automatically verified through a build and test process to detect errors early.

 1.1 Benefits of Continuous Integration □ Early detection of defects.

- Faster debugging and deployment.
- Automated testing improves code quality.
- Reduces integration issues and conflicts.

 1.2 Tools for Continuous Integration

- Jenkins – An open-source automation server.
- Maven, Gradle, Ant – Build tools to compile, test, and package applications.

2. Installing and Configuring Jenkins

2.1 Installing Jenkins

1. Download Jenkins:

- o Get Jenkins from Jenkins official site.
- o Install using the appropriate installer for your OS.
- o Start Jenkins using:
 - Windows: Run jenkins.exe
 - Linux/Mac: Run java -jar jenkins.war --httpPort=8080

2. Initial Setup:

- o Access Jenkins at <http://localhost:8080/>.
- o Enter the Administrator password (found in jenkins_home/secrets/initialAdminPassword).
- o Install suggested plugins and create an admin user.

2.2 Installing Required Plugins

- Navigate to Manage Jenkins > Plugin Manager.

- Install the following plugins:
 - Maven Integration Plugin (for Maven builds).
 - Gradle Plugin (for Gradle support).
 - Pipeline Plugin (for defining CI/CD pipelines).

3. Configuring Maven, Gradle, or Ant in Jenkins

3.1 Configuring Maven in Jenkins

1. Install Maven on the system (or use Jenkins' built-in Maven).
2. Go to Manage Jenkins > Global Tool Configuration.
3. Under Maven, click Add Maven, set a name (e.g., Maven-3.8.1), and provide the installation path.

3.2 Configuring Gradle in Jenkins

1. Install Gradle on your system.
2. In Jenkins, go to Global Tool Configuration.
3. Under Gradle, click Add Gradle, enter a name, and provide the installation path.

3.3 Configuring Ant in Jenkins

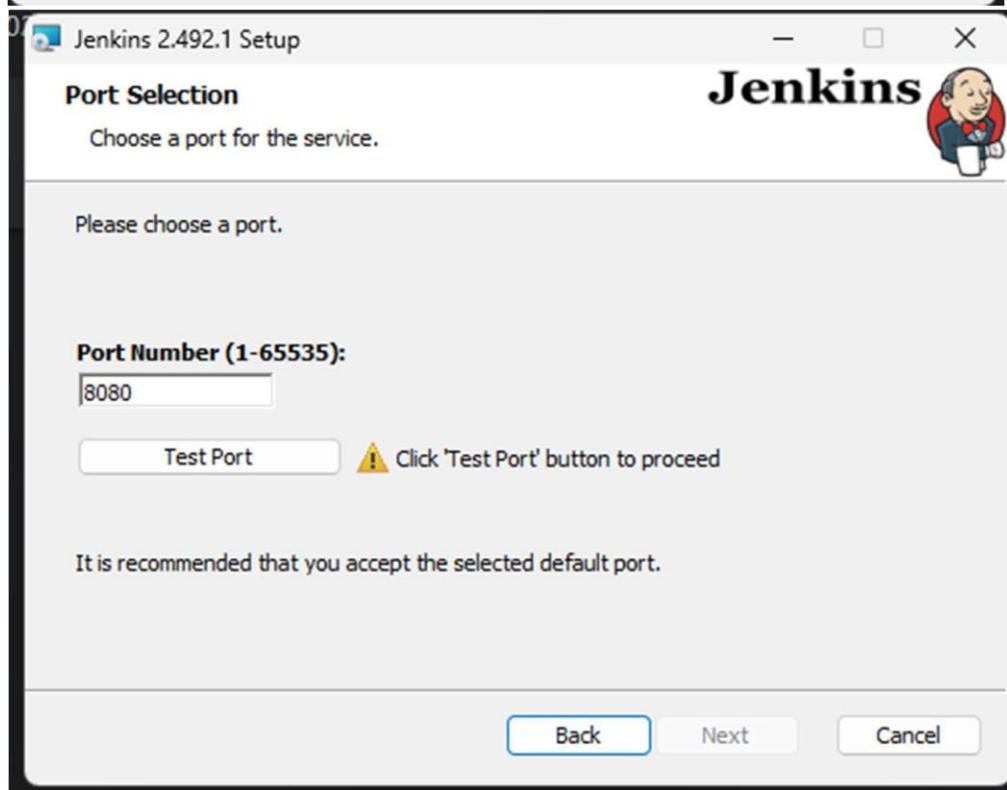
1. Install Apache Ant and set the environment variable (ANT_HOME).
2. In Global Tool Configuration, add Ant with its installation path.

4. Creating a Build Job in Jenkins

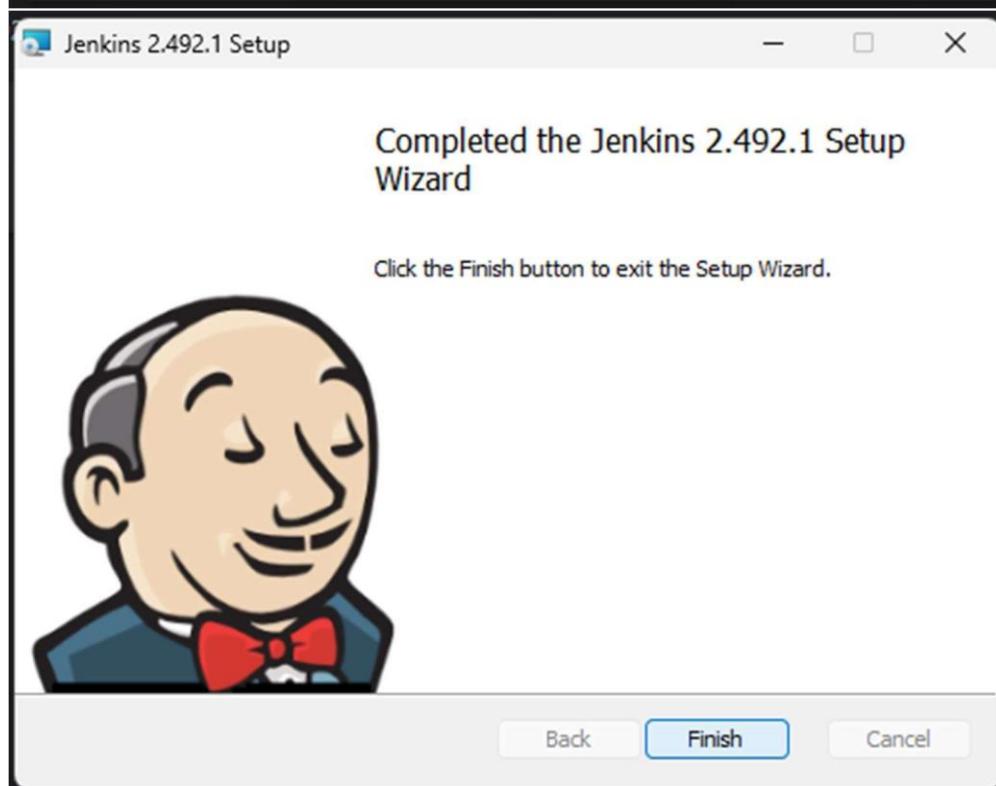
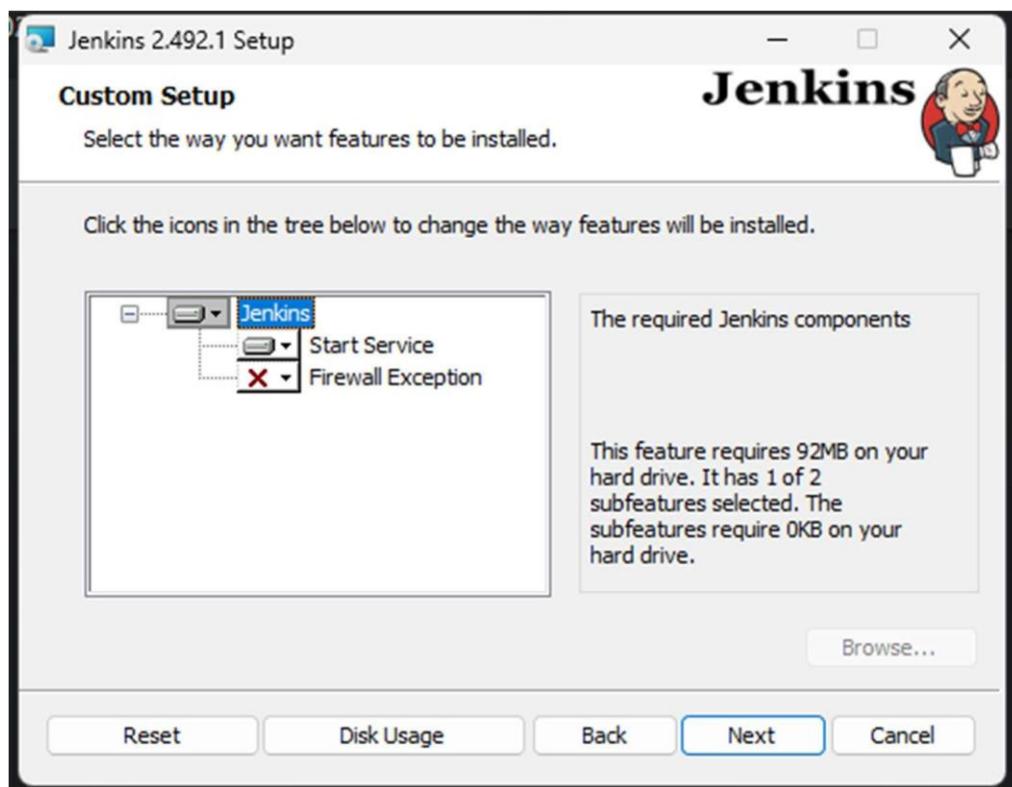
4.1 Steps to Set Up a Build Job

1. Create a New Job
 - Open Jenkins and click New Item.
 - Select Freestyle Project, enter a job name, and click OK.
2. Configure Source Code Management
 - Select Git and enter the repository URL.
 - Provide credentials if required.
3. Configure Build Steps
 - For Maven: Add a build step → Invoke Maven Targets → Enter clean package.
 - For Gradle: Add a build step → Invoke Gradle Script → Enter build.
 - For Ant: Add a build step → Invoke Ant → Enter build.xml.
4. Save and Build the Job
 - Click Save, then Build Now to execute.
 - Monitor logs in Console Output.

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The screenshot shows the Jenkins dashboard. At the top, there is a navigation bar with a user icon, the word "Jenkins", a search bar, and links for "Dashboard", "New Item", "Build History", "Manage Jenkins", and "My Views". The main content area has a heading "Welcome to Jenkins!" followed by a message: "This page is where your Jenkins jobs will be displayed. To get started, you can set up distributed builds or start building a software project." Below this, there are several cards: "Create a job" (with a plus sign), "Set up a distributed build", "Set up an agent", "Configure a cloud", and "Learn more about distributed builds". On the left side, there are two collapsed panels: "Build Queue" (showing "No builds in the queue") and "Build Executor Status" (showing "0/2"). At the bottom right, there are links for "REST API" and "Jenkins 2.492.1".

Conclusion

This experiment covered installing and configuring Jenkins for Continuous Integration, setting up build automation using Maven, Gradle, or Ant. By automating build jobs, we improve software quality, detect errors early, and enhance team collaboration.

SEPM EXP NO: 5

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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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:

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

2. Install Required Plugins:

- o Go to Manage Jenkins > Plugin Manager.
 - o 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://yourtomcat-server:8080')],           war:
'**/*.war'

}

}

}

}

```

5. Configuring Jenkins for Deployment

1. Configure Tomcat Server:

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

```

<role rolename="manager-gui"/>

<role rolename="manager-script"/>

<user username="admin" password="admin" roles="manager-gui,manager-script"/>
o
Restart Tomcat.

```

2. Set Up Jenkins Credentials:

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

3. Run the Pipeline in Jenkins:

- o Click Build Now to execute the pipeline.
- o 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

Example1 > 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.

OK

Selecting build type as “Execute shell”:

Build Steps

Add build step ^

Filter

- 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

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):

The screenshot shows the Jenkins 'Console Output' page. The log output is as follows:

```

Started by user Siddhant Chetlur
Building as SYSTEM
Building in workspace C:\ProgramData\Jenkins\jenkins\workspace\Example1
[Example1] $ "C:\Program Files\Git\bin\sh.exe" -xe C:\WINDOWS\TEMP\jenkins15583852534385490955.sh
+ echo 'Hello TSEC'
Hello TSEC
Finished: SUCCESS

```

Example 1.2: Taking parameters through files Contents of script

example1.cmd:

The screenshot shows a Windows command-line interface (cmd) window titled 'example1.cmd'. The file content is:

```

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

```

At the bottom of the window, status information is displayed: Line 1, Col 1, 47 characters, 100%, Windows (CRLF), and UTF-8.

Executing script example1.cmd on the terminal:

The screenshot shows a Windows command-line interface (cmd) window executing the 'example1.cmd' script. The output is as follows:

```

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 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 "Hello 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 Jenkins build step configuration for an 'Execute Windows batch command' step. The 'Command' field contains the command: 'C:\Admin\Academics\TSEC\Start3\SEPM\example1.cmd Siddhant Goregaon'. Below the command field is an 'Advanced' dropdown menu. At the bottom left is a 'Add build step' button.

Console output after building the modified project:

The screenshot shows the Jenkins console output for a build step. The output window title is 'Console Output'. The log shows the command being run: 'C:\ProgramData\Jenkins\jenkins\workspace\Example1\example1.cmd'. The log ends with 'Finished: SUCCESS'.

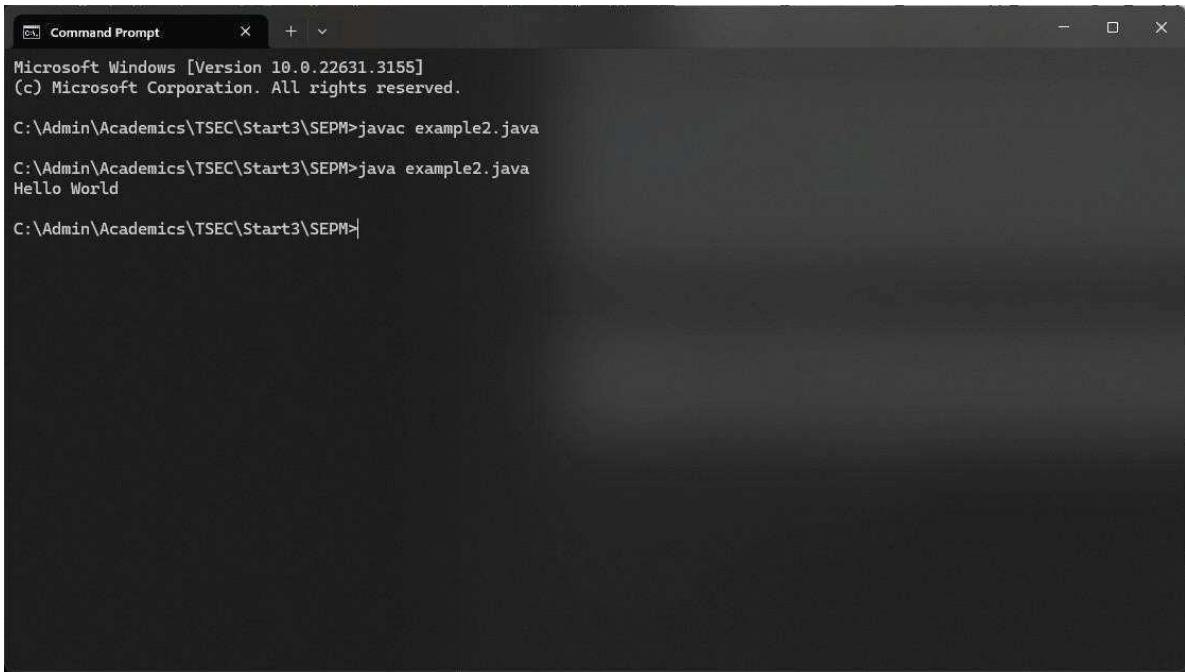
Example 2 Example 2.1: Running a Java program under Jenkins

Jenkins Creating a simple Java program:

The screenshot shows a code editor window titled 'example2.java'. The code is a simple Java class with a main method that prints 'Hello World'. The code editor interface includes tabs for 'File', 'Edit', and 'View', and status bars at the bottom indicating 'Ln 1, Col 1', '98 characters', '100%', 'Windows (CRLF)', and 'UTF-8'.

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

Compiling and running the program on the terminal:

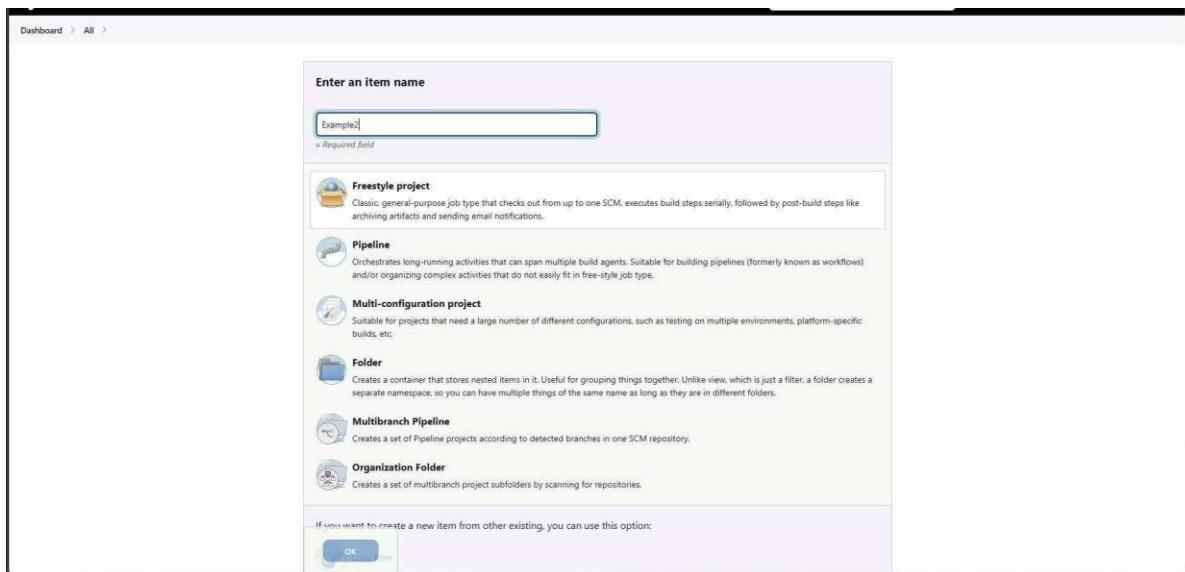


```
Microsoft Windows [Version 10.0.22631.3155]
(c) Microsoft Corporation. All rights reserved.

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:

Build Steps

The screenshot shows the Jenkins build step configuration for an 'Execute Windows batch command' step. The step contains the following command:

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

Below the command, there is an 'Advanced' dropdown menu. At the bottom left, there is a link '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

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.

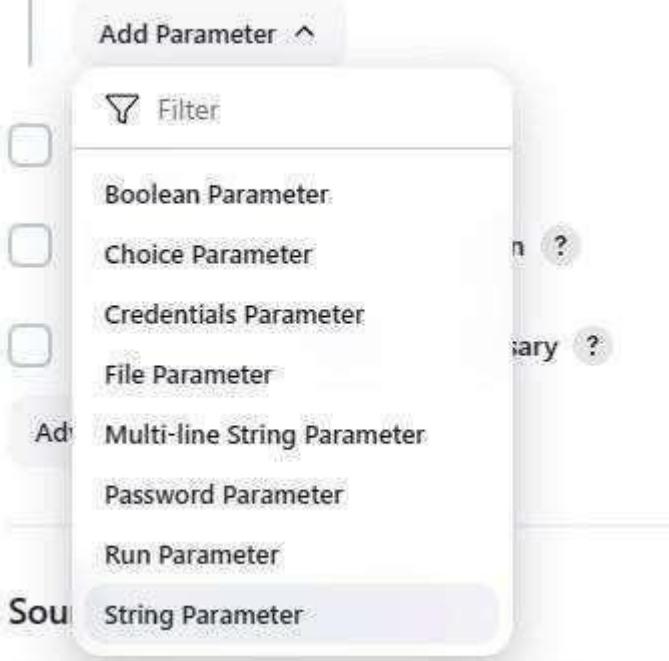
If you want to create a new item from other existing, you can use this option:

OK

Copy from

Enabling parameterisation and adding a String parameter:

This project is parameterized ?



Configuring the string parameter as Fname:

The screenshot shows the configuration dialog for a "String Parameter". The "Name" field is set to "Fname". The "Default Value" field is empty. The "Description" field is also empty. Below these fields are buttons for "Plain text" and "Preview". At the bottom is a checkbox labeled "Trim the string".

Name ?
Fname

Default Value ?

Description ?

Plain text [Preview](#)

Trim the string ?

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

Choice Parameter

Name: City

Choices:

- Bandra
- Kalyan
- Dombivli
- 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.cmd
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>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: C:\Admin\Academics\TSEC\Start3\SEPM\example3.cmd %Fname% %City%

Advanced

Add build step

Entering parameters for build:

Project Example3

This build requires parameters:

Name
Siddhant

City
Bandra

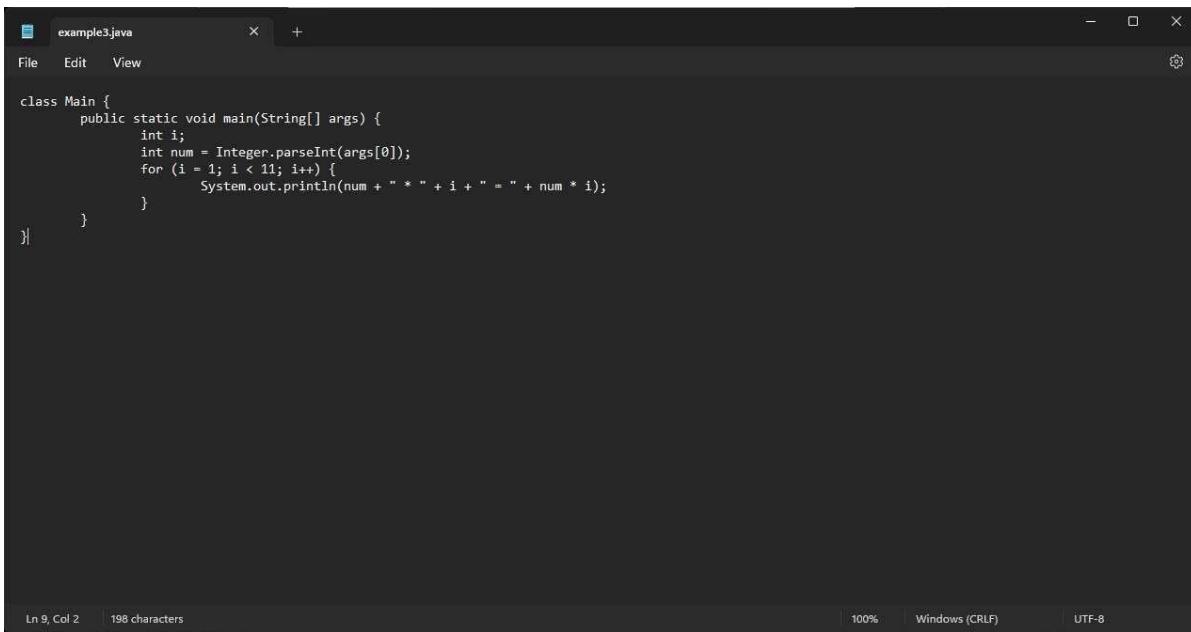
Console output after building:

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\jenkins14094536165150986151.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:

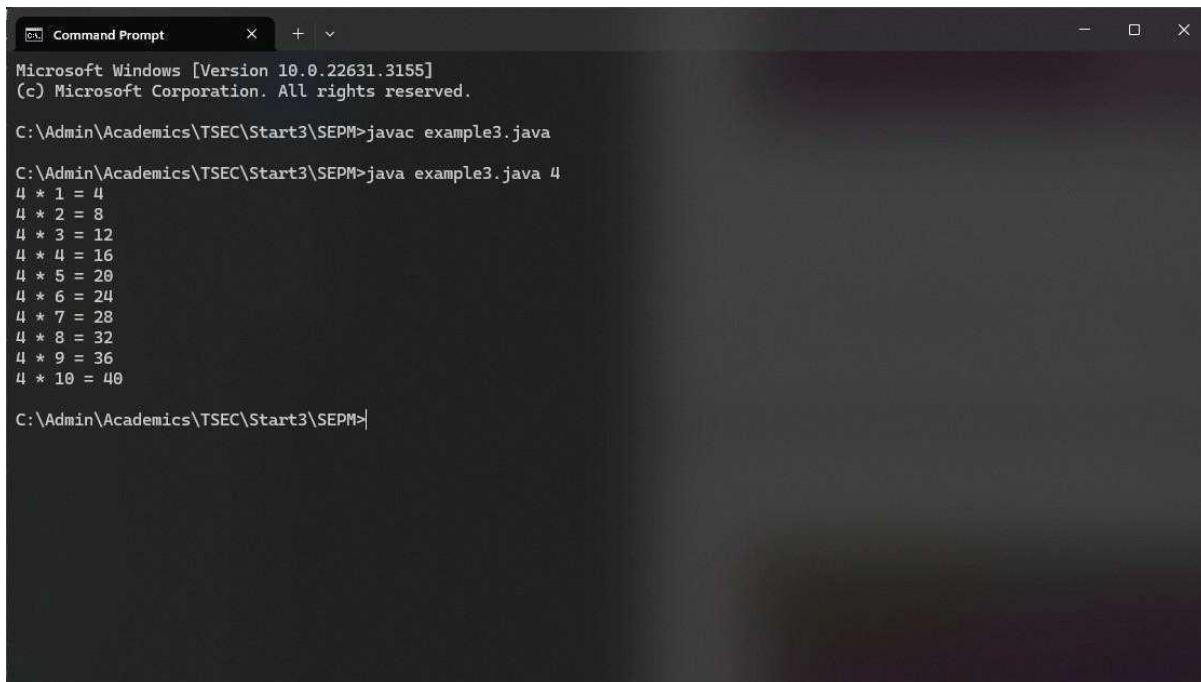


```
example3.java
File Edit View

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);
        }
    }
}

Ln 9, Col 2 198 characters 100% Windows (CRLF) UTF-8
```

Testing the program on the terminal:



A screenshot of a Windows Command Prompt window titled "Command Prompt". The window shows the following text:

```
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:

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.



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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 ▾

Configure the build steps:

Build Steps

The screenshot shows the Jenkins build step configuration for an 'Execute Windows batch command' step. The 'Command' field contains the following Java command:

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

Below the command field, there is an 'Advanced' dropdown and a 'Add build step' button.

Entering the parameter for the build:

Project Example4

This build requires parameters:

num

25

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\jenkins15119105770823247708.bat

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

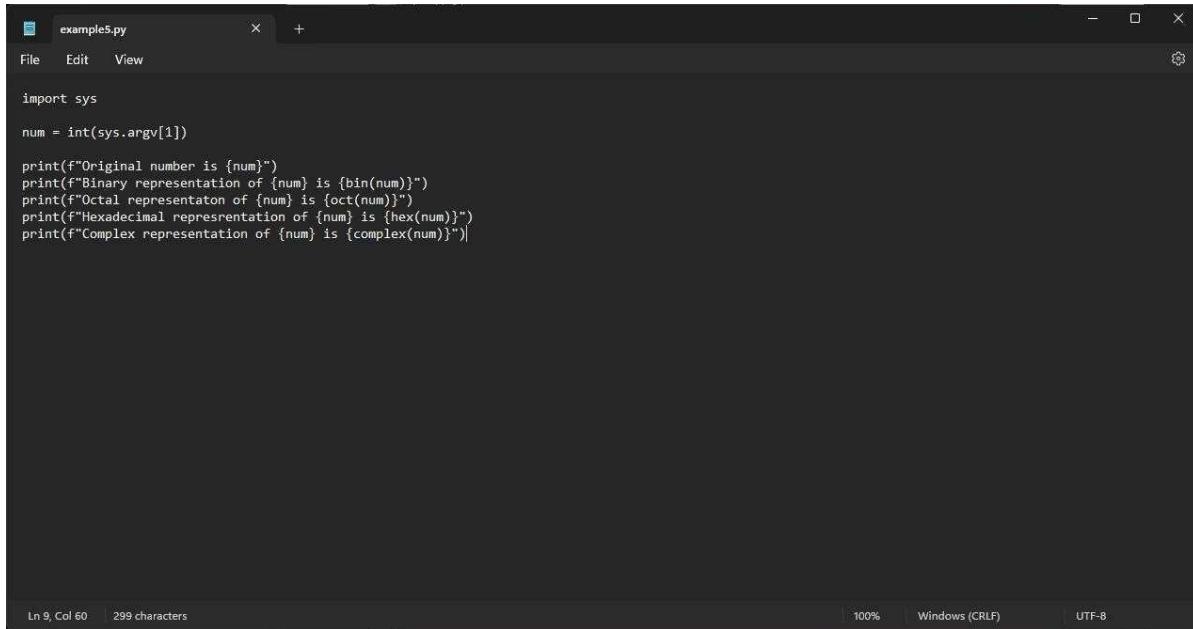
C:\ProgramData\Jenkins\jenkins\workspace\Example4>java C:\Admin\Academics\TSEC\Start3\SEPM\example3.java 25
25 * 1 = 25
25 * 2 = 50
25 * 3 = 75
25 * 4 = 100
25 * 5 = 125
25 * 6 = 150
25 * 7 = 175
25 * 8 = 200
25 * 9 = 225
25 * 10 = 250

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

Example 5 Example

5.1: Running a Python program Creating a simple Python

script:

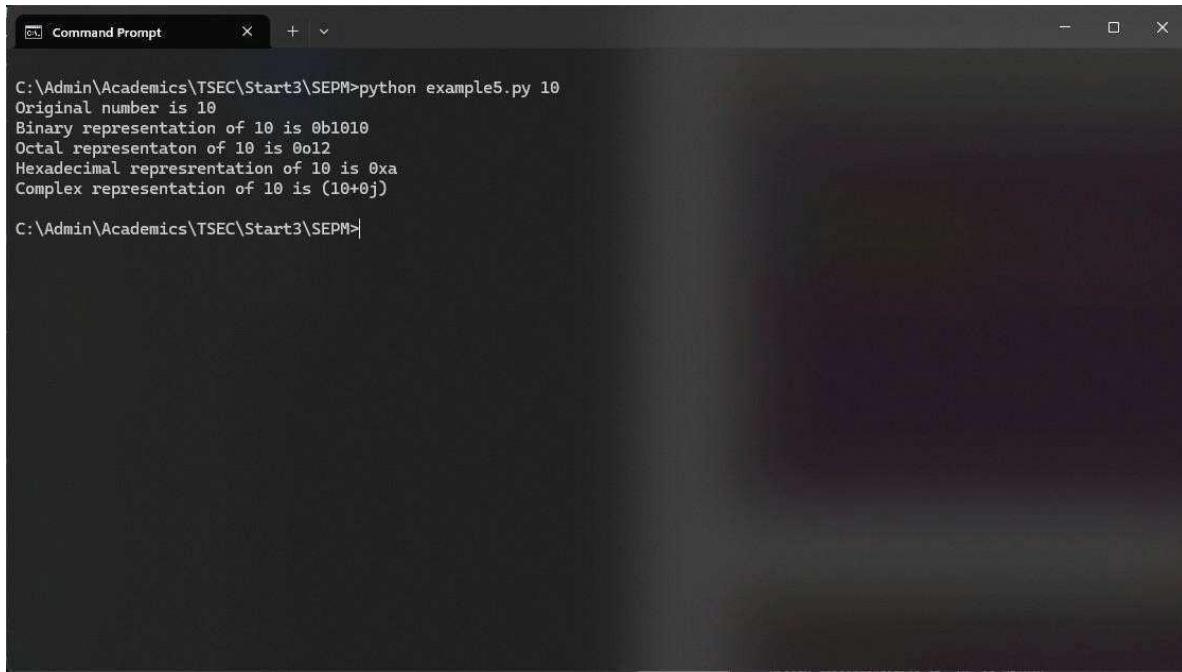


A screenshot of a code editor window titled "example5.py". The code is as follows:

```
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 representaton of {num} is {oct(num)}")
print(f"Hexadecimal representation of {num} is {hex(num)}")
print(f"Complex representation of {num} is {complex(num)}")
```

The status bar at the bottom shows "Ln 9, Col 60" and "299 characters".

Running the Python script on the terminal:



A screenshot of a Command Prompt window. The command "python example5.py 10" is run, and the output is:

```
C:\Admin\Academics\TSEC\Start3\SEPM>python example5.py 10
Original number is 10
Binary representation of 10 is 0b1010
Octal representaton 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:

Enter an item name

Example5

» 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

Parameterising the project with a string parameter as follows:

This project is parameterized [?](#)

String Parameter [?](#)

Name [?](#)
num

Default Value [?](#)

Description [?](#)

Plain text [Preview](#)

Trim the string [?](#)

Add Parameter [▼](#)

Configuring the build steps:

Build Steps

The screenshot shows the 'Build Steps' section of a Jenkins job configuration. A single step is selected: 'Execute Windows batch command'. The 'Command' field contains the following script:

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

Below the command field, there is an 'Advanced' dropdown and a '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] $ cmd /c call C:\WINDOWS\TEMP\jenkins115730649194478222.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.

EXPERIMENT 6

STUDYING AGILE METHODOLOGY AND TEST CASE MANAGEMENT USING JIRA TOOL

Theory:

1. Introduction to Agile Methodology

Agile methodology is an iterative approach to software development and project management that emphasizes flexibility, collaboration, and customer feedback. It helps teams deliver high-quality software in incremental steps rather than following a rigid plan.

1.1 Agile Manifesto

Agile is based on four core values:

1. Individuals and interactions over processes and tools.
2. Working software over comprehensive documentation.
3. Customer collaboration over contract negotiation.
4. Responding to change over following a plan.

1.2 Agile Principles

Agile follows 12 principles, including:

- Customer satisfaction through early and continuous delivery.
- Embracing changing requirements for the customer's competitive advantage.
- Delivering working software frequently.
- Close collaboration between business and development teams.
- Motivated individuals and self-organizing teams.
- Continuous attention to technical excellence.

2. Agile Frameworks

Several frameworks exist under Agile, including:

1. Scrum – A framework for iterative and incremental product development.
2. Kanban – A visual workflow management system.
3. Extreme Programming (XP) – Focuses on engineering practices.
4. Lean Software Development – Focuses on minimizing waste and maximizing value.

2.1 Scrum Framework

Scrum is one of the most popular Agile frameworks. It consists of:

- Scrum Team: Product Owner, Scrum Master, Development Team.
 - Scrum Artifacts: Product Backlog, Sprint Backlog, Increment.
-
- Scrum Events: Sprint Planning, Daily Stand-ups, Sprint Review, Sprint Retrospective.
 - Sprint Cycle: A time-boxed period (usually 2-4 weeks) where a team completes selected backlog items.

3. Introduction to Jira

Jira is a popular tool developed by Atlassian for Agile project management, issue tracking, and test case management. It helps teams plan, track, and manage software development projects efficiently.

3.1 Features of Jira

- Customizable dashboards for tracking project progress.
- Issue tracking for creating, assigning, and monitoring tasks.
- Workflow automation to improve efficiency.
- Integration with various development and testing tools.

4. Test Case Management Using Jira

Jira can be used to manage test cases effectively by integrating with testing plugins like Zephyr and Xray.

4.1 Steps to Manage Test Cases in Jira

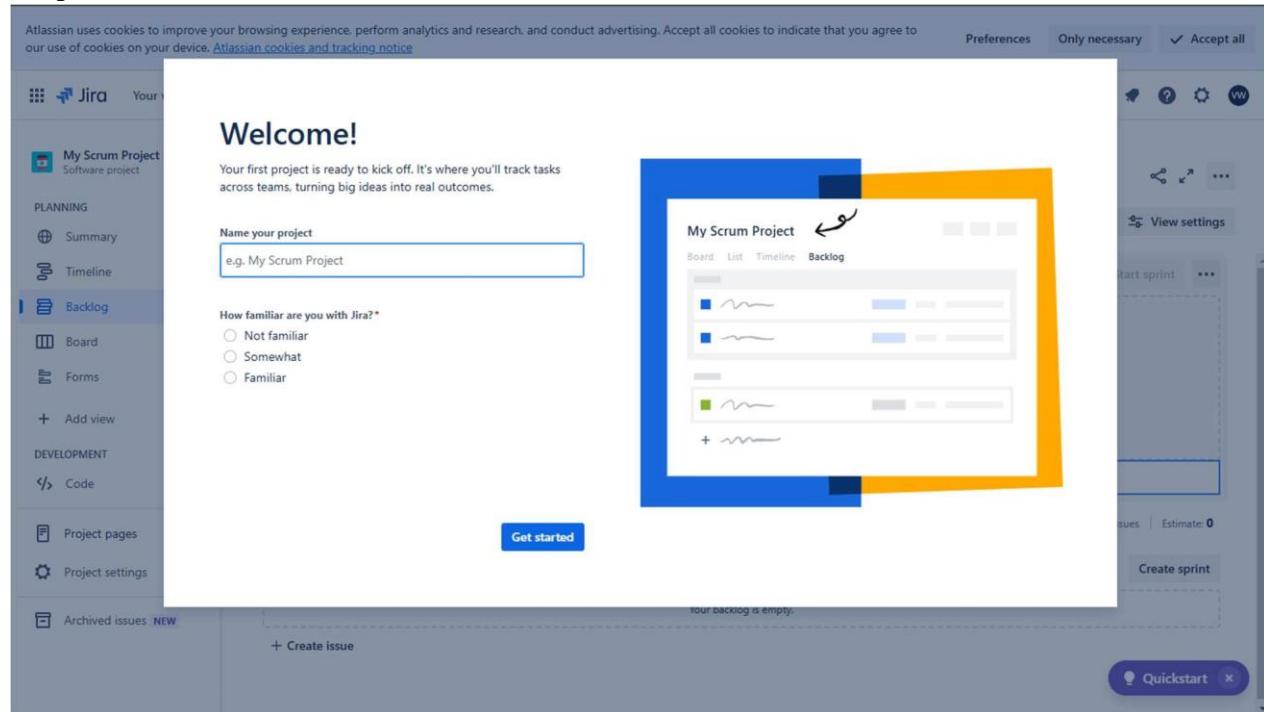
1. Creating a Test Case:
 - o Navigate to the Jira project.
 - o Click on Create Issue and select Test Case (if using Zephyr/Xray). o Define the test case with details such as Test Summary, Preconditions, Test Steps, and Expected Results.
 - o Click Create to save the test case.
2. Executing a Test Case:
 - o Open the created test case.
 - o Click Execute and select the test cycle. o Update the test execution status (Pass, Fail, In Progress, Blocked).
3. Tracking Test Results:
 - o Use Jira dashboards to generate reports on test execution progress.
 - o Analyze defects by linking test cases to bug reports.
4. Integrating Jira with CI/CD Pipelines:

- o Jira can integrate with Jenkins, Bamboo, and other DevOps tools to automate testing workflows.

5. Benefits of Using Jira for Agile and Test Case Management

- Centralized Tracking: All tasks, sprints, and test cases are managed in one place.
 - Collaboration: Teams can communicate and update task statuses in real-time.
 - Customization: Jira can be tailored to fit any workflow.
 - Automation: Reduces manual effort through workflow automation and integration with DevOps tools.
-

Output:



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T22 – 2201094

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Jira Your work

My Scrum Project Software project

PLANNING

- Summary
- Timeline
- Backlog**
- Board
- Forms

+ Add view

DEVELOPMENT

- Code

Project pages

Project settings

Archived issues NEW

Welcome!

Your first project is ready to kick off. It's where you'll track tasks across teams, turning big ideas into real outcomes.

Name your project

How familiar are you with Jira?

- Not familiar
- Somewhat
- Familiar

Get started

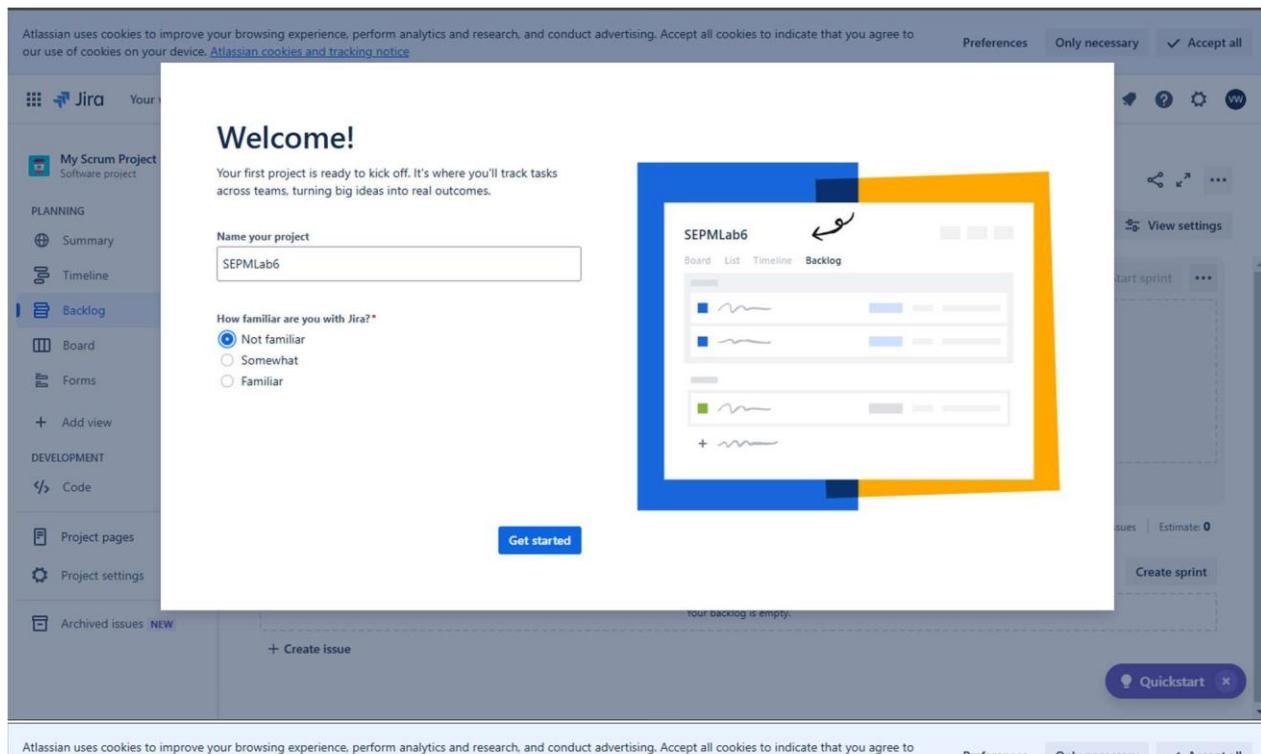
SEPMLab6

Board List Timeline Backlog

your backlog is empty.

Create sprint

Quickstart



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Jira Your work Projects Filters Dashboards Teams Plans Apps Create 30 days left Search

SEPMLab6 Software project

PLANNING

- Summary
- Timeline
- Backlog**
- Board
- Forms
- Goals

+ Add view

DEVELOPMENT

- Code

Project pages

Project settings

Archived issues NEW

Backlog

SCRUM Sprint 1 Add dates (0 issues)

0 0 0 Start sprint

Plan your sprint

Drag issues from the Backlog section, or create new issues, to plan the work for this sprint. Select Start sprint when you're ready.

+ Create issue

Backlog (0 issues)

0 0 0 Create sprint

Your backlog is empty.

+ Create issue

Quickstart

- Create a project
- Create an issue

Create Issue

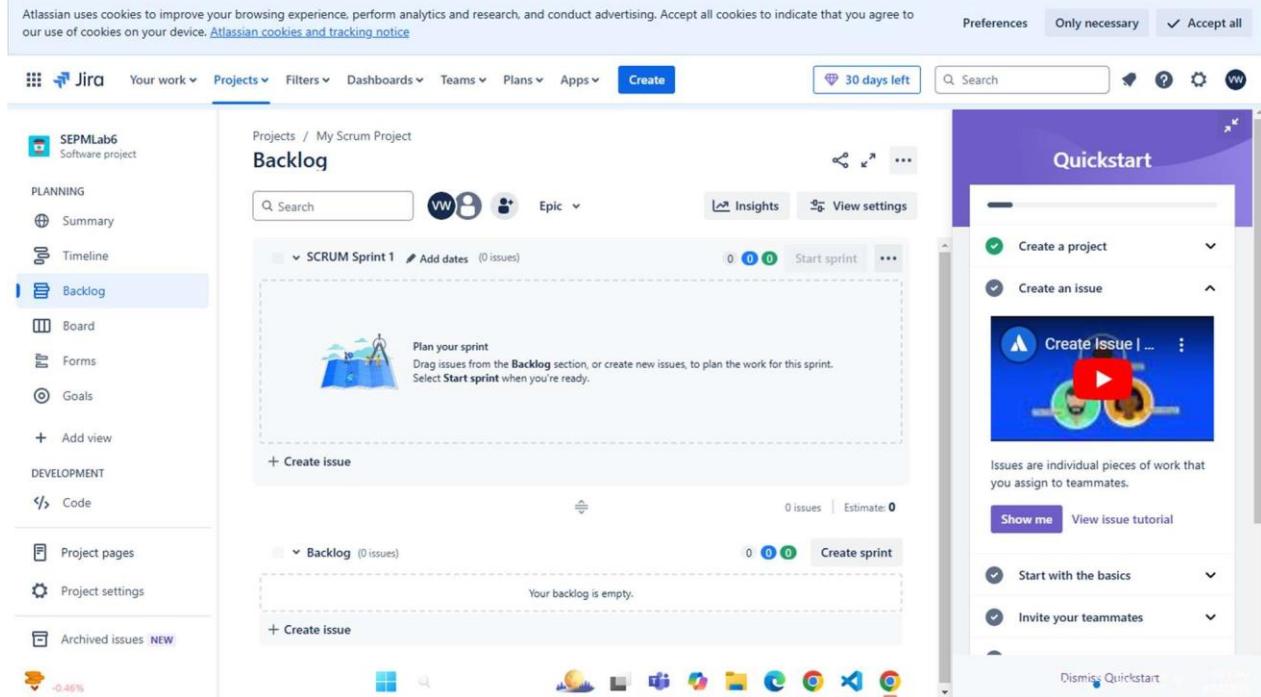
Issues are individual pieces of work that you assign to teammates.

Show me View issue tutorial

Start with the basics

Invite your teammates

Dismiss Quickstart



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SEPMLab6 Software project

PLANNING Summary Timeline Backlog Board Forms Goals + Add view

DEVELOPMENT Code Project pages Project settings Archived issues NEW

Timeline

Search timeline Give feedback Share Export ...

Status category Epic

Sprints

- SCRUM-1 Web Development
- SCRUM-2 Flutter
- SCRUM-3 API_Gangster
- SCRUM-4 Data Science

+ Create Epic

FEB

Today Weeks Months Quarters

Quickstart

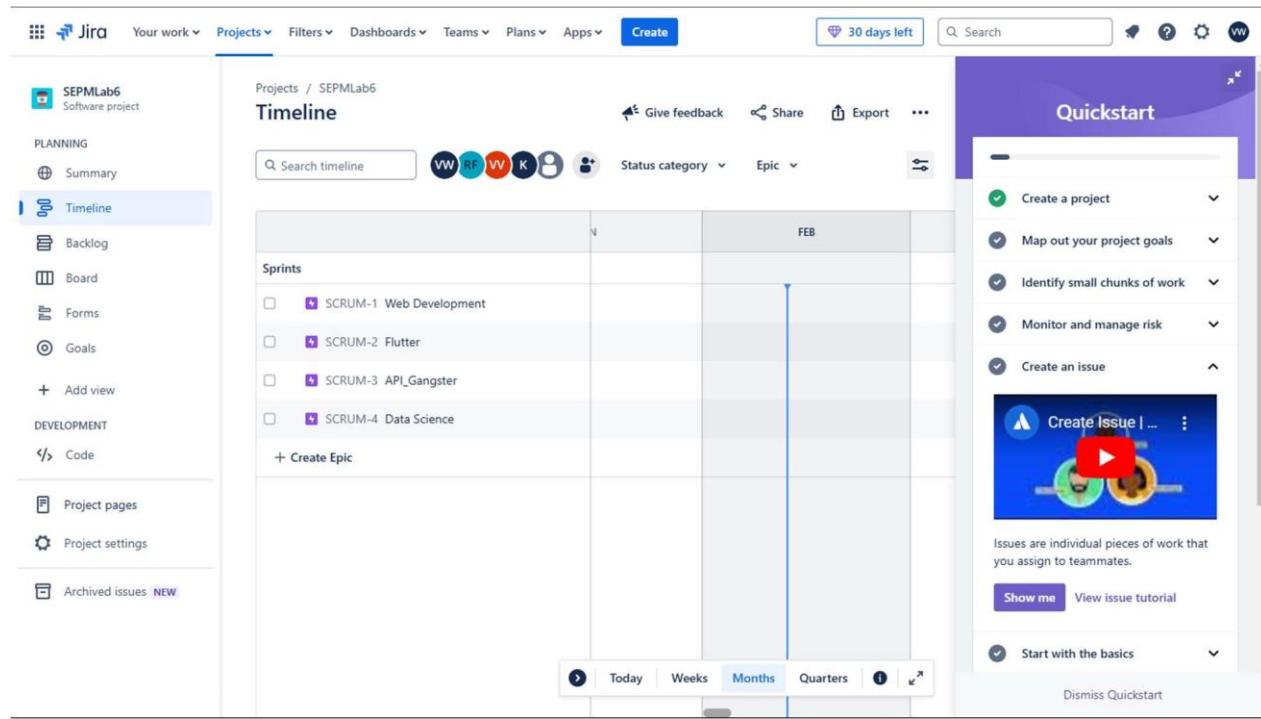
- Create a project
- Map out your project goals
- Identify small chunks of work
- Monitor and manage risk
- Create an issue

Create Issue

Issues are individual pieces of work that you assign to teammates.

Show me View issue tutorial Start with the basics

Dismiss Quickstart



Jira Your work Projects Filters Dashboards Teams Plans Apps Create 30 days left Search

SEPMLab6 Software project

PLANNING Summary Timeline Backlog Board Forms Goals + Add view

DEVELOPMENT Code Project pages Project settings Archived issues NEW

Timeline

Search timeline Give feedback Share Export ...

Status category Epic

Sprints

- SCRUM-1 Web Development DONE
- SCRUM-2 Flutter
- SCRUM-3 API_Gangster
- SCRUM-4 Data Science DONE

+ Create Epic

FEB

Today Weeks Months Quarters

Quickstart

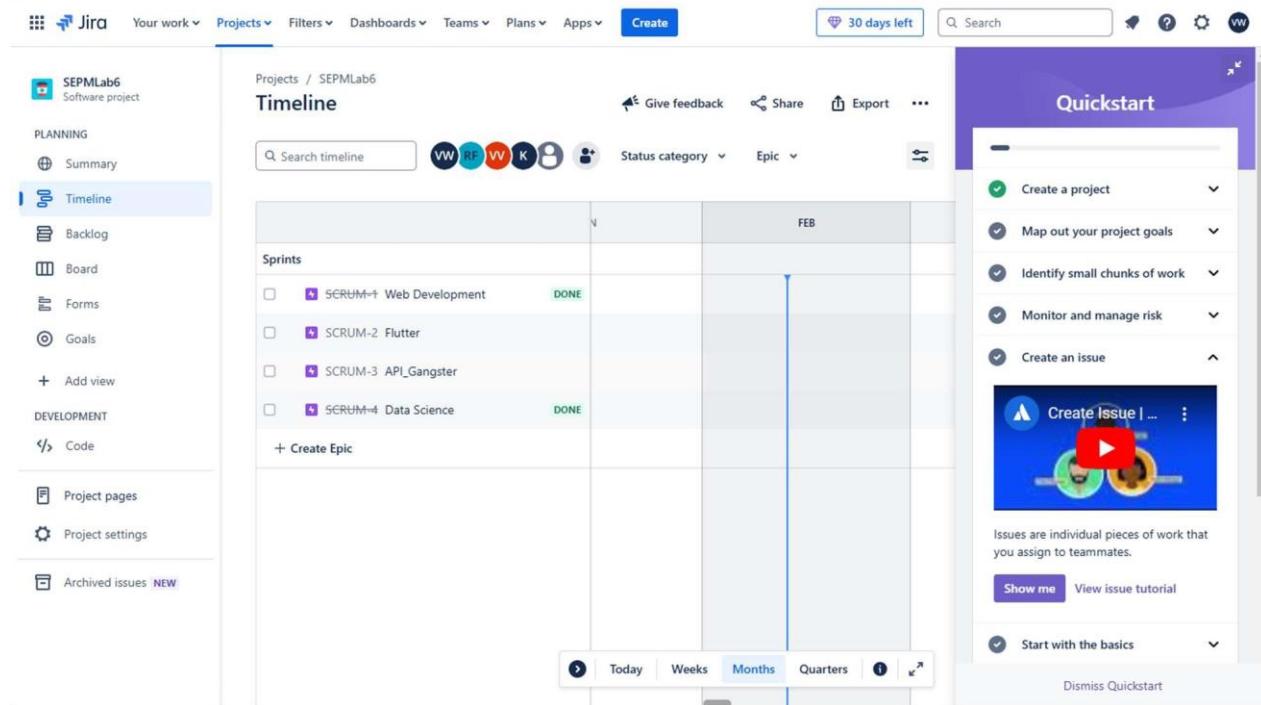
- Create a project
- Map out your project goals
- Identify small chunks of work
- Monitor and manage risk
- Create an issue

Create Issue

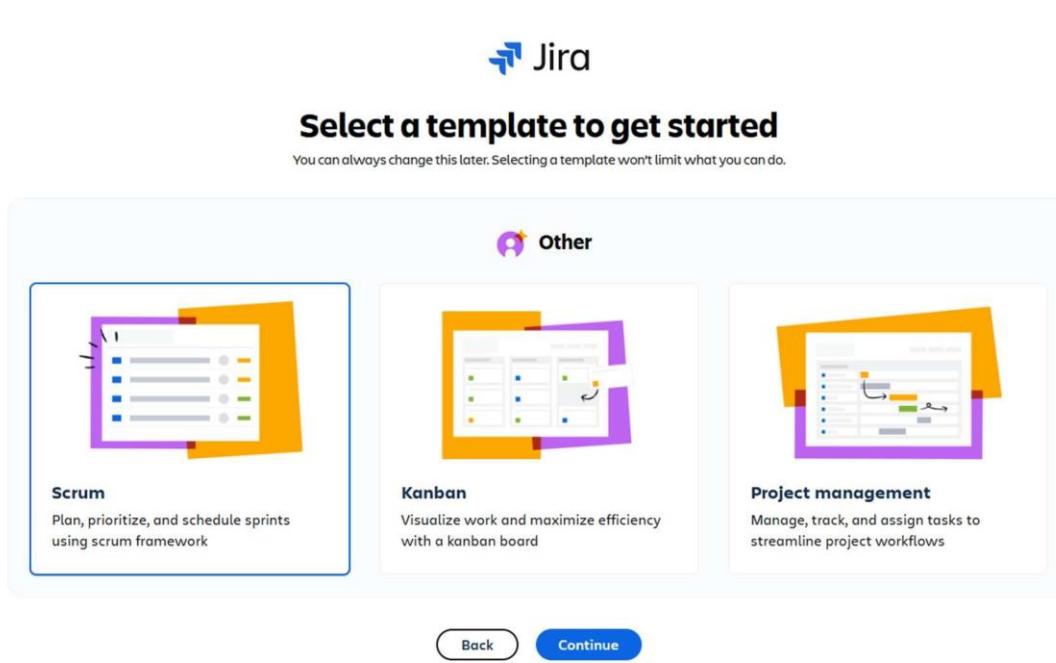
Issues are individual pieces of work that you assign to teammates.

Show me View issue tutorial Start with the basics

Dismiss Quickstart



Salif Shaikh
T22 – 2201094



Conclusion

This experiment provided an overview of Agile methodology and how Jira is used for project and test case management. Jira enhances Agile practices by improving workflow efficiency, collaboration, and test case execution tracking, making it a valuable tool in modern software development.

SEPM:EXP7

To Create Scrum Board for Scrum Master using JIRA Tool.

Salif Shaikh -

BATCH:TE-T22

Introduction to Scrum Board in JIRA

A Scrum Board in JIRA is a visual representation of work progress within a Scrum team. It helps teams manage their backlog, sprint planning, and task execution efficiently. The Scrum Master uses the board to track progress, identify bottlenecks, and ensure smooth sprint execution.

Objectives

To understand how to create and configure a Scrum Board in JIRA.

To learn how to manage sprints and tasks effectively using JIRA.

Prerequisites

A JIRA account with administrator or project management access.

A JIRA project set up for Scrum methodology.

Basic understanding of Scrum framework including backlog, sprint, and user stories.

Steps to Create a Scrum Board in JIRA

Step 1: Log in to JIRA

Open a web browser and navigate to JIRA's official website.

Enter your credentials and sign in.

Step 2: Create a New Scrum Project

1. Click on the JIRA Software option from the dashboard.
2. Select Projects > Create Project.
3. Choose Scrum Software Development as the project template.
4. Enter the project details including name, key, and team details.
5. Click Create to set up the project.

Step 3: Configure the Scrum Board

Navigate to Boards and select Create Board.

Choose Scrum Board.

Select whether to create the board from an existing project or a new project.

Assign the board to your Scrum project.

Click Create Board.

Step 4: Define and Prioritize the Backlog

Open the Scrum Board and navigate to the Backlog tab.

Click Create Issue to add user stories, tasks, and bugs.

Assign priority levels and categories to each item.

Organize backlog items based on priority.

Step 5: Create and Start a Sprint

Go to the Backlog tab.

Click Create Sprint.

Select user stories/tasks to include in the sprint.

Click Start Sprint and set the sprint duration.

Step 6: Manage and Track Sprint Progress

Move tasks across the board from To Do to In Progress and then Done.

Regularly update task statuses during daily stand-up meetings.

Use filters to view tasks assigned to different team members.

Monitor sprint burndown charts for progress tracking.

Step 7: Review and Close the Sprint

At the end of the sprint, review completed tasks.

Conduct a Sprint Retrospective to discuss improvements.

Close the sprint and move unfinished tasks to the next sprint.

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30 days left Search

SCRUM-1 Software project

Planning Summary Timeline Backlog Board Forms Goals + Add view

Development Code Project pages Learn Jira in 10 mi... Project settings Archived issues NEW

Projects / SCRUM-1 SCRUM Sprint 1

9 days | Start sprints

Search | MY AR EPIC | Group by None

To Do In Progress 1 Done 1

+ Create issue

Save Product on WishList WISHLIST SCRUM-2 SCRUM-3

View our WishList WISHLIST SCRUM-3

+ Add view

Project pages Learn Jira in 10 mi... Project settings Archived issues NEW

Search

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30 days left Search

SCRUM-1 Software project

Planning Summary Timeline Backlog Board Forms Goals + Add view

Development Code Project pages Learn Jira in 10 mi... Project settings Archived issues NEW

Projects / SCRUM-1 Backlog

SCRUM Sprint 1 11 Feb - 25 Feb (2 issues) Complete sprint

+ Create issue

Backlog (0 issues) Your backlog is empty.

+ Create issue

SCRUM-1 / SCRUM-2

Description Add a description...

Child issues Order by Suggest subtasks 0% Done

SCRUM-4 wishlist button on -product page IN PROGRESS

SCRUM-5 Create db for product website 100%

Confluence content TRY TEMPLATE

Product requirements

Activity Show: All Comments History Summarize Newest first

Add a comment... Pro tip: press M to comment

Search

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Preferences

Jira Your work Projects Filters Dashboards Teams Plans Apps Create

30 days left Search

SCRUM-1 Software project

Planning Summary Timeline Backlog Board Forms Goals + Add view

Development Code Project pages Learn Jira in 10 mi... Project settings Archived issues NEW

Projects / SCRUM-1 Backlog

SCRUM Sprint 1 11 Feb - 25 Feb (2 issues) Complete sprint

+ Create issue

Backlog (0 issues) Your backlog is empty.

+ Create issue

SCRUM-1 / SCRUM-2

Description Add a description...

Child issues Order by Suggest subtasks 0% Done

SCRUM-4 wishlist button on -product page IN PROGRESS

SCRUM-5 Create db for product website 100%

Confluence content TRY TEMPLATE

Product requirements

Activity Show: All Comments History Summarize Newest first

Add a comment... Pro tip: press M to comment

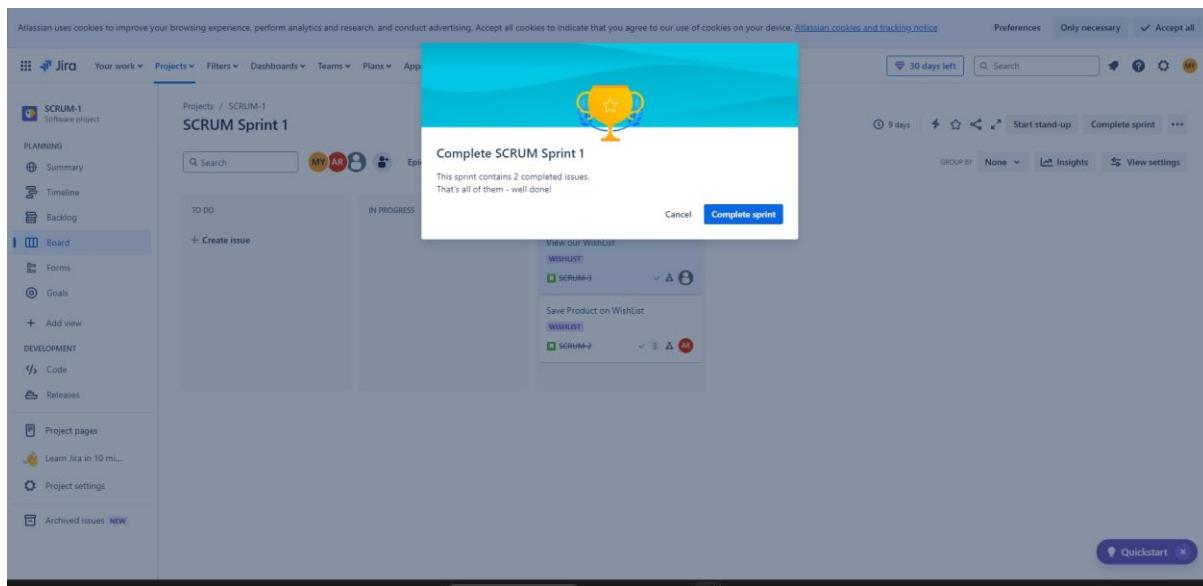
Search

The screenshot shows the Jira interface for the project SCRM-1. The left sidebar contains navigation links for Work, Projects, Filters, Dashboards, Teams, Plans, Apps, and a Create button. The main content area displays the backlog for SCRM-1 Sprint 1, which includes an option to view the WishList. A modal window titled "View our WishList" is open, showing a description field and a pinned fields section. To the right, a "Quickstart" sidebar lists various tools and services like Slack, Microsoft Teams, GitHub, GitLab, CircleCI, and Zendesk.

The screenshot shows the Jira interface for the project SCRM-1. The main view is the Backlog, which lists issues categorized by sprint. The backlog includes:

- SCRM-2: Save Product on WishList (WISHLIST)
- SCRM-3: View our WishList (DONE)
- SCRM-4: Create a new WishList (IN PROGRESS)

A sidebar on the left provides navigation links for work, projects, filters, dashboards, teams, plans, apps, and a create button. A search bar is also present. A quickstart panel on the right offers links to various tools and services.



Conclusion

Creating a Scrum Board in JIRA helps teams collaborate effectively and manage sprints systematically. The Scrum Master plays a crucial role in ensuring the board is updated and used efficiently to track progress, resolve blockers, and enhance team productivity.

EXPERIMENT 8

TO STUDY PROJECT SCHEDULING USING GNATT CHART IN CLICKUP

Theory:

1. Introduction to Project Scheduling

Project scheduling is the process of defining tasks, setting deadlines, assigning responsibilities, and tracking progress to ensure timely project completion. A Gantt chart is a visual tool used for planning and scheduling tasks over a timeline.

1.1 What is a Gantt Chart?

A Gantt chart is a bar chart that represents project tasks and their durations. It helps project managers:

- Visualize task dependencies and overlaps.
- Monitor progress against deadlines.
- Allocate resources effectively.
- Identify bottlenecks early.

1.2 Features of a Gantt Chart

- Task dependencies (finish-to-start, start-to-start, etc.).
- Milestones to mark key deliverables.
- Critical path analysis to determine the longest sequence of dependent tasks.
- Progress tracking using percentage completion.

2. Introduction to ClickUp

ClickUp is an all-in-one project management tool that offers Gantt charts for scheduling, tracking, and managing tasks efficiently.

2.1 Why Use ClickUp for Project Scheduling?

- Intuitive drag-and-drop interface for adjusting timelines.
- Supports task dependencies and rescheduling.
- Real-time collaboration with team members.
- Automation and notifications to streamline workflows.

3. Creating a Gantt Chart in ClickUp 3.1 Steps to Create a Gantt Chart in ClickUp

1. Login to ClickUp at [ClickUp Website](#).

2. Create a New Project:

- o Click Spaces > Create New List or Folder.

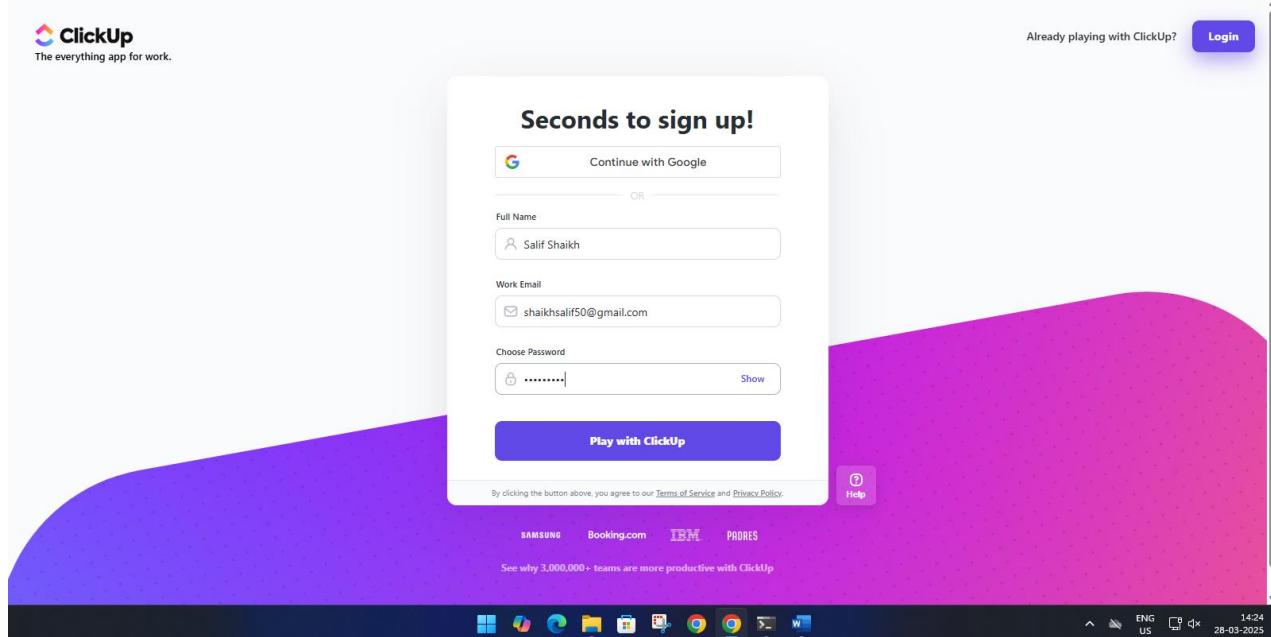
Salif Shaikh
T22 – 2201094

- o Name your project and define the project scope.
3. Add Tasks to the Project:
- o Click New Task, provide a task name, description, assignee, and due date.
 - o Define task priorities and set dependencies.
4. Enable Gantt Chart View:
- o Go to View Options and select Gantt Chart.
 - o Adjust start and due dates to organize the timeline.
5. Define Dependencies:
- o Click and drag connectors between tasks to create relationships (e.g., Task B starts after Task A).
6. Set Milestones:
- o Identify key deadlines and mark them as Milestones.

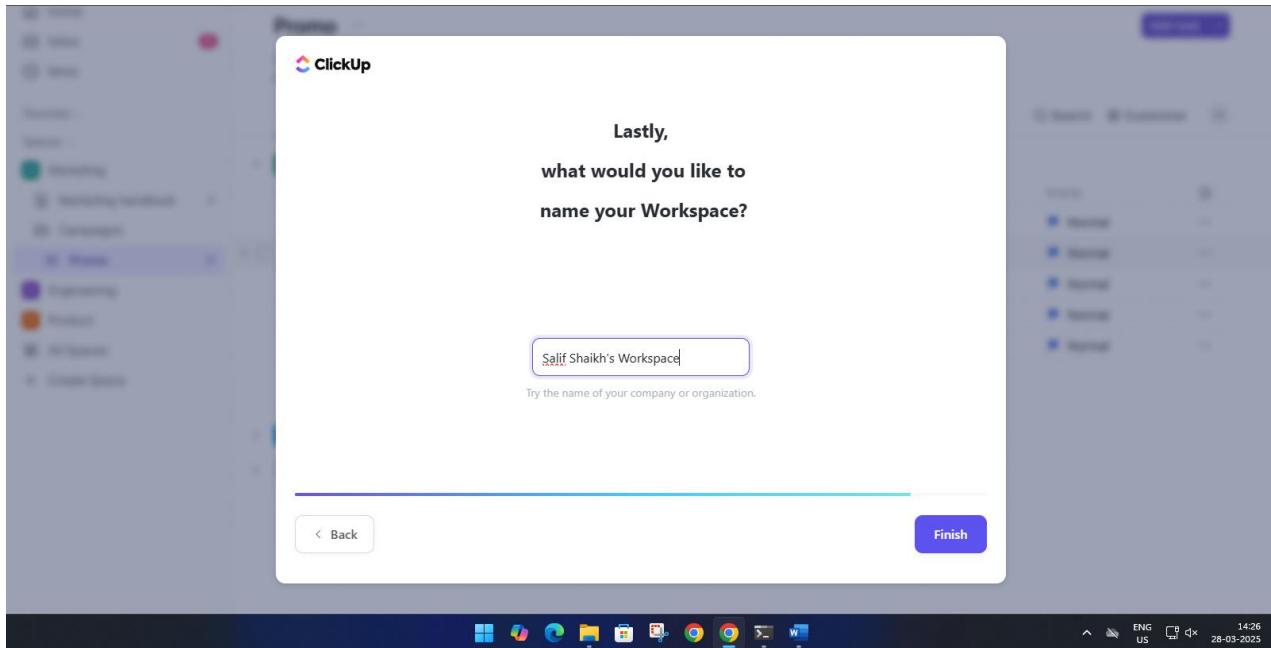
4. Tracking and Managing a Gantt Chart in ClickUp

- Modify Timelines: Drag tasks to change deadlines dynamically.
- Monitor Progress: Use task completion percentages to track status.
- Adjust Dependencies: Update task sequences when project plans change.
- Generate Reports: Use ClickUp's reporting features to analyze workload and delays.

Output:



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A screenshot of the ClickUp workspace home screen for "Salif Shaikh's Workspace". The left sidebar shows sections for Home, My Tasks, Calendar, and More. The main area has tabs for Overview, List, and Board. A "Getting started" modal is open, showing tasks: "Understand the ClickUp Hierarchy", "Manage your work with tasks", "Customize your views", and "Collaborate with your team via Inbox". The status bar at the bottom shows "14:26", "ENG US", and the date "28-03-2025".

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The screenshot shows the ClickUp application interface. On the left, there's a sidebar with icons for Home, My Tasks, Calendar, and More. The main area displays a Gantt chart titled "Project List 2". The chart has two sections: "IN PROGRESS" and "TO DO". Under "IN PROGRESS", there is one task named "Task 1". Under "TO DO", there are three tasks: "Task 2" and "Task 3". Each task row includes columns for Name, Assignee, Due date, Priority, and more. At the bottom of the chart, there's a button for "+ New status". The top right of the screen has various navigation and search tools.

Conclusion

This experiment demonstrated the importance of project scheduling using a Gantt chart in ClickUp. By visualizing tasks, dependencies, and deadlines, teams can efficiently manage projects, avoid delays, and ensure smooth workflow execution.

Software Engineering & Project Management Lab Experiment No: - 09

Aim: To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers

Salif Shaikh

T22-94

AI&DS

Theory:

What is Docker?

Docker is a platform that allows developers to build, package, and deploy applications in lightweight, portable containers. These containers include everything needed to run an application, such as code, runtime, system tools, libraries, and dependencies.

Containerization Technology

Containers are isolated environments where applications run independently. Unlike traditional virtualization, which requires separate operating systems for each application, containers share the host OS kernel, making them faster and more efficient.

Docker Architecture

Docker follows a client-server architecture consisting of the following key components:

1. Docker Client

- It is the command-line interface (CLI) that allows users to interact with Docker.
- Commands such as docker run, docker build, and docker stop are executed through the client.

2. Docker Daemon (dockerd)

- It runs in the background and manages Docker containers, images, volumes, and networks.
- It listens for requests from the Docker Client and executes commands.

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Aim: To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers

3. Docker Images

- A Docker image is a read-only template containing the application code, libraries, and dependencies.
- Images are created using Dockerfiles, which define the steps to build an image.
- Images are stored in Docker Hub or private repositories.

4. Docker Containers

- A container is an instance of a Docker image running as an isolated process on a host machine.
- Containers are lightweight, portable, and can be started, stopped, or removed as needed.

5. Docker Registry

- It is a storage system for Docker images.
- The public registry, Docker Hub, provides access to a vast collection of pre-built images.
- Users can also create private registries for security and control.

Docker Container Life Cycle

The **life cycle of a container** follows these steps:

1. **Create** – A container is created from an image using the docker create command.
2. **Start** – The container starts running using the docker start command.
3. **Run** – A new container can be started directly using docker run.
4. **Pause/Unpause** – Containers can be temporarily paused and resumed.
5. **Stop** – The container can be stopped using docker stop.
6. **Restart** – A stopped container can be restarted.
7. **Kill** – A container can be forcefully stopped using docker kill.
8. **Remove** – Containers that are no longer needed can be deleted using docker rm.

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Aim: To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers

Benefits of Docker

1. Portability

- Containers can run on any platform that supports Docker.
- Applications behave consistently across different environments.

2. Efficiency

- Containers share the host OS kernel, reducing overhead and improving performance.
- They consume fewer resources compared to virtual machines.

3. Isolation

- Each container runs in its own isolated environment, preventing dependency conflicts.

4. Scalability

- Applications can be scaled up quickly by launching multiple containers.
- Docker enables automatic load balancing in large-scale deployments.

5. Consistency

- Ensures that the application runs the same way in development, testing, and production.
- Eliminates the "works on my machine" problem.

Docker Engine:

At the core of Docker is the Docker Engine, which is responsible for building, running, and managing containers. It consists of the Docker daemon, which manages containers, images, networks, and volumes, and the Docker client, which allows users to interact with the daemon through the Docker API.

Docker Images:

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Aim: To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers

Docker images are read-only templates used to create containers. They contain the application code, runtime, libraries, dependencies, and other files needed to run the application. Images are built using Dockerfiles, which are text files that define the steps needed to create the image.

☒ OUTPUT:-

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Aim: To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers

```
C:\Users\202>docker run redis
Unable to find image 'redis:latest' locally
latest: Pulling from library/redis
8a1e25ce7c4f: Pull complete
8ab039a68e51: Pull complete
2b12a49dcfb9: Pull complete
cdf9868f47ac: Pull complete
e73ea5d3136b: Pull complete
890ad32c613f: Pull complete
4f4fb700ef54: Pull complete
ba517b76f92b: Pull complete
Digest: sha256:7dd707032d90c6eaaf566f62a00f5b0116ae08fd7d6cbbb0f311b82b47171a2
Status: Downloaded newer image for redis:latest
1:C 13 Mar 2024 03:19:03.928 * o000o000o000o Redis is starting o000o000o000o
1:C 13 Mar 2024 03:19:03.928 * Redis version=7.2.4, bits=64, commit=00000000, mod
1:C 13 Mar 2024 03:19:03.928 # Warning: no config file specified, using the defau
s.conf
1:M 13 Mar 2024 03:19:03.929 * monotonic clock: POSIX clock_gettime
1:M 13 Mar 2024 03:19:03.929 * Running mode=standalone, port=6379.
1:M 13 Mar 2024 03:19:03.929 * Server initialized
1:M 13 Mar 2024 03:19:03.929 * Ready to accept connections tcp
1:signal-handler (1710300105) Received SIGINT scheduling shutdown...
1:M 13 Mar 2024 03:21:45.877 * User requested shutdown...
1:M 13 Mar 2024 03:21:45.877 * Saving the final RDB snapshot before exiting.
1:M 13 Mar 2024 03:21:45.887 * DB saved on disk
1:M 13 Mar 2024 03:21:45.887 # Redis is now ready to exit, bye bye...
```

```
C:\Users\202>docker images
REPOSITORY      TAG          IMAGE ID      CREATED        SIZE
redis           latest        170a1e90f843   2 months ago   138MB
```

```
C:\Users\202>docker pull redis
Using default tag: latest
latest: Pulling from library/redis
Digest: sha256:7dd707032d90c6eaaf566f62a00f5b0116ae08fd7d6cbbb0f311b82b47171a2
Status: Image is up to date for redis:latest
docker.io/library/redis:latest
```

```
C:\Users\202>docker ps
CONTAINER ID  IMAGE      COMMAND     CREATED      STATUS      PORTS      NAMES
C:\Users\202>docker ps
CONTAINER ID  IMAGE      COMMAND     CREATED      STATUS      PORTS      NAMES
062aecb0ee88  redis      "docker-entrypoint.s..."  About a minute ago  Up 4 seconds  6379/tcp  container121
1c4472744083  redis      "docker-entrypoint.s..."  6 minutes ago    Up 10 seconds  6379/tcp  modest_herschel
C:\Users\202>
```

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Aim: To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers

```
C:\Users\202>docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
052aecb0ee88 redis "docker-entrypoint.s..." About a minute ago Up 4 seconds 6379/tcp container121
1c4472744083 redis "docker-entrypoint.s..." 6 minutes ago Up 10 seconds 6379/tcp modest_herschel

C:\Users\202>
C:\Users\202>
C:\Users\202>docker stop 052aecb0ee88
052aecb0ee88

C:\Users\202>docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
1c4472744083 redis "docker-entrypoint.s..." 9 minutes ago Up 2 minutes 6379/tcp modest_herschel
```

```
C:\Users\202>docker start 052aecb0ee88
052aecb0ee88

C:\Users\202>docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
052aecb0ee88 redis "docker-entrypoint.s..." 5 minutes ago Up 8 seconds 6379/tcp container121
1c4472744083 redis "docker-entrypoint.s..." 10 minutes ago Up 3 minutes 6379/tcp modest_herschel
```

```
C:\Users\202>docker rm 052aecb0ee88
052aecb0ee88
```

```
C:\Users\202>docker images
REPOSITORY TAG IMAGE ID CREATED SIZE
redis latest 170a1e90f843 2 months ago 138MB
```

```
C:\Users\202>docker exec -d 1c4472744083 touch /tmp/execWorks
```

```
C:\Users\202>docker exec -it 1c4472744083 bash
root@1c4472744083:/data# |
```

```
C:\Users\202>docker restart 1c4472744083
1c4472744083

C:\Users\202>docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
1c4472744083 redis "docker-entrypoint.s..." 13 minutes ago Up 3 seconds 6379/tcp modest_herschel
```

Software Engineering & Project Management Lab Experiment No: - 09

Aim: To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers

```
C:\Users\202>docker inspect 1c4472744083
[
  {
    "Id": "1c44727440831475b093dcfb93163064b819bdd9ad8378bb3a4fa847dc411d80",
    "Created": "2024-03-13T03:19:03.418741433Z",
    "Path": "docker-entrypoint.sh",
    "Args": [
      "redis-server"
    ],
    "State": {
      "Status": "running",
      "Running": true,
      "Paused": false,
      "Restarting": false,
      "OOMKilled": false,
      "Dead": false,
      "Pid": 2112,
      "ExitCode": 0,
      "Error": "",
      "StartedAt": "2024-03-13T03:32:13.750463204Z",
      "FinishedAt": "2024-03-13T03:32:13.145321277Z"
    },
    "Image": "sha256:170a1e90f8436daa6778aeea3926e716928826c215ca23a8dfd8055f663f9428",
    "ResolvConfPath": "/var/lib/docker/containers/1c44727440831475b093dcfb93163064b819bdd9a
```

```
C:\Users\202>docker commit 1c4472744083 new_image_name:redis2
sha256:33e4284a7e92a4a1331555d01f6e078fc496e3a3ed8eb7f84f2678261ad07e83
```

```
C:\Users\202>docker images
REPOSITORY          TAG           IMAGE ID        CREATED         SIZE
new_image_name     redis2        33e4284a7e92   4 seconds ago  138MB
new_image_name     tag          61ab016507fa   36 seconds ago  138MB
redis              latest       170a1e90f843   2 months ago   138MB
```

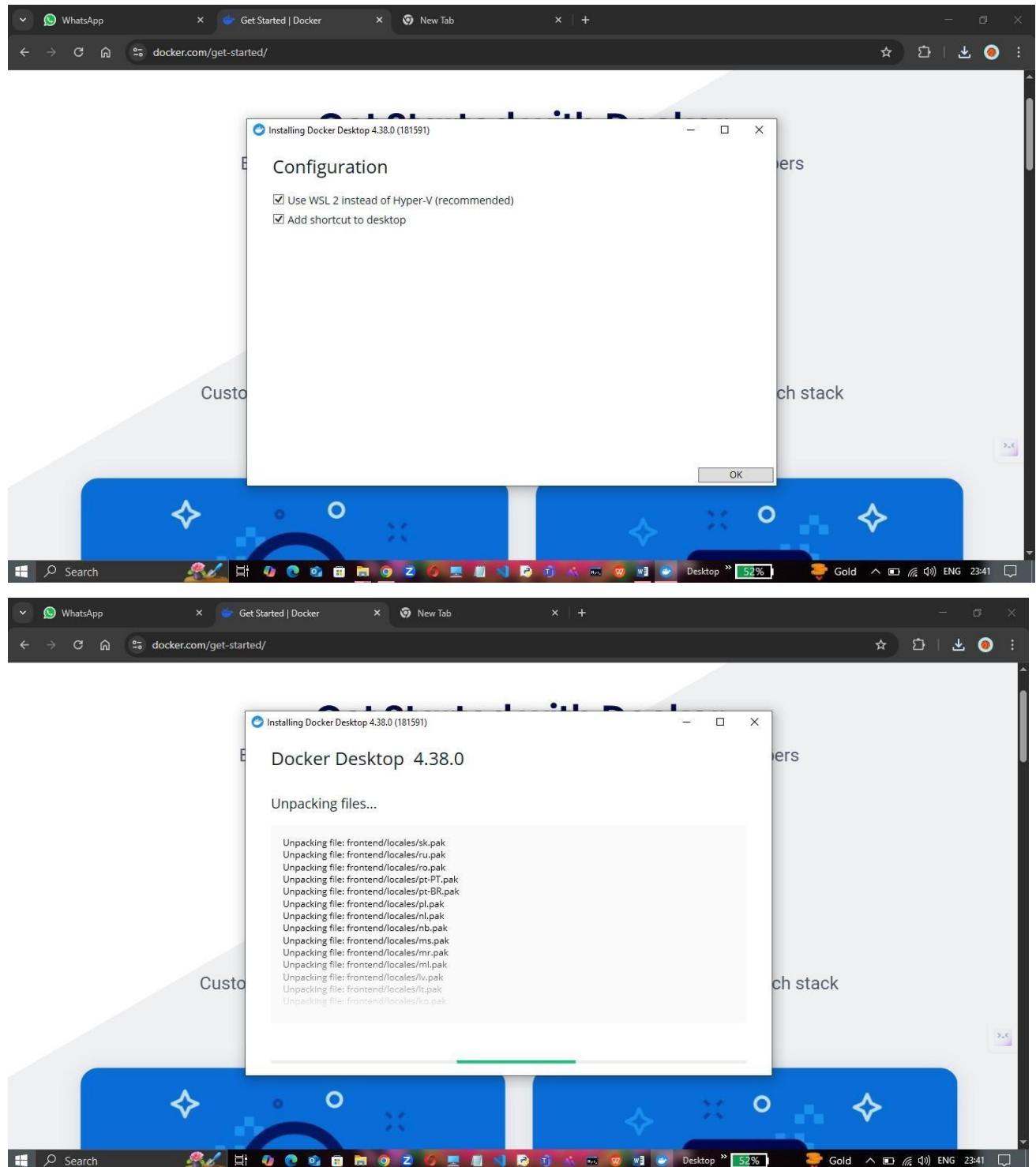
Software Engineering & Project Management Lab Experiment No: - 09

Aim: To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers

☒ SCREENSHOTS:

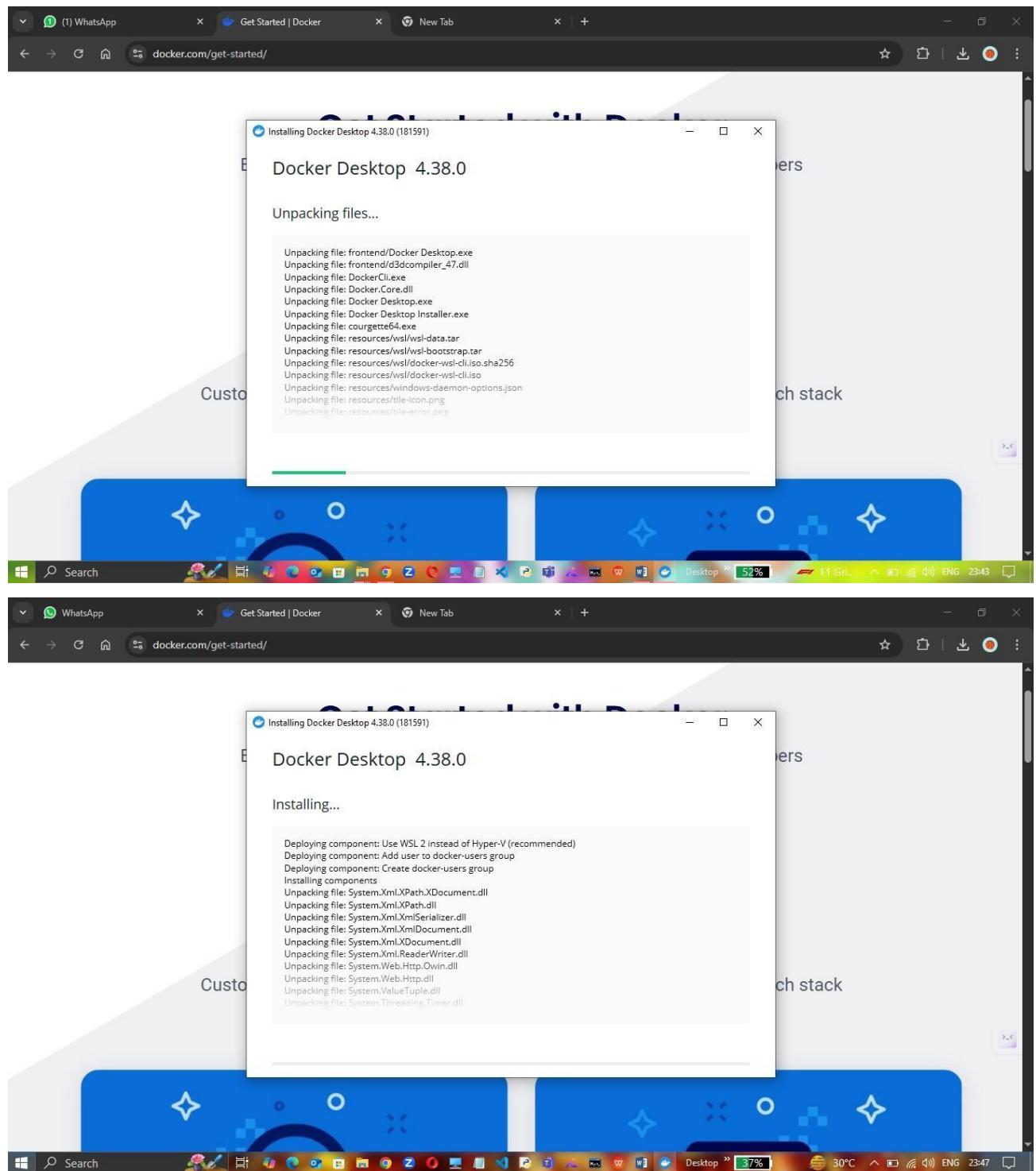
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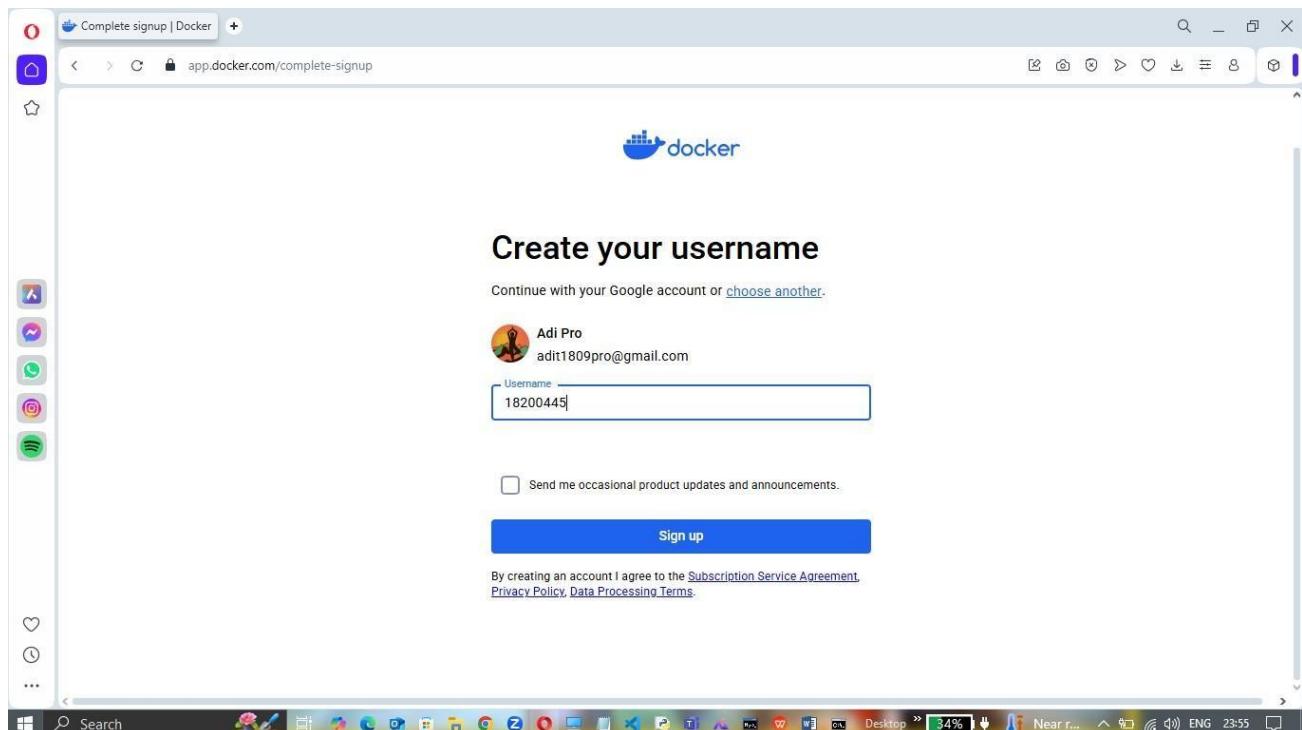
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Aim: To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers



Software Engineering & Project Management Lab Experiment No: - 09

Aim: To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers

A screenshot of a terminal window on a Linux system. The terminal session starts with "[ec2-user@ip-172-31-75-31 ~]\$". The user runs several commands: "mkdir myapp", "cd myapp/", "echo "Hello World" > index.html", "ls", "cat index.html", "touch demo.html", "ls", and "vi demo.html". The output shows the creation of a directory "myapp", navigating into it, writing "Hello World" to "index.html", listing files, displaying the contents of "index.html", creating a new file "demo.html", listing files again, and finally opening "demo.html" in the vi editor. The terminal window has a dark background and is titled "Documents — ec2-user@ip-172-31-75-31:~/myapp — ssh -i LinuxMachine1One.pem ec2-user@ec2-3-235-17-143.compute-1.amazonaws.com — 96x22".

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Aim: To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers

The screenshot shows two terminal windows side-by-side. Both windows have a dark background with a mountain landscape image. The top window shows the command 'echo "Hello World" > index.html' being run, followed by 'ls' which lists 'index.html'. The bottom window shows the creation of a directory 'myapp', navigating into it, creating files 'index.html' and 'demo.html', editing 'demo.html' with 'vi', listing files with 'ls', and finally creating a 'Dockerfile'.

```
Documents — ec2-user@ip-172-31-75-31:~/myapp — ssh -i LinuxMachine1One.pem ec2-user@ec2-3-235-17-143.compute-1.amazonaws.com — 96x22
Hello World
-- INSERT --
1,12      All

Documents — ec2-user@ip-172-31-75-31:~/myapp — ssh -i LinuxMachine1One.pem ec2-user@ec2-3-235-17-143.compute-1.amazonaws.com — 96x22
[ec2-user@ip-172-31-75-31 ~]$
[ec2-user@ip-172-31-75-31 ~]$ mkdir myapp
[ec2-user@ip-172-31-75-31 ~]$ cd myapp/
[ec2-user@ip-172-31-75-31 myapp]$ echo "Hello World" > index.html
[ec2-user@ip-172-31-75-31 myapp]$ ls
index.html
[ec2-user@ip-172-31-75-31 myapp]$ cat index.html
Hello World
[ec2-user@ip-172-31-75-31 myapp]$ touch demo.html
[ec2-user@ip-172-31-75-31 myapp]$ ls
demo.html  index.html
[ec2-user@ip-172-31-75-31 myapp]$ vi demo.html
[ec2-user@ip-172-31-75-31 myapp]$ cat demo.html
Hello World
[ec2-user@ip-172-31-75-31 myapp]$ touch Dockerfile
[ec2-user@ip-172-31-75-31 myapp]$ ls -l
total 8
-rw-rw-r-- 1 ec2-user ec2-user  0 Mar 14 00:56 Dockerfile
-rw-rw-r-- 1 ec2-user ec2-user 12 Mar 14 00:55 demo.html
-rw-rw-r-- 1 ec2-user ec2-user 12 Mar 14 00:54 index.html
[ec2-user@ip-172-31-75-31 myapp]$
```

Software Engineering & Project Management Lab Experiment No: - 09

Aim: To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers

The screenshot shows a terminal window with a dark background and light-colored text. At the top, it displays the path: 'Documents — ec2-user@ip-172-31-75-31:~/myapp — ssh -i LinuxMachine1One.pem ec2-user@ec2-3-235-17-143.compute-1.amazonaws.com'. The terminal prompt '[ec2-user@ip-172-31-75-31 myapp]\$' appears twice. Between the first two prompts, the command 'ls' is run, showing files 'Dockerfile', 'demo.html', and 'index.html'. The third prompt '[ec2-user@ip-172-31-75-31 myapp]\$' is followed by the command 'vi Dockerfile', which opens a text editor. In the editor, the 'Dockerfile' content is being typed, starting with 'FROM nginx' and 'COPY index.html /usr/share/nginx/html'. The bottom right corner of the terminal window shows status information: '96x22', 'video0', '2,38', and 'All'.

```
[ec2-user@ip-172-31-75-31 myapp]$  
[ec2-user@ip-172-31-75-31 myapp]$ ls  
Dockerfile demo.html index.html  
[ec2-user@ip-172-31-75-31 myapp]$ vi Dockerfile  
  
FROM nginx  
COPY index.html /usr/share/nginx/html  
  
-- INSERT -- 2,38 All
```

Software Engineering & Project Management Lab Experiment No: - 09

Aim: To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers

```
Documents — ec2-user@ip-172-31-75-31:~/myapp — ssh -i LinuxMachine1One.pem ec2-user@ec2-3-235-17-143.compute-1.amazonaws.com — 96x22
[ec2-user@ip-172-31-75-31 myapp]$ ls
Dockerfile  demo.html  index.html
[ec2-user@ip-172-31-75-31 myapp]$ vi Dockerfile
[ec2-user@ip-172-31-75-31 myapp]$ cat Dockerfile
FROM nginx
COPY index.html /usr/share/nginx/html
[ec2-user@ip-172-31-75-31 myapp]$ docker info
Client:
  Context:    default
  Debug Mode: false

Server:
ERROR: Cannot connect to the Docker daemon at unix:///var/run/docker.sock. Is the docker daemon running?
errors pretty printing info
[ec2-user@ip-172-31-75-31 myapp]$ sudo service docker start
Redirecting to /bin/systemctl start docker.service
[ec2-user@ip-172-31-75-31 myapp]$
```

```
Documents — ec2-user@ip-172-31-75-31:~/myapp — ssh -i LinuxMachine1One.pem ec2-user@ec2-3-235-17-143.compute-1.amazonaws.com — 96x22
init version: de40ad0
Security Options:
  seccomp
    Profile: default
Kernel Version: 5.10.167-147.601.amzn2.x86_64
Operating System: Amazon Linux 2
OSType: linux
Architecture: x86_64
CPUs: 1
Total Memory: 964.8MiB
Name: ip-172-31-75-31.ec2.internal
ID: 3DRI:26BR:Y5X4:GCJ2:2UYQ:TFHFW:AQ5Q:5UIY:67Z2:VVGE:KC6M:DHX2
Docker Root Dir: /var/lib/docker
Debug Mode: false
Registry: https://index.docker.io/v1/
Labels:
Experimental: false
Insecure Registries:
  127.0.0.0/8
Live Restore Enabled: false

[ec2-user@ip-172-31-75-31 myapp]$
```

Software Engineering & Project Management Lab Experiment No: - 09

Aim: To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers

```
Documents — ec2-user@ip-172-31-75-31:~/myapp — ssh -i LinuxMachine1One.pem ec2-user@ec2-3-235-17-143.compute-1.amazonaws.com — 96x22
[ec2-user@ip-172-31-75-31 myapp]$
[ec2-user@ip-172-31-75-31 myapp]$ docker build -t myapp .
Sending build context to Docker daemon 4.096kB
Step 1/2 : FROM nginx
--> 904b8cb13b93
Step 2/2 : COPY index.html /usr/share/nginx/html
--> dffa39f040c6
Successfully built dffa39f040c6
Successfully tagged myapp:latest
[ec2-user@ip-172-31-75-31 myapp]$ docker images
REPOSITORY      TAG          IMAGE ID       CREATED        SIZE
myapp           latest        dffa39f040c6   25 seconds ago  142MB
nginx           latest        904b8cb13b93   12 days ago    142MB
hello-world     latest        feb5d9fea6a5   17 months ago   13.3kB
[ec2-user@ip-172-31-75-31 myapp]$
[ec2-user@ip-172-31-75-31 myapp]$ docker run -p 8080:80 myapp
```

```
Documents — ec2-user@ip-172-31-75-31:~/myapp — ssh -i LinuxMachine1One.pem ec2-user@ec2-3-235-17-143.compute-1.amazonaws.com — 96x22
REPOSITORY      TAG          IMAGE ID       CREATED        SIZE
myapp           latest        dffa39f040c6   25 seconds ago  142MB
nginx           latest        904b8cb13b93   12 days ago    142MB
hello-world     latest        feb5d9fea6a5   17 months ago   13.3kB
[ec2-user@ip-172-31-75-31 myapp]$
[ec2-user@ip-172-31-75-31 myapp]$ docker run -p 8080:80 myapp
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
10-listen-on-ipv6-by-default.sh: info: Getting the checksum of /etc/nginx/conf.d/default.conf
10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/default.conf
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/30-tune-worker-processes.sh
/docker-entrypoint.sh: Configuration complete; ready for start up
2023/03/14 01:03:25 [notice] 1#1: using the "epoll" event method
2023/03/14 01:03:25 [notice] 1#1: nginx/1.23.3
2023/03/14 01:03:25 [notice] 1#1: built by gcc 10.2.1 20210110 (Debian 10.2.1-6)
2023/03/14 01:03:25 [notice] 1#1: OS: Linux 5.10.167-147.601.amzn2.x86_64
2023/03/14 01:03:25 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 32768:65536
2023/03/14 01:03:25 [notice] 1#1: start worker processes
2023/03/14 01:03:25 [notice] 1#1: start worker process 29
```

Software Engineering & Project Management Lab Experiment No: - 09

Aim: To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with containers

```
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
10-listen-on-ipv6-by-default.sh: info: Getting the checksum of /etc/nginx/conf.d/default.conf
10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/default.conf
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/30-tune-worker-processes.sh
/docker-entrypoint.sh: Configuration complete; ready for start up
2023/03/14 01:03:25 [notice] 1#1: using the "epoll" event method
2023/03/14 01:03:25 [notice] 1#1: nginx/1.23.3
2023/03/14 01:03:25 [notice] 1#1: built by gcc 10.2.1 20210110 (Debian 10.2.1-6)
2023/03/14 01:03:25 [notice] 1#1: OS: Linux 5.10.167-147.601.amzn2.x86_64
2023/03/14 01:03:25 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 32768:65536
2023/03/14 01:03:25 [notice] 1#1: start worker processes
2023/03/14 01:03:25 [notice] 1#1: start worker process 29
^C2023/03/14 01:03:47 [notice] 1#1: signal 2 (SIGINT) received, exiting
2023/03/14 01:03:47 [notice] 29#29: exiting
2023/03/14 01:03:47 [notice] 29#29: exit
2023/03/14 01:03:47 [notice] 1#1: signal 17 (SIGCHLD) received from 29
2023/03/14 01:03:47 [notice] 1#1: worker process 29 exited with code 0
2023/03/14 01:03:47 [notice] 1#1: exit
[ec2-user@ip-172-31-75-31 myapp]$
```

```
[ec2-user@ip-172-31-75-31 myapp]$
[ec2-user@ip-172-31-75-31 myapp]$ docker run -d -p 8080:80 myapp
f31fe21f8fc1a77ee768f2604ab695bc8e87733d95a587a62b482c3cd9fa11e6
[ec2-user@ip-172-31-75-31 myapp]$
[ec2-user@ip-172-31-75-31 myapp]$ docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS
NAMES
f31fe21f8fc1 myapp "/docker-entrypoint..." 7 seconds ago Up 6 seconds 0.0.0.0:8080->80
0/tcp, :::8080->80/tcp ecstatic_beaver
[ec2-user@ip-172-31-75-31 myapp]$
```

Conclusion: Thus, we have successfully installed Docker and execute docker commands to manage images and interact with containers.

Software Engineering & Project Management Lab Experiment No: - 10

Aim: To learn Dockerfile instructions, build an image for a sample web application using DOCKERFILE.

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T22-94

AI&DS

Theory:

What is Docker?

Docker is a platform that allows developers to build, package, and deploy applications in lightweight, portable containers. These containers include everything needed to run an application, such as code, runtime, system tools, libraries, and dependencies.

Benefits of Docker

1. Portability

- Containers can run on any platform that supports Docker.
- Applications behave consistently across different environments.

2. Efficiency

- Containers share the host OS kernel, reducing overhead and improving performance.
- They consume fewer resources compared to virtual machines.

3. Isolation

- Each container runs in its own isolated environment, preventing dependency conflicts.

4. Scalability

- Applications can be scaled up quickly by launching multiple containers.
- Docker enables automatic load balancing in large-scale deployments.

5. Consistency

- Ensures that the application runs the same way in development, testing, and production.
- Eliminates the "works on my machine" problem.

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Aim: To learn Dockerfile instructions, build an image for a sample web application using DOCKERFILE.

DIRECTIVE argument

Although the DIRECTIVE is case-insensitive, it is recommended to write all directives in uppercase to differentiate them from arguments. A Dockerfile usually consists of multiple lines

1

of instructions that are executed sequentially by the Docker engine during the image-building process.

Now that you understand the purpose of a Dockerfile, let's get our hands dirty by building one for a sample Python application.

Building a Dockerfile for a Sample Python/Flask Application The application we'll be working with is a simple Flask app with only one home route that returns Hello, World!.

Let's start by setting up the Flask application. Open your favorite code editor and create a new directory for your project. In this directory, create a new file named app.py and add the following Python code:

```
from flask import Flask  
app = Flask(__name__)  
@app.route('/')  
def hello():  
    return 'Hello, World!'
```

Now, let's build the Dockerfile.

In the same directory as your app.py, create a new file named Dockerfile (with no file extension). This is where you'll write the instructions for Docker to build your image.

Now, follow the steps below to create the Dockerfile:

2

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Aim: To learn Dockerfile instructions, build an image for a sample web application using DOCKERFILE.

#1: Specify the base image

The very first instruction you write in a Dockerfile must be the FROM directive, which specifies the base image. The base image is the image from which all other layers in your Docker image will be built. It's the foundation of your Docker image, much like the foundation of a building.

Add the following instruction to your Dockerfile:

FROM python:3.11-slim

Here, we're telling Docker to use the official Python Docker image, and more specifically, the 3.11-slim version. This slim variant of Python Docker image is a minimal version that excludes some packages to make the image smaller. Note that the base image you specify will be downloaded from Docker Hub, Docker's official image registry. The reason we're using Python as the base image is that the application containerization is written in Python. The Python base image includes a Python interpreter, which is necessary to run Python code, as well as a number of commonly used Python utilities and libraries. By using the Python base image, we're ensuring that the environment within the Docker container is preconfigured for running Python code.

#2 Set the working directory

Once you've chosen the base image, the next step is to determine the working directory using the WORKDIR directive. Insert the following line after the FROM directive:

WORKDIR /app

Here, we're telling Docker to create a directory named app in the Docker container and use it as the current working directory. All instructions that FROM python:3.11-slim WORKDIR /app follow (like RUN, COPY, and CMD) will be run in this directory inside the container. Think of this as typing the command cd /app in a terminal to change the current working directory to /app. The difference here is that it's being done within the Docker container as part of the build process. A working directory within the container is necessary because it designates a specific

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Aim: To learn Dockerfile instructions, build an image for a sample web application using **DOCKERFILE**.

location for our application code within the container and determines where commands will be run from. If we don't set a working directory, Docker won't have a clear context for where your application is located, which would make it harder to interact with.

#3 Install dependencies Once the working directory is set, the next step is to install the dependencies. Our Python application relies on the Flask web framework, which manages requests, routes URLs, and handles other web-related tasks. To install Flask, add the following instruction in your Dockerfile just under the WORKDIR directive:

RUN pip install flask==2.3

Here, we're instructing Docker to use pip (a package installer for Python) to install the specific version of Flask we need for our application.

#4 Copy application files to the container After setting up the working directory and installing the necessary dependencies, we're now ready to copy the application files into the Docker container. To do this, add the following instruction just below the RUN directive:

COPY . /app

This line copies everything in the current directory (denoted by ".") on our host machine into the /app directory we previously set as our working directory within the Docker container. It's like using the cp command in the terminal to copy files from one directory to another, but in this context, it's copying files from your local machine to the Docker container. Why do we need to do this? It's simple. Without this step, the Docker container wouldn't have access to our application's code, making it impossible to run our app.

#5 Specify the environment variable Once the application files are copied, we need to set up the FLASK_APP environment variable for our Docker container using the ENV directive. Now, you may be wondering why we need this environment variable in the first place. In our app.py file, we create an instance of the Flask application and assign it to the variable app. This

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Aim: To learn Dockerfile instructions, build an image for a sample web application using DOCKERFILE.

application instance is what Flask needs to run, and it's located in the app.py file. When starting our Flask application using the flask run command (which we'll discuss in the next section), Flask must know where to locate the application instance to run. Flask uses the FLASK_APP environment variable to find this instance. Hence, we need to use the ENV directive to set the value of FLASK_APP to app.py. To do this, add the following line under the RUN directive:

ENV FLASK_APP=app.py

This line ensures Flask knows exactly where to find the application instance to run, which in our case is app.py.

#6 Define the default command The last instruction that we need for our application is to specify the default command that will be executed when the Docker container starts:

CMD ["flask", "run", "--host=0.0.0.0", "--port=5000"] from
the image, we'll build from this Dockerfile.

Insert the following instruction below the ENV directive:

Here's what each part of the argument passed to the CMD directive does:

- flask: This is the program that we want to run. In this case, it's the Flask commandline interface.
- run: This command instructs Flask to start a local development server.
- --host=0.0.0.0: This argument tells the Flask server to listen on all public IPs. In the context of Docker, this means the Flask application will be accessible on any IP address that can reach the Docker container.
- --port=5000: This argument specifies the port number that the Flask server will listen on. Port 5000 is the default port for Flask, but it's good practice to explicitly declare it for clarity.

After this, our Dockerfile is ready. It should look like this:

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Aim: To learn Dockerfile instructions, build an image for a sample web application using DOCKERFILE.

```
FROM python:3.11-slim
WORKDIR /app
RUN pip install flask==2.3
COPY . /app
ENV FLASK_APP=app.py
CMD ["flask", "run", "--host=0.0.0.0", "--port=5000"]
```

It's worth noting that the directives we used in the Dockerfile for our Python app aren't the only ones available in Docker. But they are the ones you'll often encounter when working with Dockerfiles.

#7 Create a .dockerignore file Before we go ahead and build our Docker image, we need to take care of one last thing. Remember the following COPY directive?

```
COPY . /app
```

This line instructs Docker to copy everything from our current directory to the app directory inside the container, which includes the Dockerfile itself. But, the Dockerfile isn't required for our app to work—it's just for us to create the Docker image. So, we need to ensure that the Dockerfile doesn't get copied to the app directory in the container. Here's how we do it: Create a new file called `.dockerignore` in the same directory as your Dockerfile. This file works much like a `.gitignore` file if you're familiar with Git. Then, add the word `Dockerfile` to this file. This tells Docker to ignore the Dockerfile when copying files into the container. Now that we've prepared everything, it's time to build our Docker image, run a container from this image, and test our application to see if everything works as expected.

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Aim: To learn Dockerfile instructions, build an image for a sample web application using DOCKERFILE.

Building and running the Docker Image

Open a terminal and navigate to the directory where your Dockerfile is located. Now, run the following command to create an image named sample-flask-app:v1 (you can name the image anything you prefer):

```
$ docker build . -t sample-flask-app:v1
```

In the command above, the dot (.) after the build command indicates that the current directory is the build context. We're using the -t flag to tag the Docker image with the name sampleflaskapp and version v1. After running this command, you'll see an output similar to this:

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Aim: To learn Dockerfile instructions, build an image for a sample web application using DOCKERFILE.

```
$ docker build . -t sample-flask-app:v1
[+] Building 17.7s (10/10) FINISHED docker:default
=> [internal] load build definition from Dockerfile  0.0s
=> => transferring dockerfile: 192B  0.0s
=> [internal] load metadata for docker.io/library/python  3.5s
=> [auth] library/python:pull token for registry  0.0s
=> [internal] load .dockerignore  0.0s
=> => transferring context: 50B  0.0s
=> [1/4] FROM docker.io/library/python:3.11  9.0s
=> => resolve docker.io/library/python:3.11  0.0s
=> => sha256:1103112ebfc46e 3.51MB / 3.51MB  1.9s
=> => sha256:b4b80ef7128d 12.87MB / 12.87MB  2.7s
=> => sha256:a2eb07f336e4f1 1.65kB / 1.65kB  0.0s
=> => sha256:4bcdb5d5bc81ca 1.37kB / 1.37kB  0.0s
=> => sha256:15646a3fa12dde 6.93kB / 6.93kB  0.0s
=> => sha256:8a1e25ce7c4f 29.12MB / 29.12MB  4.8s
=> => sha256:cc7f04ac52f8a3bad5 243B / 243B  2.4s
=> => sha256:87b8bf94a2ace2 3.41MB / 3.41MB  3.3s
=> => extracting sha256:8a1e25ce7c4f75e372e  1.8s
=> => extracting sha256:1103112ebfc46e01c0f  0.2s
=> => extracting sha256:b4b80ef7128dc9bd114  1.0s
=> => extracting sha256:cc7f04ac52f8a3bad5b  0.0s
=> => extracting sha256:87b8bf94a2ace2b005d  0.7s
=> [internal] load build context  0.0s
=> => transferring context: 194B  0.0s
=> [2/4] WORKDIR /app  0.2s
=> [3/4] RUN pip install flask==2.3  4.7s
=> [4/4] COPY . /app  0.0s
=> exporting to image  0.2s
=> => exporting layers  0.2s
=> => writing image sha256:c6879156c7750c89  0.0s
=> => naming to docker.io/library/sample-flask-app:v1  0.0s
```

What's Next?

View a summary of image vulnerabilities and recommendations → [docker scout quickview](#)

To make sure the image sample-flask-app:v1 has been successfully created, run the following command to check the list of Docker images on your system:

```
$ docker image ls
```

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Aim: To learn Dockerfile instructions, build an image for a sample web application using DOCKERFILE.

The resulting output should look something like this:

\$ docker image ls				
REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
sample-flask-app	v1	c6879156c775	10 seconds ago	147MB
mongo	latest	24041ceefc56	6 days ago	755MB

In the list, you should see sample-flask-app:v1, which confirms the image is now in our system.

Now, run the sample-flask-app:v1 image as a container by executing the following command:

```
$ docker container run -d -p 5000:5000 sample-flask-app:v1
```

The -d flag is short for --detach and runs the container in the background. The -p flag is short for --publish and maps port 5000 of the host to port 5000 of the Docker container. After running this command, you'll see an output like this:

```
$ docker container run -d -p 5000:5000 sample-flask-app:v1  
ff37071dd4cef95cc1dc2ce7e145019339cfaec54575659f72aea4e560238f8c
```

The long string you see printed in the terminal is the container ID. To make sure the container is running, list the currently active Docker containers by running the following command:

```
$ docker container ls
```

You should see something like this:

```
$ docker container ls  
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES  
c301c50152ac sample-flask-app:v1 "flask run --host=0..." 14 seconds ago Up 12 seconds 0.0.0.0:5000->5000/tcp xenodochial_mendel
```

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Aim: To learn Dockerfile instructions, build an image for a sample web application using DOCKERFILE.

The container is up and running as expected. Our Flask application is now running inside the container. To test it, open a web browser and go to <http://localhost:5000>. You should see the message Hello, World! displayed like this:



SCREENSHOTS:

```
ubuntu@ip-172-31-40-218:~$ systemctl status docker
● docker.service - Docker Application Container Engine
  Loaded: loaded (/lib/systemd/system/docker.service; enabled; vendor preset: enabled)
  Active: active (running) since Mon 2023-04-10 19:46:05 UTC; 18min ago
TriggeredBy: ● docker.socket
    Docs: https://docs.docker.com
 Main PID: 684 (dockerd)
   Tasks: 12
  Memory: 141.2M
    CPU: 3.736s
   CGroup: /system.slice/docker.service
           └─684 /usr/bin/dockerd -H fd:// --containerd=/run/containerd/containerd.sock

Apr 10 19:46:01 ip-172-31-40-218 dockerd[684]: time="2023-04-10T19:46:01.899794323Z" level=info msg="ccResolverWrapper: se
Apr 10 19:46:01 ip-172-31-40-218 dockerd[684]: time="2023-04-10T19:46:01.899956895Z" level=info msg="ClientConn switching >
Apr 10 19:46:02 ip-172-31-40-218 dockerd[684]: time="2023-04-10T19:46:02.339992511Z" level=info msg="[graphdriver] using p>
Apr 10 19:46:03 ip-172-31-40-218 dockerd[684]: time="2023-04-10T19:46:03.665306795Z" level=info msg="Loading containers: s>
Apr 10 19:46:04 ip-172-31-40-218 dockerd[684]: time="2023-04-10T19:46:04.873139021Z" level=info msg="Default bridge (docke>
Apr 10 19:46:05 ip-172-31-40-218 dockerd[684]: time="2023-04-10T19:46:05.081644328Z" level=info msg="Loading containers: d>
Apr 10 19:46:05 ip-172-31-40-218 dockerd[684]: time="2023-04-10T19:46:05.543882435Z" level=info msg="Docker daemon" commit>
Apr 10 19:46:05 ip-172-31-40-218 dockerd[684]: time="2023-04-10T19:46:05.547797680Z" level=info msg="Daemon has completed >
Apr 10 19:46:05 ip-172-31-40-218 systemd[1]: Started Docker Application Container Engine.
Apr 10 19:46:05 ip-172-31-40-218 dockerd[684]: time="2023-04-10T19:46:05.743749833Z" level=info msg="API listen on /run/do
Lines 1-22/22 (END)
```



```
ubuntu@ip-172-31-40-218:~$ docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
ubuntu@ip-172-31-40-218:~$ docker images
REPOSITORY TAG IMAGE ID CREATED SIZE
ubuntu@ip-172-31-40-218:~$
```

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Aim: To learn Dockerfile instructions, build an image for a sample web application using DOCKERFILE.

```
ubuntu@ip-172-31-40-218:~$  
ubuntu@ip-172-31-40-218:~$ pwd  
/home/ubuntu  
ubuntu@ip-172-31-40-218:~$ mkdir my-website  
ubuntu@ip-172-31-40-218:~$ cd my-website/  
ubuntu@ip-172-31-40-218:~/my-website$ wget https://www.free-css.com/assets/files/free-css-templates/download/page290/wave-cafe.zip  
--2023-04-10 20:06:14-- https://www.free-css.com/assets/files/free-css-templates/download/page290/wave-cafe.zip  
Resolving www.free-css.com (www.free-css.com)... 217.160.0.242, 2001:8d8:100f:f000::28f  
Connecting to www.free-css.com (www.free-css.com)|217.160.0.242|:443... connected.  
HTTP request sent, awaiting response... 200 OK  
Length: 11896390 (11M) [application/zip]  
Saving to: 'wave-cafe.zip'  
  
wave-cafe.zip          100%[=====] 11.34M 6.08MB/s    in 1.9s  
  
2023-04-10 20:06:17 (6.08 MB/s) - 'wave-cafe.zip' saved [11896390/11896390]  
  
ubuntu@ip-172-31-40-218:~/my-website$  
ubuntu@ip-172-31-40-218:~/my-website$  
ubuntu@ip-172-31-40-218:~/my-website$ ls  
wave-cafe.zip  
ubuntu@ip-172-31-40-218:~/my-website$ unzip wave-cafe.zip
```

```
ubuntu@ip-172-31-40-218:~/my-website$  
inflating: 2121_wave_cafe/fontawesome/webfonts/fa-regular-400.ttf  
inflating: 2121_wave_cafe/fontawesome/webfonts/fa-regular-400.woff  
inflating: 2121_wave_cafe/fontawesome/webfonts/fa-regular-400.woff2  
inflating: 2121_wave_cafe/fontawesome/webfonts/fa-solid-900.eot  
inflating: 2121_wave_cafe/fontawesome/webfonts/fa-solid-900.svg  
inflating: 2121_wave_cafe/fontawesome/webfonts/fa-solid-900.ttf  
inflating: 2121_wave_cafe/fontawesome/webfonts/fa-solid-900.woff  
inflating: 2121_wave_cafe/fontawesome/webfonts/fa-solid-900.woff2  
creating: 2121_wave_cafe/img/  
inflating: 2121_wave_cafe/img/about-1.png  
inflating: 2121_wave_cafe/img/about-2.png  
inflating: 2121_wave_cafe/img/hot-americano.png  
inflating: 2121_wave_cafe/img/hot-cappuccino.png  
inflating: 2121_wave_cafe/img/hot-espresso.png  
inflating: 2121_wave_cafe/img/hot-latte.png  
inflating: 2121_wave_cafe/img/iced-americano.png  
inflating: 2121_wave_cafe/img/iced-cappuccino.png  
inflating: 2121_wave_cafe/img/iced-espresso.png  
inflating: 2121_wave_cafe/img/iced-latte.png  
inflating: 2121_wave_cafe/img/smoothie-1.png  
inflating: 2121_wave_cafe/img/smoothie-2.png  
inflating: 2121_wave_cafe/img/smoothie-3.png  
inflating: 2121_wave_cafe/img/smoothie-4.png  
inflating: 2121_wave_cafe/img/special-01.jpg  
inflating: 2121_wave_cafe/img/special-02.jpg  
inflating: 2121_wave_cafe/img/special-03.jpg  
inflating: 2121_wave_cafe/img/special-04.jpg  
inflating: 2121_wave_cafe/img/special-05.jpg  
inflating: 2121_wave_cafe/img/special-06.jpg  
inflating: 2121_wave_cafe/index.html  
creating: 2121_wave_cafe/js/  
inflating: 2121_wave_cafe/js/jquery-3.4.1.min.js  
creating: 2121_wave_cafe/video/  
inflating: 2121_wave_cafe/video/wave-cafe-video-bg.mp4  
ubuntu@ip-172-31-40-218:~/my-website$  
ubuntu@ip-172-31-40-218:~/my-website$  
ubuntu@ip-172-31-40-218:~/my-website$  
ubuntu@ip-172-31-40-218:~/my-website$ clear
```

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Aim: To learn Dockerfile instructions, build an image for a sample web application using DOCKERFILE.

```
ubuntu@ip-172-31-40-218:~/my-website$ ls
2121_wave_cafe wave-cafe.zip
ubuntu@ip-172-31-40-218:~/my-website$ cd 2121_wave_cafe
ubuntu@ip-172-31-40-218:~/my-website/2121_wave_cafe$ ls
css fontawesome img index.html js video
ubuntu@ip-172-31-40-218:~/my-website/2121_wave_cafe$ cp -R * ../.
ubuntu@ip-172-31-40-218:~/my-website/2121_wave_cafe$ rm -rf wave-cafe.zip 2121_wave_cafe
ubuntu@ip-172-31-40-218:~/my-website/2121_wave_cafe$ cd ..
ubuntu@ip-172-31-40-218:~/my-website$ ls
css fontawesome img index.html js video
ubuntu@ip-172-31-40-218:~/my-website$ nano Dockerfile
```

```
GNU nano 6.2                               Dockerfile
FROM httpd:2.4
COPY . /usr/local/apache2/htdocs/
```

[Wrote 2 lines]

^G Help ^O Write Out ^W Where Is ^K Cut ^T Execute ^C Location M-U Undo M-A Set Mark
^X Exit ^R Read File ^\ Replace ^U Paste ^J Justify ^/ Go To Line M-E Redo M-6 Copy

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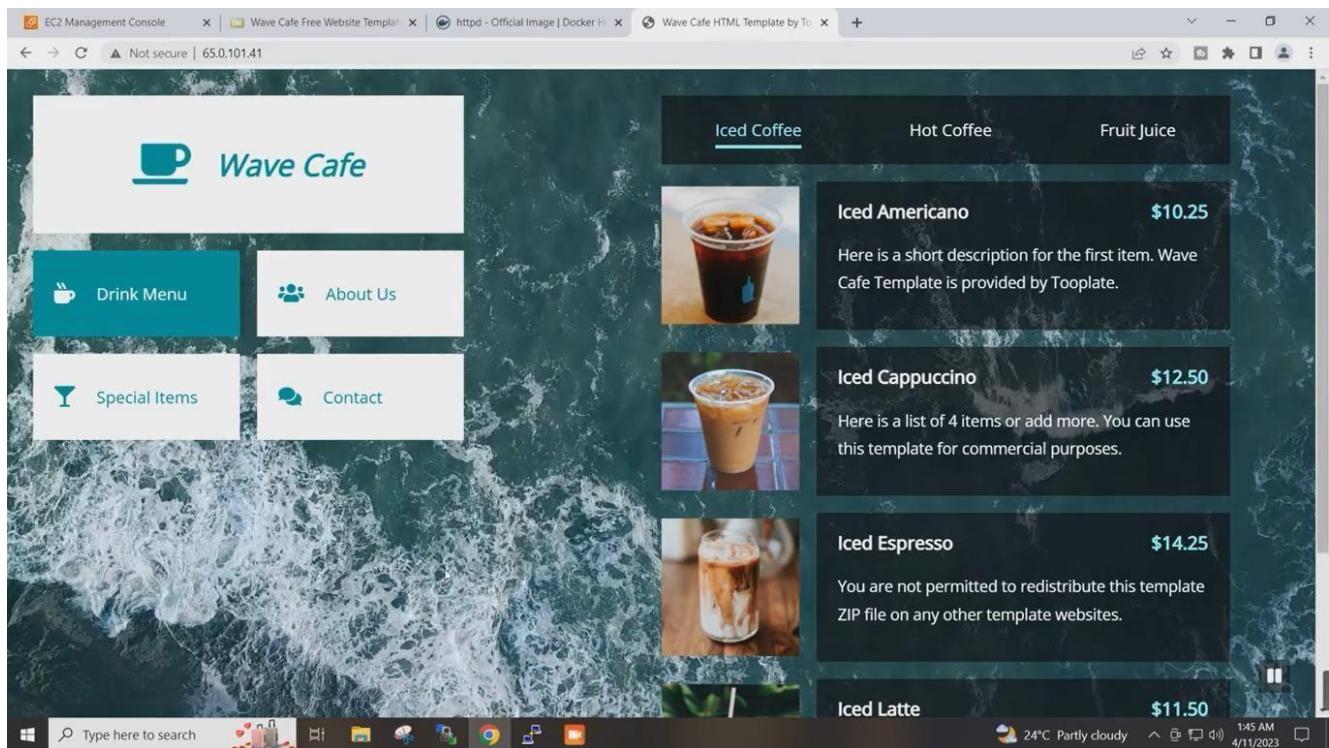
Aim: To learn Dockerfile instructions, build an image for a sample web application using DOCKERFILE.

```
ubuntu@ip-172-31-40-218:~/my-website$ ls
ubuntu@ip-172-31-40-218:~/my-website$ cd 2121_wave_cafe
ubuntu@ip-172-31-40-218:~/my-website/2121_wave_cafe$ ls
css fontawesome img index.html js video
ubuntu@ip-172-31-40-218:~/my-website/2121_wave_cafe$ cp -R * ../
ubuntu@ip-172-31-40-218:~/my-website/2121_wave_cafe$ rm -rf wave-cafe.zip 2121_wave_cafe
ubuntu@ip-172-31-40-218:~/my-website$ ls
css fontawesome img index.html js video
ubuntu@ip-172-31-40-218:~/my-website$ cd ..
ubuntu@ip-172-31-40-218:~/my-website$ ls
2121_wave_cafe css fontawesome img index.html js video wave-cafe.zip
ubuntu@ip-172-31-40-218:~/my-website$ rm -rf wave-cafe.zip 2121_wave_cafe
ubuntu@ip-172-31-40-218:~/my-website$ ls
css fontawesome img index.html js video
ubuntu@ip-172-31-40-218:~/my-website$ nano Dockerfile
ubuntu@ip-172-31-40-218:~/my-website$ ls
Dockerfile css fontawesome img index.html js video
ubuntu@ip-172-31-40-218:~/my-website$ docker build . -t my-website:latest
Sending build context to Docker daemon 13.61MB
Step 1/2 : FROM httpd:2.4
2.4: Pulling from library/httpd
f1f26f570256: Pull complete
a6b093ae1967: Pull complete
6b400bbb27df: Pull complete
6e310dd059b6: Pull complete
471cb5914961: Pull complete
Digest: sha256:4055b18d92fd006f74d4a2aac172a371dc9a750eaa78000756dee55a9beb4625
Status: Downloaded newer image for httpd:2.4
--> dcl95e13784
Step 2/2 : COPY ./usr/local/apache2/htdocs/
--> 7d48427f5e2f
Successfully built 7d48427f5e2f
Successfully tagged my-website:latest
ubuntu@ip-172-31-40-218:~/my-website$ ls
ubuntu@ip-172-31-40-218:~/my-website$ clear
```

```
ubuntu@ip-172-31-40-218:~/my-website$ docker images
REPOSITORY TAG IMAGE ID CREATED SIZE
my-website latest 7d48427f5e2f 15 seconds ago 159MB
httpd 2.4 dcl95e13784 4 days ago 145MB
ubuntu@ip-172-31-40-218:~/my-website$ docker run -d -p 80:80 my-website:latest
e0a6d7f3ab6718a1b648d9b5f00dcc89e846d1fe12bd568ce9b1412fc0d3c9da
ubuntu@ip-172-31-40-218:~/my-website$ ls
ubuntu@ip-172-31-40-218:~/my-website$ docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS
NAMES
e0a6d7f3ab67 my-website:latest "httpd-foreground" 8 seconds ago Up 7 seconds 0.0.0.0:80->80/tcp, :::80->80/tcp
trusting_rosalind
ubuntu@ip-172-31-40-218:~/my-website$
```

Software Engineering & Project Management Lab Experiment No: - 10

Aim: To learn Dockerfile instructions, build an image for a sample web application using DOCKERFILE.



Conclusion: Thus, we have successfully learnt Dockerfile instructions & build an image for a sample web application using DOCKERFILE.

SEPM ASSIGNMENT : 2

Q. Differentiate between CPM and PERT.

PERT

- ① PERT stands for project eval and review technique
- ② It is a technique of project management which is used to manage uncertain activities of any project.
- ③ It is a probability model
- ④ Appropriate for high precision time estimation
- ⑤ Non-repetitive nature of job
- ⑥ CPM stands for critical path method
- ⑦ It is a technique of project management used to only certain ie (time is known) activities of any project.
- ⑧ It is a deterministic model.
- ⑨ Appropriate for reasonable time estimation.
- ⑩ Repetitive nature of job.

Q. Explain the difference between Total Slack and Free slack.

Ans. Total Slack :

- It is the amount of time a task can be delayed without delaying the project overall completion date.
- It is calculated as the difference between late finish

and early finish of a task.

- If total slack is negative it means the project is behind schedule and needs compression techniques like crashing or fast tracking.

Free Slack:

- It is the amount of time a task can be delayed without delaying the start of any successor tasks.
- It is useful for identifying tasks that can be postponed without affecting dependent activities.
- If free slack is zero, any delay in the task will immediately affect atleast one successor task.

(ii) AON and AOA diagram.

→ Activity on Node (AON) diagram:

In AON diagrams, activities are represented by nodes and dependencies between them are shown with arrows

Key characteristics:-

- Node represents project activities.
- Arrows indicate dependencies between activities.
- Used in precedence diagramming method.

Activity on arrows (AOA)

In AOA, activities are represented by arrows, while nodes represent the start and end points of activities.

Key characteristics :-

- Arrows represent activities
- Nodes represent center
- Uses only finish to start relationships.

Q. Explain risk identification, risk projection, RMMM plan in detail.

Ans Risk identification is the process of recognizing potential risks that could negatively impact a project system or organization.

Key steps:

- Understanding project scopes
- SWOT analysis
- Checklist based approach
- Historical Data analysis.

Risk projection also known as risk estimation or risk management involves analysing the identified risks in terms of their likelihood, impact and priority.

This helps in decision making regarding mitigation strategies.

Key aspects -

- Probability assessment
- Impact analysis
- Risk exposure calculation
- Risk mitigation

RMM plan:

It is a structured approach to handling risks by reducing their probability and impact, monitoring their states and defining management strategies.

Components of RMM plan:

- Risk Mitigation
- Risk Monitoring
- Risk Management.

Q. Consider an xyz company undertake a project to computerized working of ABC city bank then

- (i) Develop For the same project.
- (ii) Develop responsibility matrix.

Ans (i) Lobs divides the project into manageable sections ensuring a structured approach.

- Likewise Lobs for the project

(a) Project initiation and planning

- Requirements analysis
- Feasibility study.
- Risk assessment and planning.
- Project scheduling and budgeting.

(b) System design and architecture

- Design a database
- Software and security architecture

(c) Software development

- Core banking system development
- Customer management module.

(d) Integration and Testing.

- System integration
- Fundamental testing.
- Security and Performance Testing.

(e) Responsibility Assignment Matrix.

Task / Activity	Project Manager	Business Analyst	Support Developer	Testers	IT Support
Requirement Analysis	R	A	C	-	-
Software development	R	I	A	-	-
System design	R	C	A	-	I
Testing Integration	R	C	A	C	I
Training & Documentation	R	A	C	-	I
Maintenance and Support	R	C	C	-	A

Q. Explain Software Configuration Management in detail

Ans. • It is a systematic approach to managing changes in software throughout its development lifecycle.

- It ensures that software modifications are well tracked, recording and reporting the status of configuration items.
- Configuration Management is practised in form or other as part of any software engineering project where several individuals or organisations have to coordinate their activities.
- Software Configuration Management is a system for managing the evolution of software products, both during the initial stages of development and during all stages of maintenance.
- All supporting software used in development even though not part of the software product, should also be controlled by SCM.
- Advantages of SCM:
 - SCM provides significant benefits to all projects regardless of size, scope and complexity.
 - Provides a snapshot of dynamically changing software.

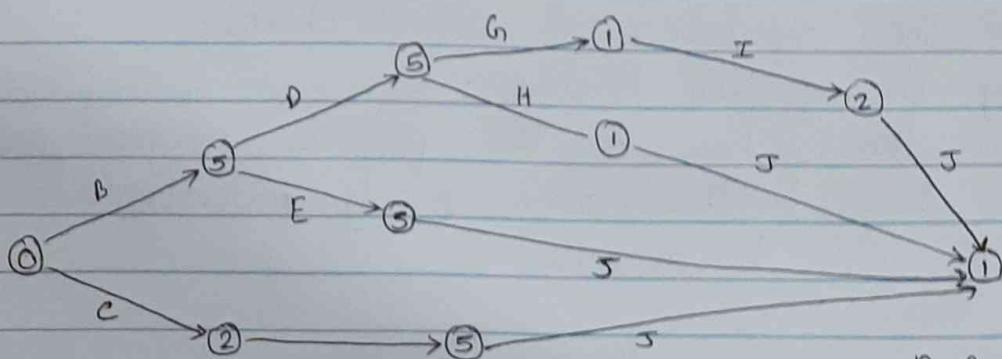
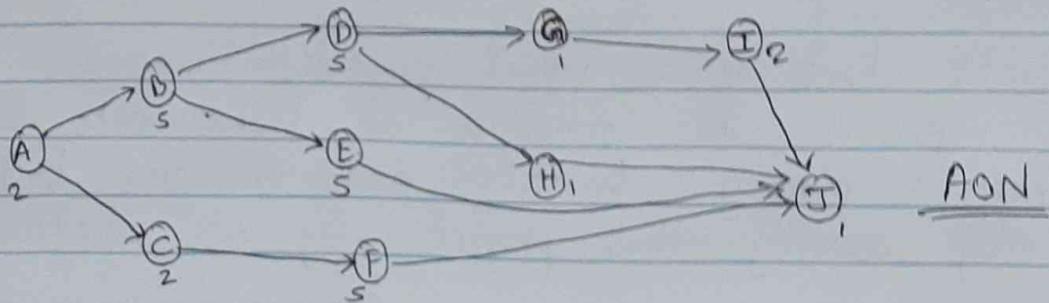
Q. Explain the significance of Gantt charts in project management.

Ans A Gantt chart is a visual project management tool that represents the schedule of tasks over time. It helps in planning, tracking and managing tasks efficiently ensuring that project stay on schedule.

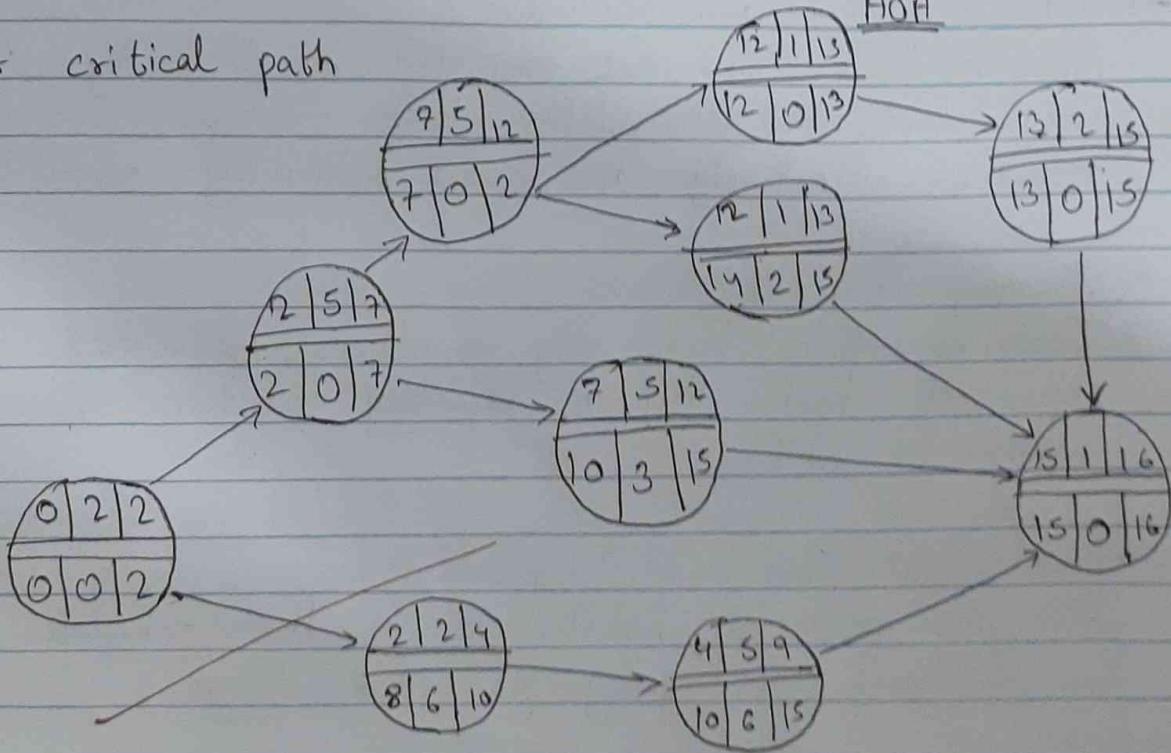
Some of the significance of Gantt charts:

- Visualising the project timelines:
Provides a clear picture of the projects program and structure helps stakeholders quickly understand deadline dependencies and bottlenecks.
- Task scheduling and deadlines:
Ensures that tasks are completed on time by setting clear starts and end dates. Helps manages, allocates resources effectively and avoid scheduling conflicts.
- Managing Task dependencies.
Identifies which tasks rely on others, preventing delays in sequential tasks. Help in adjusting schedules when dependencies shift.
- Risk identification and Mitigation
Highlights potential bottlenecks in the schedule helps in developing contingency plan for delays.

Q. Draw the AON and AOA network diagram for the following project and show critical path.



For critical path



Path: A → B → D → G → I → J

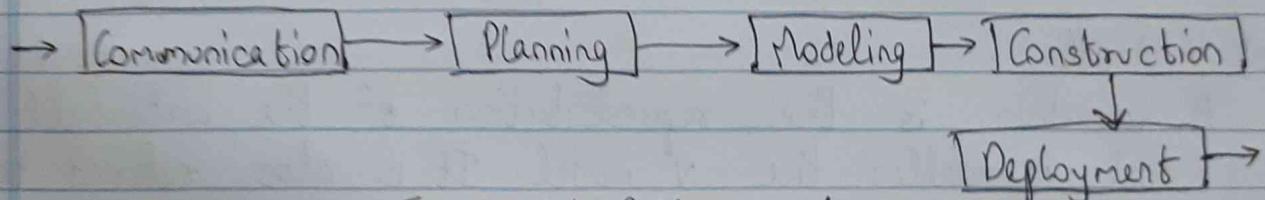
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RT

SEPM ASSIGNMENT - 1

1) Waterfall Model

The waterfall model, sometimes called the classic life cycle, suggests a systematic, sequential approach to software development begins with customer specifications of requirement and progress through planning, modelling, construction and deployment, eliminating in ongoing support of the completed software.

A variation is representation of the waterfall model is called v model



The Waterfall Model

Advantages :

- Simple and easy to understand
- Easy to manage.
- Best for smaller projects

Disadvantages :

- Late testing
- Lengthy development cycle.
- Not suitable for evolving projects.

e.g. In a library management system, phases include requirement analysis, system design, implementation testing.

Where to use waterfall model?

- Well understood requirement
- Very little changes expected
- limited resources
- Small to medium size projects.

2) V Model

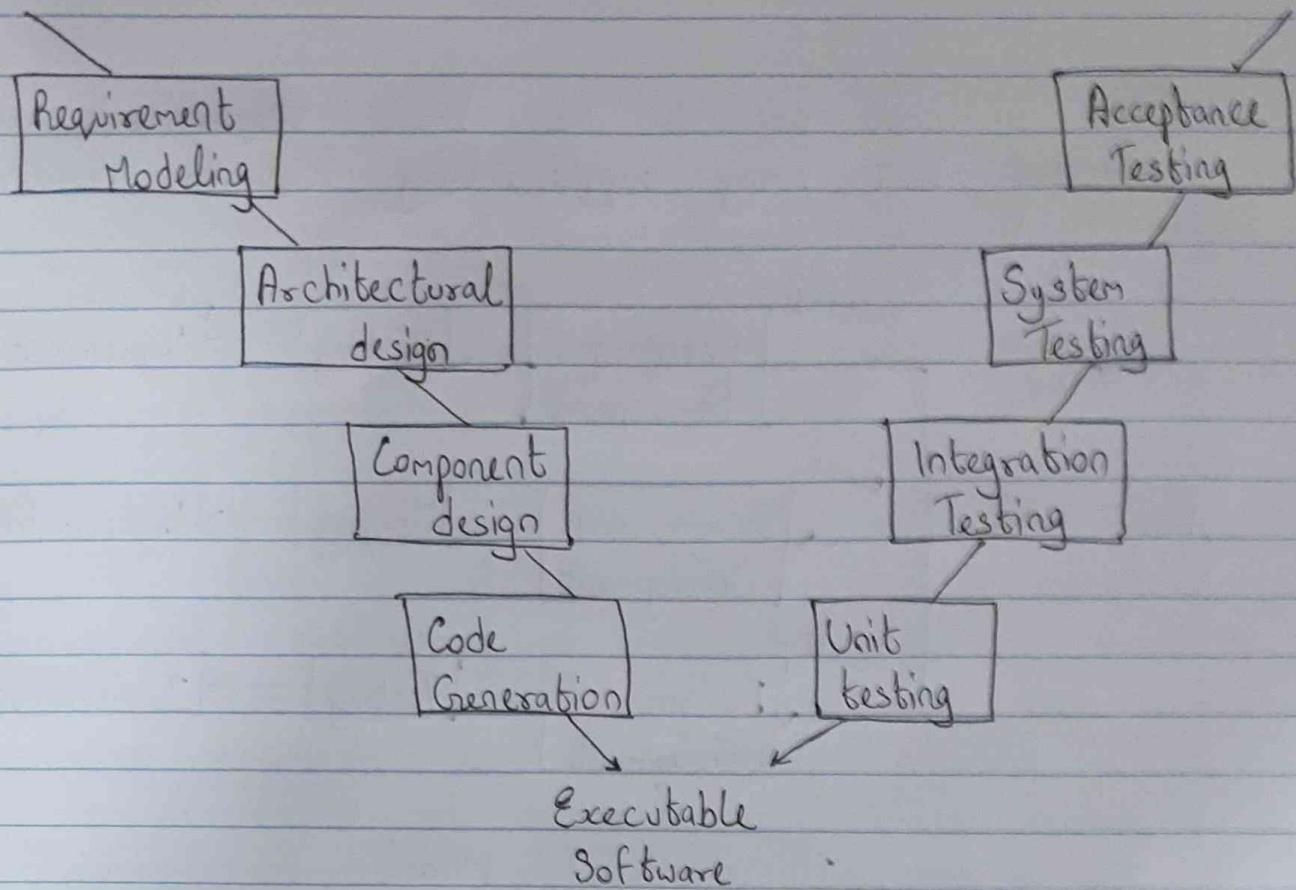
A variation is the representation of the waterfall model is called the V model. It is also referred to as the verification and validation model. It depicts the relationship of quality assurance actions to the actions associated with communication, modelling and early construction activities.

Where to use V Model?

- Clear and stable requirements
- Defined testing phases.
- Strict quality assurance needs.

Advantages

- Easy to understand
- Saves a lot of time



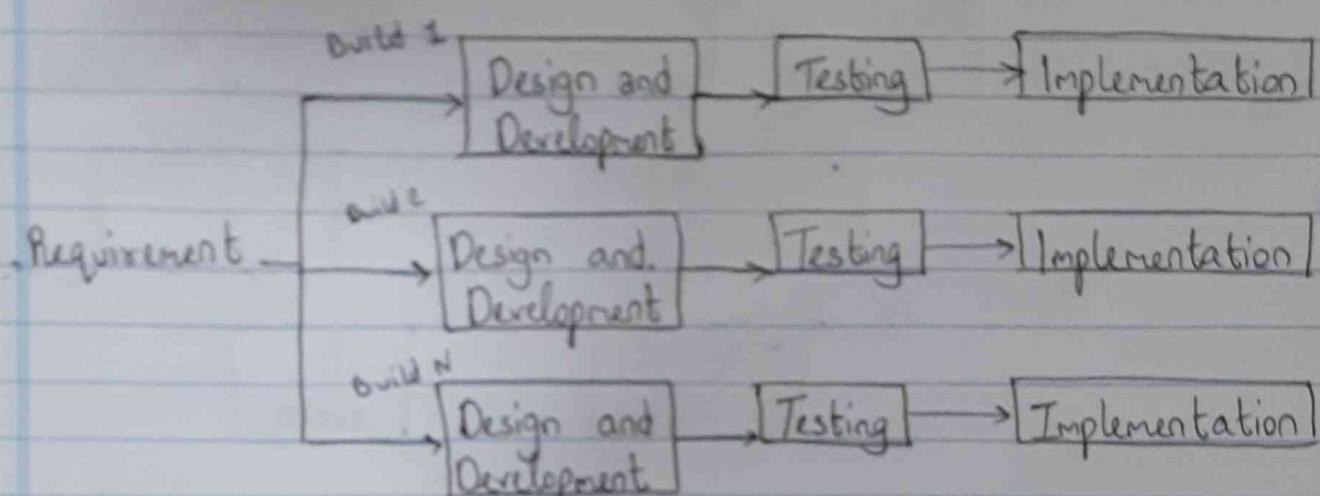
Disadvantages

- Rigid and least flexible
- Not good for complex projects

3) Incremental process Model:

The incremental model combines elements of linear and parallel process flow. It applies ~~unis~~ sequence in a ~~staggered~~ fashion, as calendar time progresses. When an incremental model is used, the first increment

after a core product i.e. basic requirement are addressed but many supplementary features remain undivided.



Incremental Model

Advantages

- errors are easy to be recognised
- More flexible

Disadvantages

- Cost is high
- Need for good planning
- Well-defined module interfaces are needed.

4) Special Model

Originally proposed by Barry Boehm, the special model is an evolutionary software process model that couples the iterative nature of prototyping with controlled, in systematic aspects of the waterfall model.

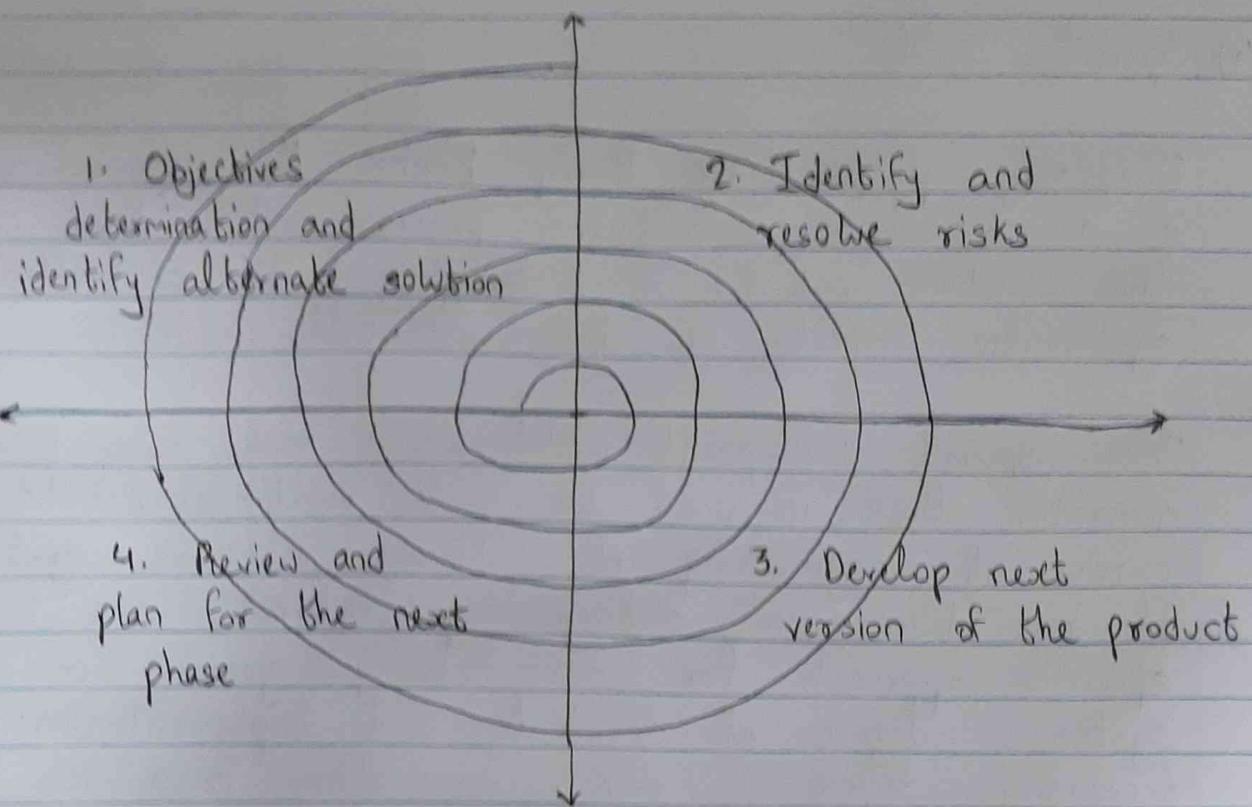
The spiral development model is a risk down model generator that is used to guide multi-stakeholder concurrent engineering of software intensive systems. It has two main distinguishing features; one is a specific approach for incrementally growing a system's degree of definite and implementation while decreasing degree of risk. The other is a set of anchor point milestone for ensuring stakeholder commitment to feasible and mutually satisfactory system solutions.

Advantages

- Risk handling
- Good for larger projects
- Improved quality

Disadvantages

- Complex
- Expensive
- Difficulty in time management



5) Rapid Prototyping

Methodology is similar to that of incremental or waterfall model the project is completed within the time and all requirements are collected before starting project. It is very fast.

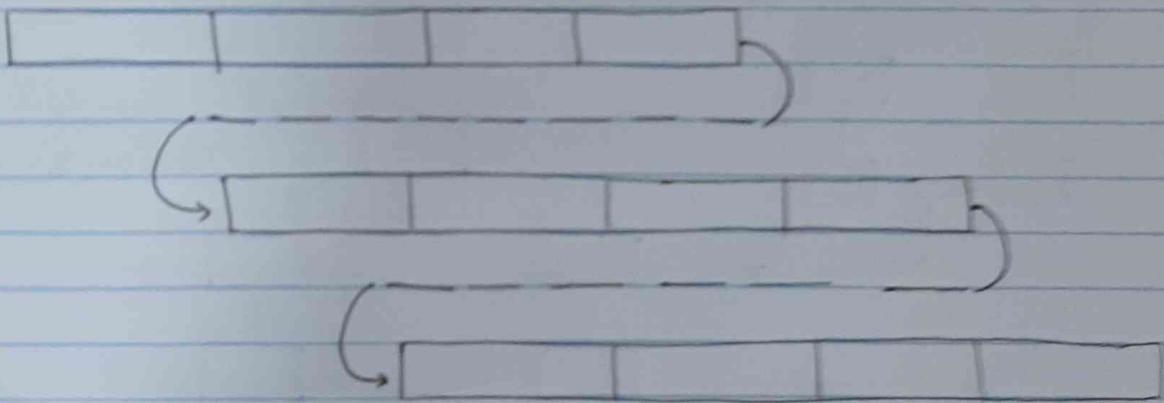
Phases :

- Business Modelling
- Data Modelling

Process Modelling

Advantages

- reduces time taken in development
- Components can be reused
- Flexible and easy to make changes



Rapid Prototyping

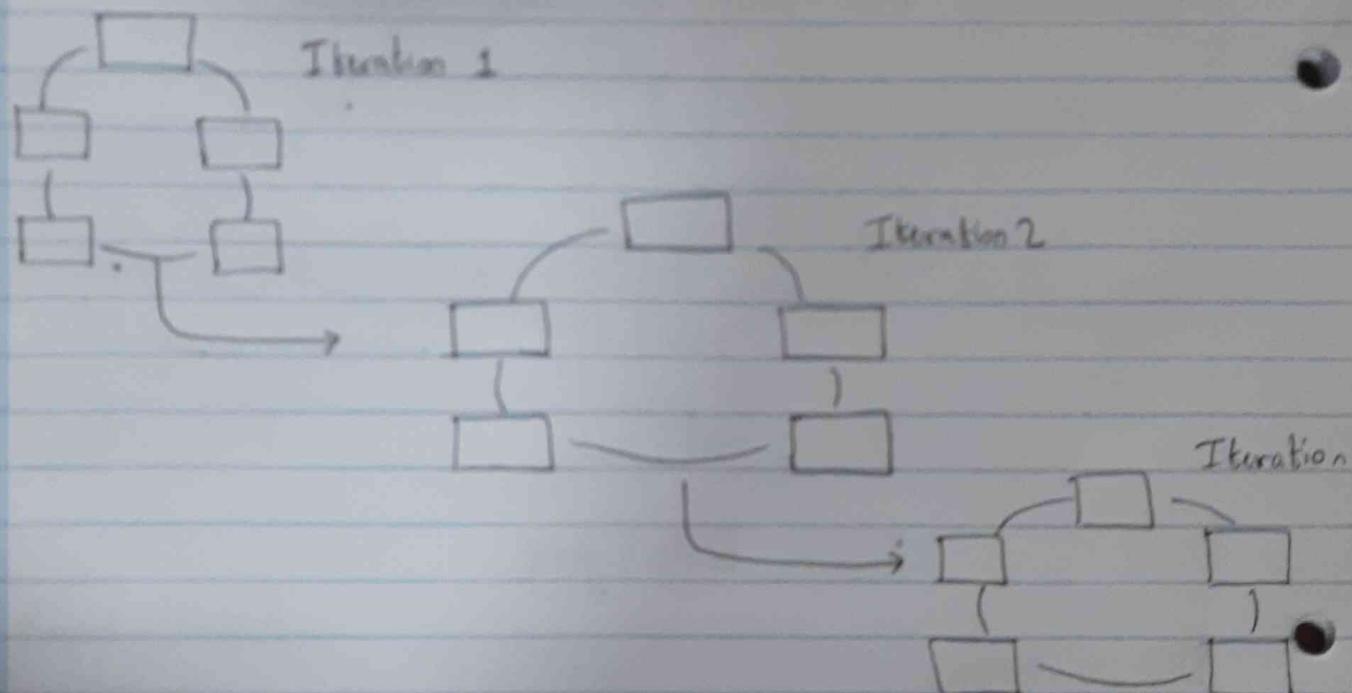
Disadvantages

- need highly skilled developers and designers
- very difficult to manage
- automated code generation is expensive.

6) Agile Model

It is a combination of iterative and incremental models.

Its focus is given to process adaptivity and customer satisfaction. It was created mainly to make changes in the middle of software development so that the software project can be completed quickly.



- Agile manifesto principle
 - ↳ Individual and interactions
 - 2) Working software
 - 3) Customer collaboration

Advantages

- Project completed in very small time.
- Very realistic approach
- Provide flexibility to developers

Disadvantages

- Cannot handle complex dependencies
- Mostly depends on customer representation.
- Due to lack of documentation, there can be confusion in development.

Agile has the following models

- ↳ Scrum
- ↳ Extreme Programming

more
xx