Dr. T.THIMMAIAH INSTITUTE OF TECHNOLOGY

(Estd.1986)Oorgaum,KolarGoldFields,Karnataka–563120

(Affiliated to Visvesvaraya Technological University)

NAAC Accredited 'A' Grade, NBA Accredited for CSE, ECE & Mining Engg Programs

DEPARTMENT OF COMPUTER SCIENCEAND ENGINEERING

VI Semester

DevOps **(BCSL657D)**

LAB MANUAL

Name of the Student _____

RegNo. Of the Student _____

Dr. T.THIMMAIAH INSTITUTE OF TECHNOLOGY
(Estd. 1986) Oorgaum, Kolar Gold Fields, Karnataka – 563120
(Affiliated to VTU,Belgaum,ApprovedbyAICTE -NewDelhi)
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Department of Computer Science and Engineering

DEVOPS (BCSL657D)

Lab Manual

Preparedby:

1. **Prof. Mercy Flora**
2. **Prof. Sophia S**

Name of the Student: _____

Reg No of the Student: _____

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NAAC Accredited 'A' Grade, NBA Accredited for CSE,ECE & Mining Engg programs.

Laboratory Certificate

This is to certify that …….bearing USN ……. Has satisfactorily completed the experiments in Practical **DevOps** prescribed by the Visvesvaraya Technological University for the course with course code **BCSL657D** in the Laboratory of this college in the year 2024-25

Signature of the faculty in-charge **Head of the Department**

Final Marks obtained.

College Vision and Mission

College-Vision:

To produce technically competent engineers having innovative skills, positive attitude, leadership and professional ethics, with a focus on developing sustainable and new technology

College- Mission:

- Create a conducive environment for teaching, learning and innovation by providing state of the art infrastructure.
- Learn sustainable and new technologies through industry institute collaborations.
- Produce technically competent engineers with ethics, discipline and social consciousness through holistic education.

Department of Computer Science and Engineering

Vision and Mission

Dept.-Vision

To produce highly competent and innovative Computer Science professionals through excellence in teaching, training and research.

Dept.-Mission

- To provide appropriate infrastructure to impart need-based technical education through effective teaching and research.
- To involve the students in innovative projects on emerging technologies to fulfill the industrial requirements.
- To render leadership skills and ethical responsibilities in students that leads them to become globally competent professionals.

BE:Program Outcomes (POs)

Attend of the B.E program, students are expected to have developed the following outcomes.

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis andinterpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one‘s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

COURSE OBJECTIVES AND OUTCOMES

Course Objectives:

.

This course will enable students to:

CLO1	To introduce DevOps terminology, definition & concepts
CLO2	To understand the different Version control tools like Git, Mercurial
CLO3	To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
CLO4	To understand Configuration management using Ansible
CLO5	Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

Course Outcomes:

At the end of the course the student will be able to:

CO1	Demonstrate Build Automation and Continuous Integration
CO2	Demonstrate Configuration Management and Deployment
CO3	Design and Demonstrate DevOps Pipelines

Conduction of Practical Examination:

Assessment Details (both CIE and SEE)

- The weightage of Continuous Internal Evaluation (CIE)is50%and forSemesterEndExam (SEE) is 50%.
- The minimumpassingmark fortheCIEis40%ofthemaximummarks (20 marksout of50).
- The minimumpassing markfortheSEEis35%ofthemaximummarks18marksoutof50).
- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/courseifthestudents secures not less than 35%(18Marksoutof50) in the semester-end examination (SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation (CIE):

CIE marks for the practical course are 50 Marks. The split-up of CIE marks for record/ journal and test are in the ratio 60:40.

- Each experiment is to be evaluated for conduction with an observation sheet and record write-up..
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled down to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus.
- In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The marks scored shall be scaled down to 20 marks (40% of the maximum marks). The Sum of scaled-down marks scored in the report write-up/journal and marks of a test is the total CIE marks scored by the student.

Rubrics for Lab Performance Assessment

In Each Lab, students will be assessed on their participation and performance in the lab. The marks obtained in each lab will be totaled and combined with Final Lab test or Viva-voce. The students need to attend 85% of the labs to qualify to be eligible to attend the university examination.

Lab Participation Rubric(Conduction)

Proficient(15-13)	Good(12-10)	Adequate(9-7)	Substandard(6-4)	Unacceptable(3-0)
Labperformance is excellent. The student has attended all labs. Studentdemonstrates an accurateunderstandingofthe lab objectives and concepts. The studentcan correctly answer questions and if appropriate, can explain concepts to fellow classmates. Student is eager to participate and assists whenneeded.	Labperformance isgood.Atmost, the student has one lab absence. Student demonstrates a fair understanding of thelabobjectives and concepts. Thestudentcan answer questions.	Lab performanceis adequate. The student is absentmorethan 2 classes. Student arrives on timetolab, but may be unprepared. Answers to questions are basic and superficial suggestingthat concepts are not fully grasped	Labperformanceis fair. The student may have been absent 3-4 times. Student unpreparedness makes it impossibletofully participate. If able to participate, student has difficulty explainingkeylab concepts.	Labperformanceis barely adequate. The student is irregular. Studentwaslateto lab or did not participate. There was no attempt to make prior arrangements to make up the lab.

Dr. T.THIMMAIAHINSTITUTEOFTECHNOLOGY

Departmentof Computer Scienceand Engineering.

DEVOPS - BCSL657D
Contents

EVALVUATION SHEET

Sl. No	Date of Conduction	TITLE OF THE EXPERIMENT	Date of Submission	Conduction (20)	Faculty sign with Date
1		Introduction to Maven and Gradle: Overview of Build Automation Tools, Key Differences Between Maven and Gradle, Installation and Setup			
2		Working with Maven: Creating a Maven Project, Understanding the POM File, Dependency Management and Plugins			
3		Working with Gradle: Setting Up a Gradle Project, Understanding Build Scripts (Groovy and Kotlin DSL), Dependency Management and Task Automation			
4		Practical Exercise: Build and Run a Java Application with Maven, Migrate the Same Application to Gradle			
5		Introduction to Jenkins: What is Jenkins?, Installing Jenkins on Local or Cloud Environment, Configuring Jenkins for First Use			
6		Continuous Integration with Jenkins: Setting Up a CI Pipeline, Integrating Jenkins with Maven/Gradle, Running Automated Builds and Tests			
7		Configuration Management with Ansible: Basics of Ansible: Inventory, Playbooks, and Modules, Automating Server Configurations with Playbooks, Hands-On: Writing and Running a Basic Playbook			
8		Practical Exercise: Set Up a Jenkins CI Pipeline for a Maven Project, Use Ansible to Deploy Artifacts Generated by Jenkins			
9		Introduction to Azure DevOps: Overview of Azure DevOps Services, Setting Up an Azure DevOps Account and Project			
10		Creating Build Pipelines: Building a Maven/Gradle Project with Azure Pipelines, Integrating Code Repositories (e.g., GitHub, Azure Repos), Running Unit Tests and Generating Reports			
11		Creating Release Pipelines: Deploying Applications to Azure App Services, Managing Secrets and Configuration with Azure Key Vault, Hands-On: Continuous Deployment with Azure Pipelines			
12		Practical Exercise and Wrap-Up: Build and Deploy a Complete DevOps Pipeline, Discussion on Best Practices and Q&A			
Average of Conduction					

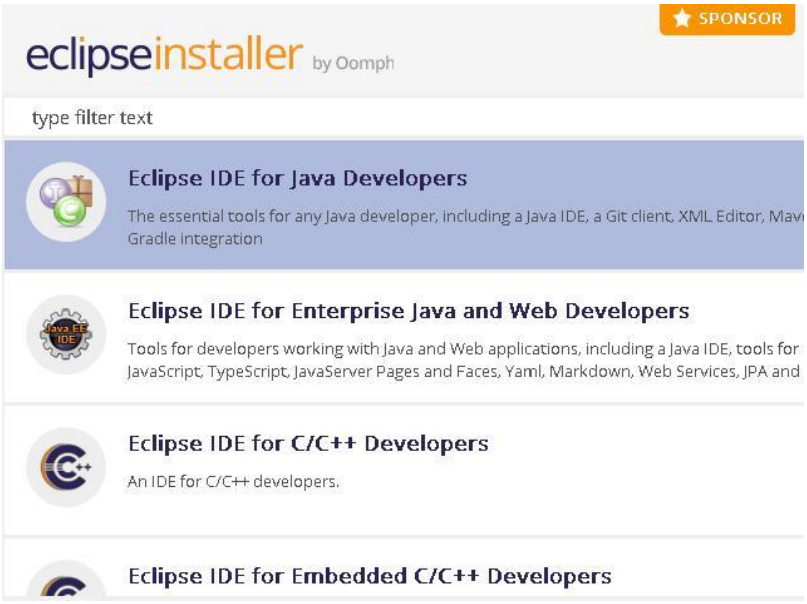
PROGRAM-1

Introduction to Maven and Gradle: Overview of Build Automation Tools, Key Differences Between Maven and Gradle, Installation and Setup

STEP1:Install Eclipse using this link

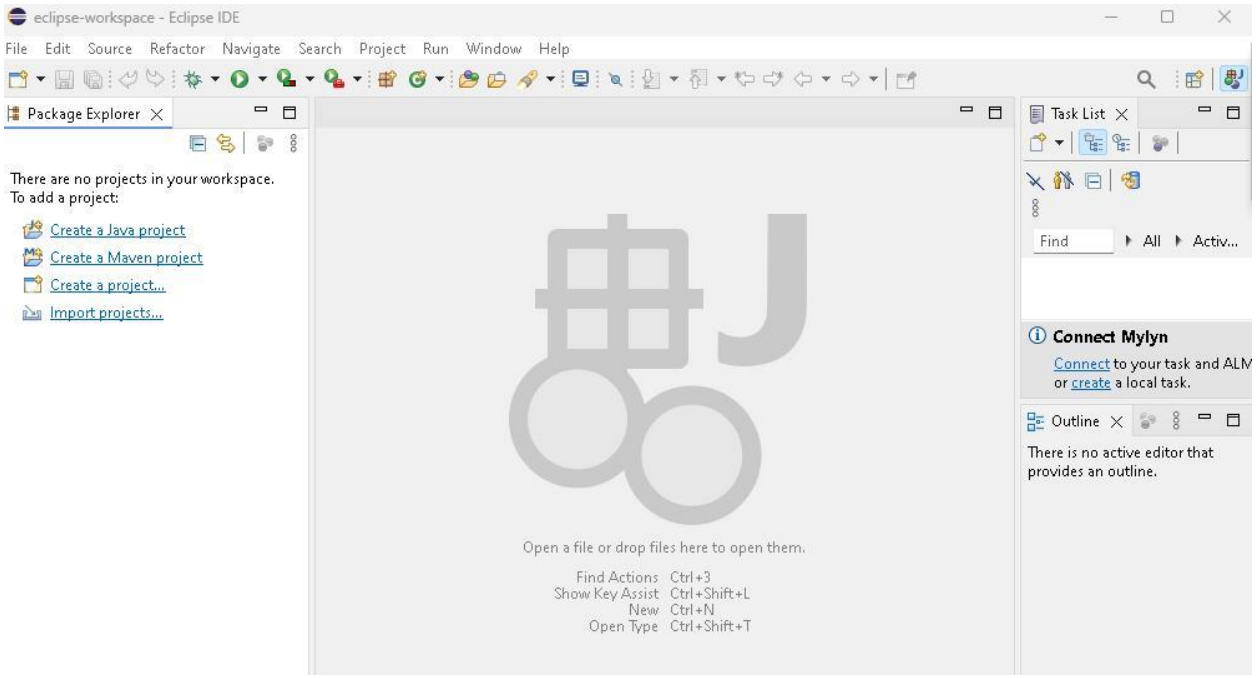
https://www.eclipse.org/downloads/

ENTERPRISE JAVA AND WEB DEVELOPERS



STEP2:Select ECLIPSE IDE FOR JAVA DEVELOPER OR ECLIPSE IDE FOR STEP3:SELECT INSTALLATION FOLDER JAVA VERSION

STEP4:ONCE ECLIPSE IS INSTALLED THE SCREEN LOOKS AS IN BELOW



STEP5:Lets see Procedure to install MAVEN & GRADLE

a) First make sure JDK current version is installed

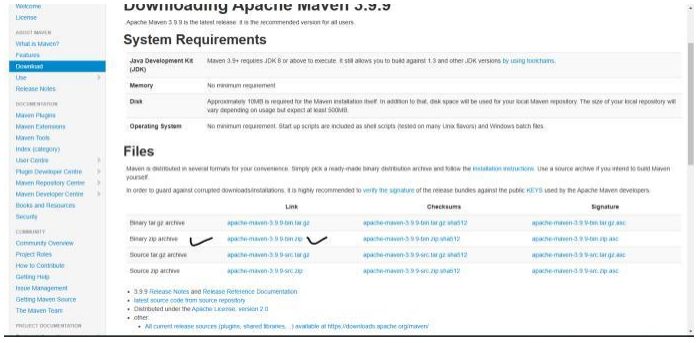
https://www.oracle.com/java/technologies/downloads/?er=221886#jdk23-wi ndows

Then set environment variable path both user and system

- **Have a JDK installation on your system. Either set the JAVA_HOME environment variable pointing to your JDK installation or have the java executable on your PATH.**

b) To install apache maven pls go to link as in below and download zip file of bin

https://maven.apache.org/download.cgi



c) To unzip the Source zip archive

Run in Windows cmd prompt

unzip apache-maven-3.9.9-bin.zip

If don't want to run directly extract the file to Program Files

d) Setup a PATH in environmental settings

"Add the bin directory of the created directory apache-maven-3.9.9 to the PATH environment variable"

e) After environment variable is set

Run this command in CMD prompt

mvn --v(2 hyphen)

After running, you see the text screen as in below

```
Apache Maven 3.9.9 (8e8579a9e76f7d015ee5ec7bfcdc97d260186937)
Maven home: /opt/apache-maven-3.9.9
Java version: 1.8.0_45, vendor: Oracle Corporation
Java home: /Library/Java/JavaVirtualMachines/jdk1.8.0_45.jdk/Contents/Home/jre
Default locale: en_US, platform encoding: UTF-8
OS name: "mac os x", version: "10.8.5", arch: "x86_64", family: "mac"
```

f) TO INSTALL GRADLE FOR WINDOWS follow procedure as in below

1. Create a new directory C:\Gradle with File Explorer.

2. Open a second File Explorer window and go to the directory where the Gradle distribution was downloaded. Double-click the ZIP archive to expose the content. Drag the content folder gradle-8.12.1 to your newly created C:\Gradle folder.

Alternatively you can unpack the Gradle distribution ZIP into C:\Gradle using an archiver tool of your choice or run command with path folder where the folder is created.

unzip apache-maven-3.9.9-bin.zip

Or can directly extract the zip file.

3. Configure your system environment

4. Finally type the command gradle –v to check if the gradle is installed.

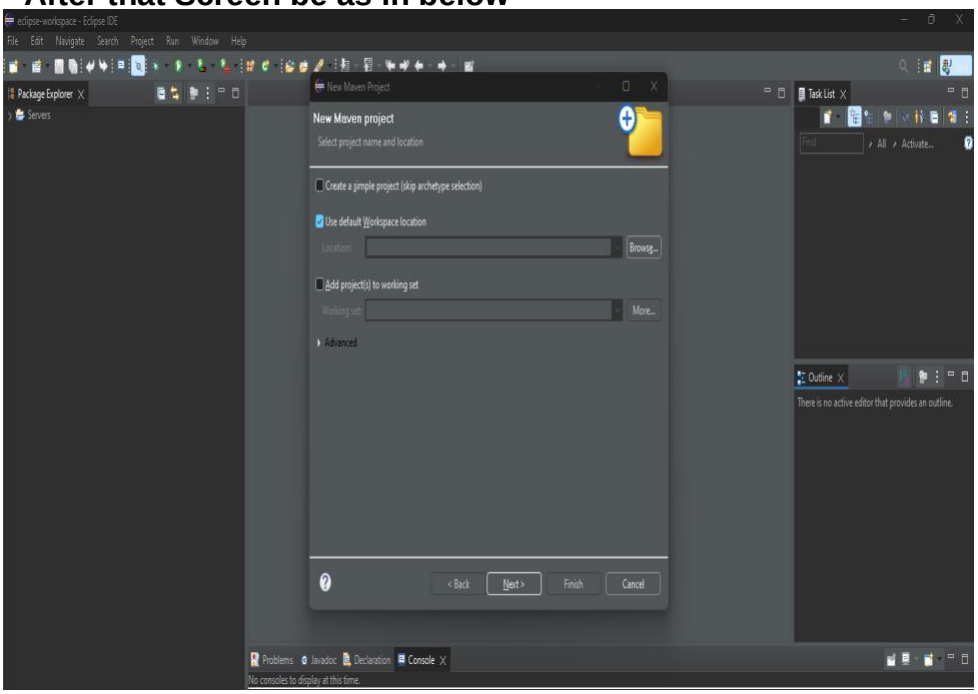
PROGRAM-2

Working with Maven: Creating a Maven Project, Understanding the POM File, Dependency Management and Plugins

STEP1:OPEN ECLIPSE THEN follow this navigation

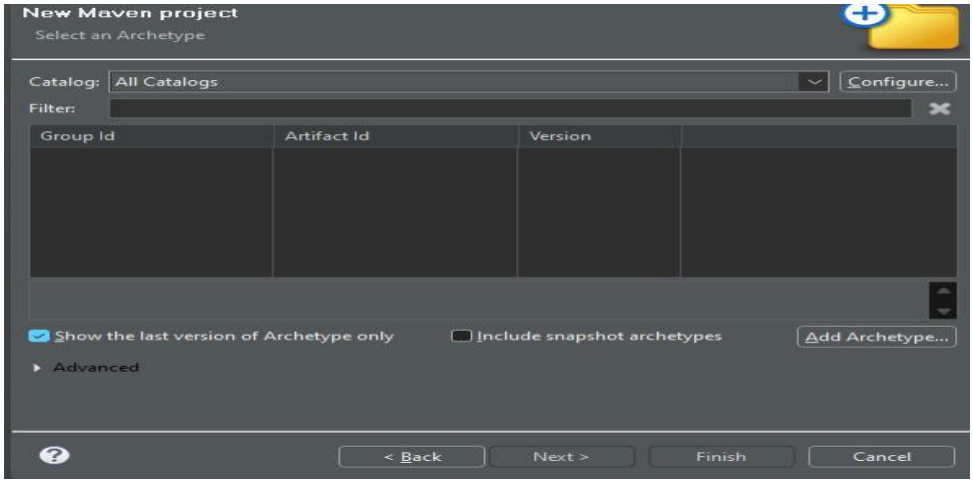
FIle —-----> New —------>Maven Project

After that Screen be as in below



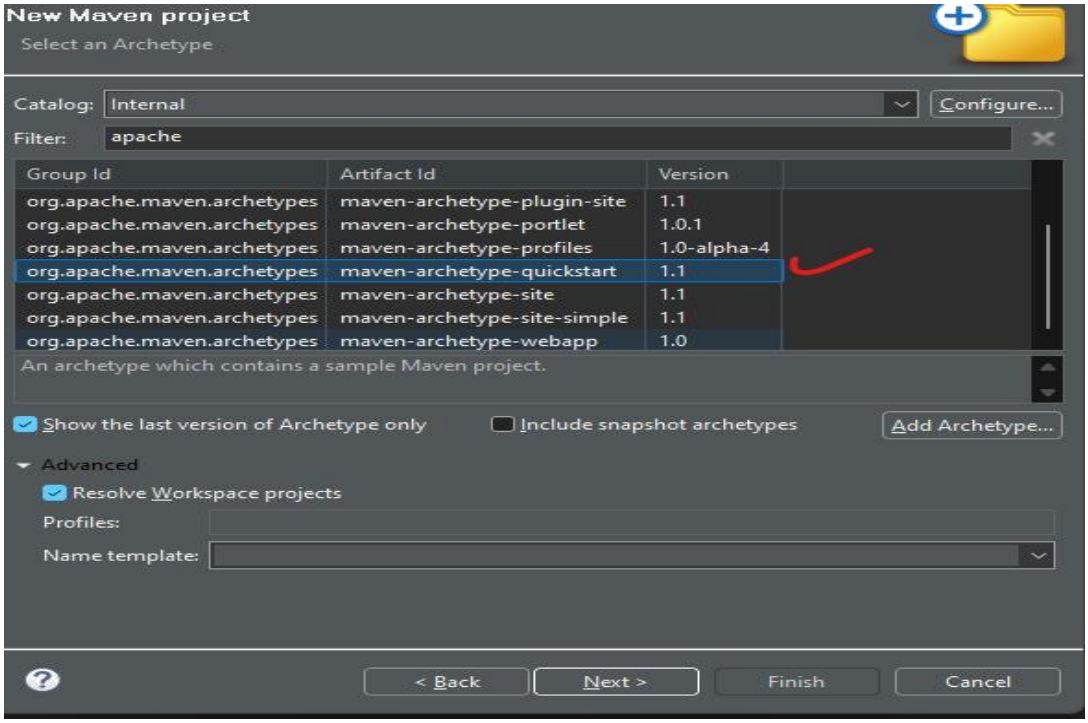
STEP2: Make sure Use default Workspace Location is selected, then click Next

The screen be as in below



STEP3:In Screen shown above, click near the entry place of Filter and type “apache” or select catalog as Internal

We want a simple maven JAR based application. So, we will choose the “maven-archetype-quickstart” artifact to create the project.



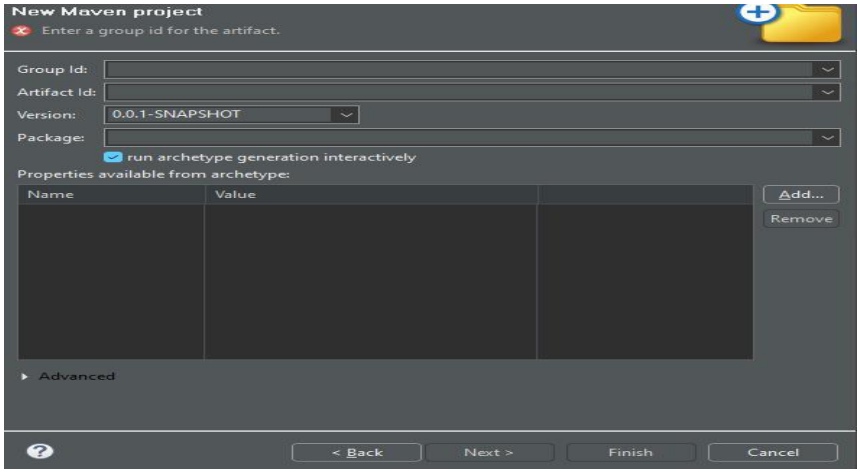
STEP4: Enter

Group Id:com.program2.maven

Artifact Id:program2-example-jar

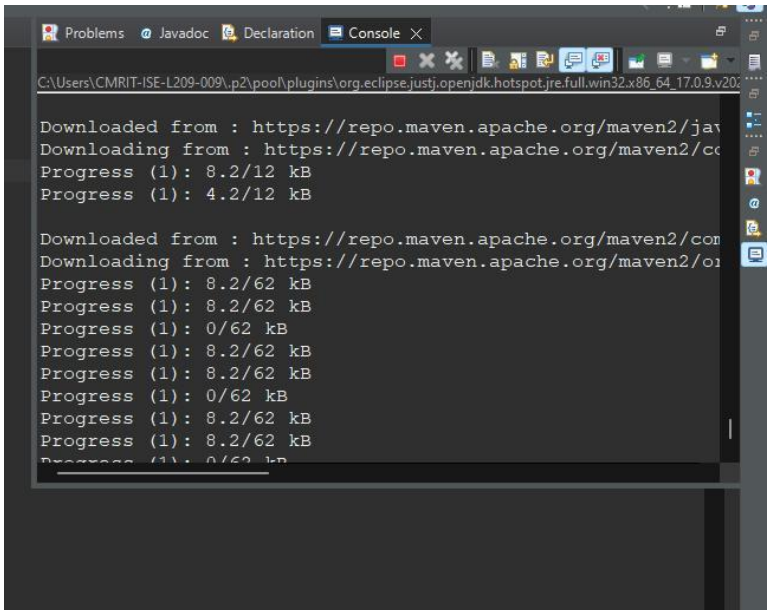
Keep snapshot as it is

Package:com.program2.maven.program2



After entering above mentioned details click on Finish

You be able to see the automation build happening for Maven Jar Pro



It asks for Configuration confirmation just click Y

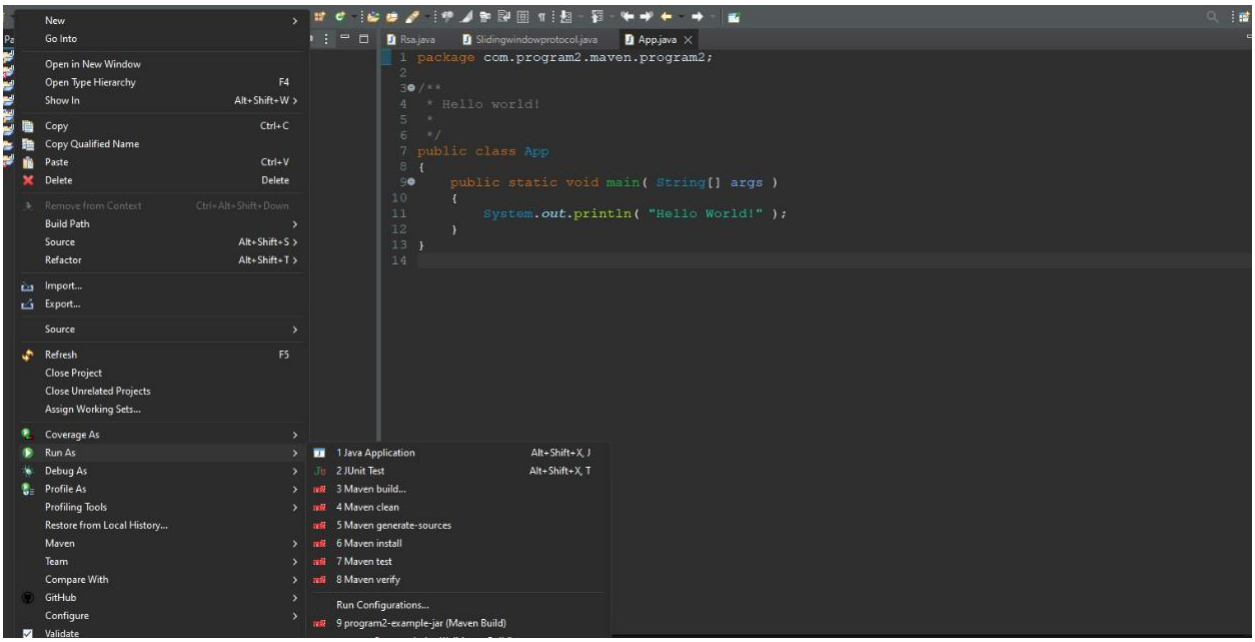
```
Confirm properties configuration:
groupId: com.program2.maven
artifactId: program2-example-jar
version: 0.0.1-SNAPSHOT
package: com.program2.maven.program2
```

The RESULT be as in below

```
package: com.program2.maven.program2
 Y: y
[INFO] ----------------------------------------------------------------------------
[INFO] Using following parameters for creating project from Old (1.x) Archetype: maven-archetype-quickstart:1.1
[INFO] ----------------------------------------------------------------------------
[INFO] Parameter: basedir, Value: C:\Users\CMRIT-ISE-L209-009\Desktop\IS147
[INFO] Parameter: package, Value: com.program2.maven.program2
[INFO] Parameter: groupId, Value: com.program2.maven
[INFO] Parameter: artifactId, Value: program2-example-jar
[INFO] Parameter: packageName, Value: com.program2.maven.program2
[INFO] Parameter: version, Value: 0.0.1-SNAPSHOT
[INFO] project created from Old (1.x) Archetype in dir: C:\Users\CMRIT-ISE-L209-009\Desktop\IS147\program2-example-
[INFO] ------------------------------------------------------------------------
[INFO] BUILD SUCCESS
[INFO] ------------------------------------------------------------------------
[INFO] Total time:  03:37 min
[INFO] Finished at: 2025-01-29T10:31:45+05:30
[INFO] ------------------------------------------------------------------------
```

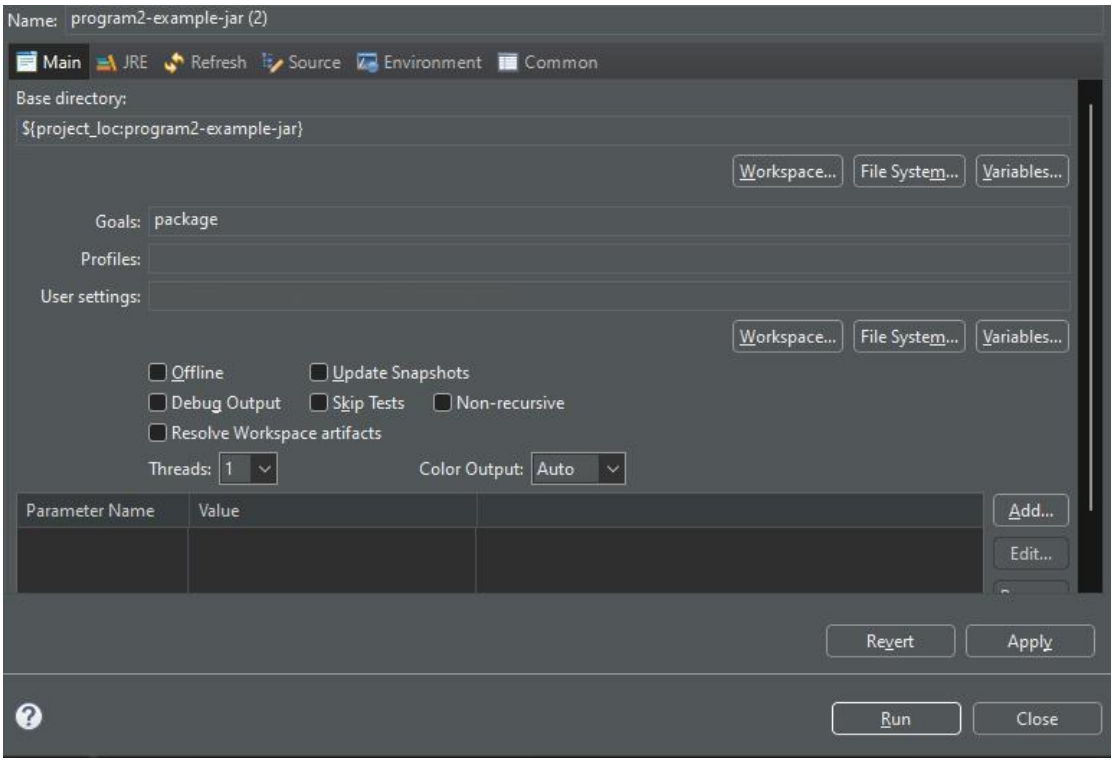
STEP5: Now its time to build Maven Project

Go to Maven Project —---------->Right Click on the Project and select Maven Build



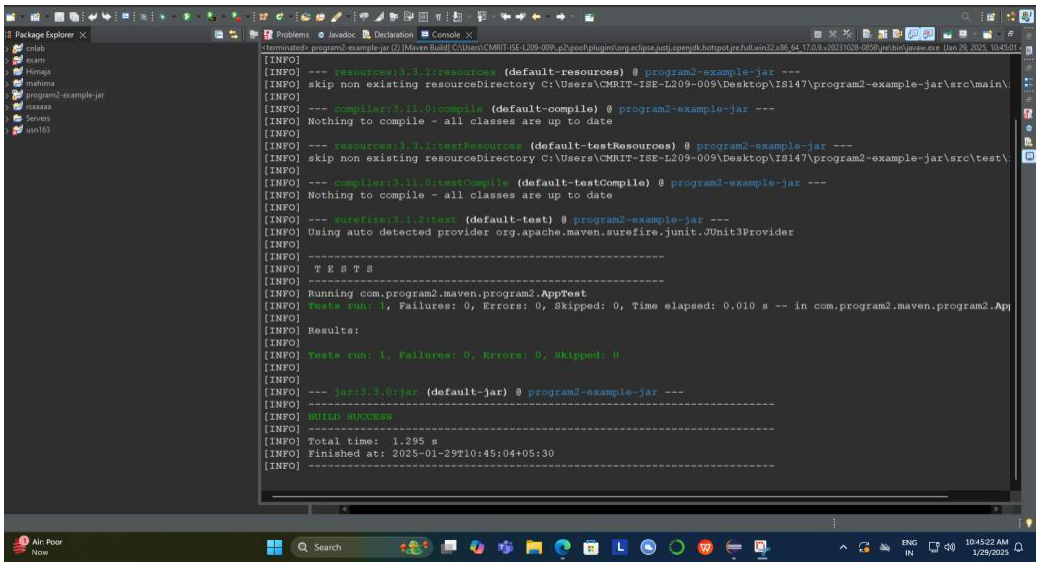
After the above procedure is done

Select Goal as package

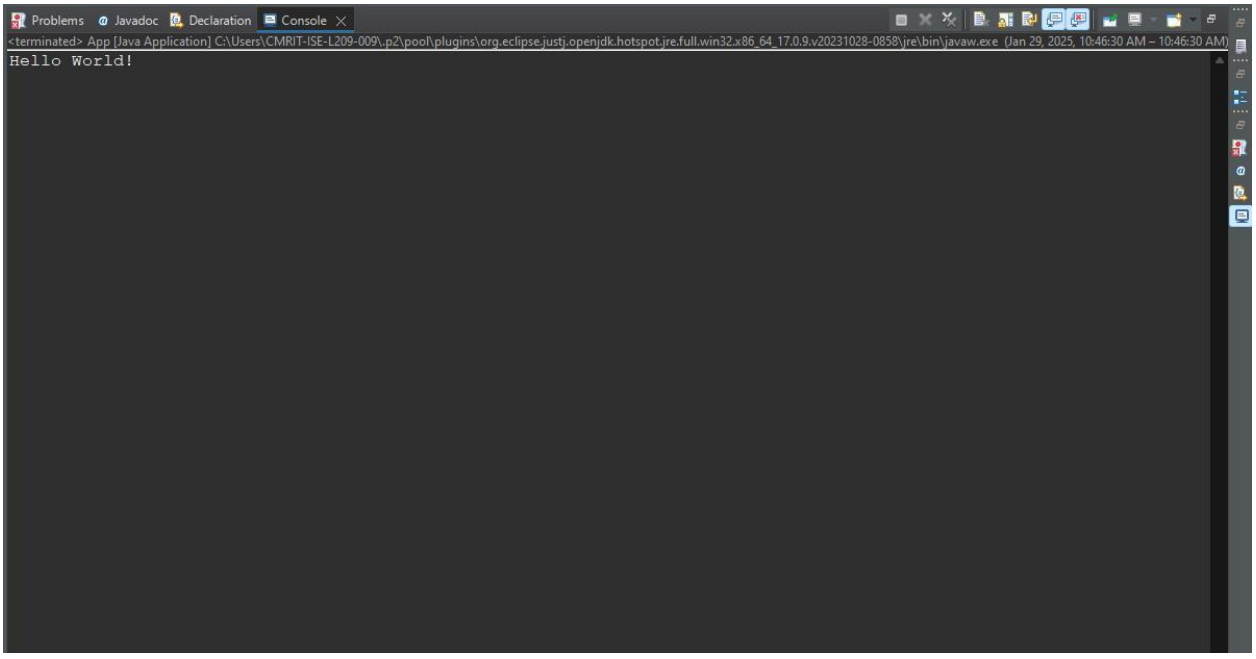


And Click Run

The result be as in below



Now goto App.java finally run java application



Description

What is groupId in maven ?

groupId identifies a particular project uniquely across all projects, so we should follow a naming convention. A very simple and commonly used way of doing this is to use the reverse of your domain, i.e. com.javarewind.maven.
A good way of maintaining the integrity of groupId is to use the project structure. In case the project consists of multiple modules then every module should append an identifier to the parent groupId. i.e. com.javarewind.maven, com.java rewind.spring, com.javarewind.struts .. etc.

What is artifactId in maven ?

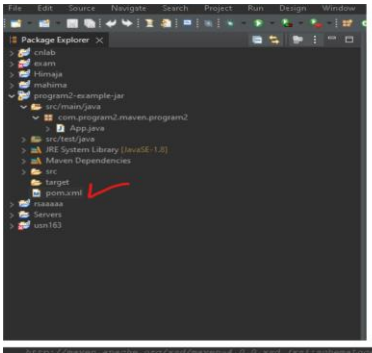
artifactId is the name of war file without version, if you are creating it by yourself you are free to took any name of your choice in lower case and without any strange symbol. But if this is a third party jar than we have to take the name of the jar as suggested by its distribution.

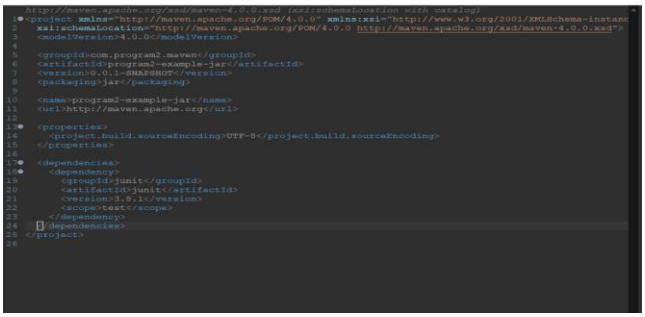
What is the archetype in maven ?

Archetype is a Maven project templating toolkit which tells the maven the type of project we are going to create. Archetype enables the maven to create a template project of the user's choice so that the user can get the project up and running instantly.

“archetype:generate” generates a new project from the provided archetype or updates the actual project if using a partial archetype. Maven provides a number of predefined archtypes, see more details from Maven Documentation.

HOW POM.XML LOOKS IS AS IN SCREEN BELOW





PROGRAM 3:

Working with Gradle: Setting Up a Gradle Project, Understanding Build Scripts (Groovy and Kotlin DSL), Dependency Management and Task Automation

STEP1:Let's do this in cmd prompt
Goto Command Prompt

Then first make a new directory the command is

mkdir pgm3

For changing to a current directory the command is

cd pgm3

Now run

gradle init

After execution of command the screen shows as in below where we opt for build type select as 1

```
C:\Users\CMRIT-ISE-L209-009\gradletest>gradle init
Starting a Gradle Daemon (subsequent builds will be faster)

Select type of build to generate:
  1: Application
  2: Library
  3: Gradle plugin
  4: Basic (build structure only)
Enter selection (default: Application) [1..4] 1
```

After selecting application type next it asks for Implementation language select as groovy

```
Select implementation language:
  1: Java
  2: Kotlin
  3: Groovy
  4: Scala
  5: C++
  6: Swift
Enter selection (default: Java) [1..6] 3
```

After selecting Implementation language it will ask for Java version and project name

```
Enter selection (default: Java) [1..6] 3

Enter target Java version (min: 7, default: 21): 21

Project name (default: gradletest): gradletest
```

After providing version and project name
Select application structure as Single application structure and Domain Specific Language as Kotlin

```
Select application structure:
  1: Single application project
  2: Application and library project
Enter selection (default: Single application project) [1..2] 1

Select build script DSL:
  1: Kotlin
  2: Groovy
Enter selection (default: Groovy) [1..2] 1
```

After every procedure is over it shows Build successful

```
Generate build using new APIs and behavior (some features may change in the next minor release)? (default: no) [yes, no] yes


> Task :init
Learn more about Gradle by exploring our Samples at https://docs.gradle.org/8.12.1/samples/sample_building_groovy_applications.html

BUILD SUCCESSFUL in 2m 2s
1 actionable task: 1 executed
```

STEP2:Now its time to Build the script
Just type the command as:
gradlew run

It will take atleast 3-5 minutes to run the configuration script we have set through steps finally the output be as in below If You want to see the structure of an application run the command as tree

```
C:\Users\CMRIT-ISE-L209-009\gradletest>gradlew run
Calculating task graph as no cached configuration is available for tasks: run

> Task :app:run
Hello World!
```

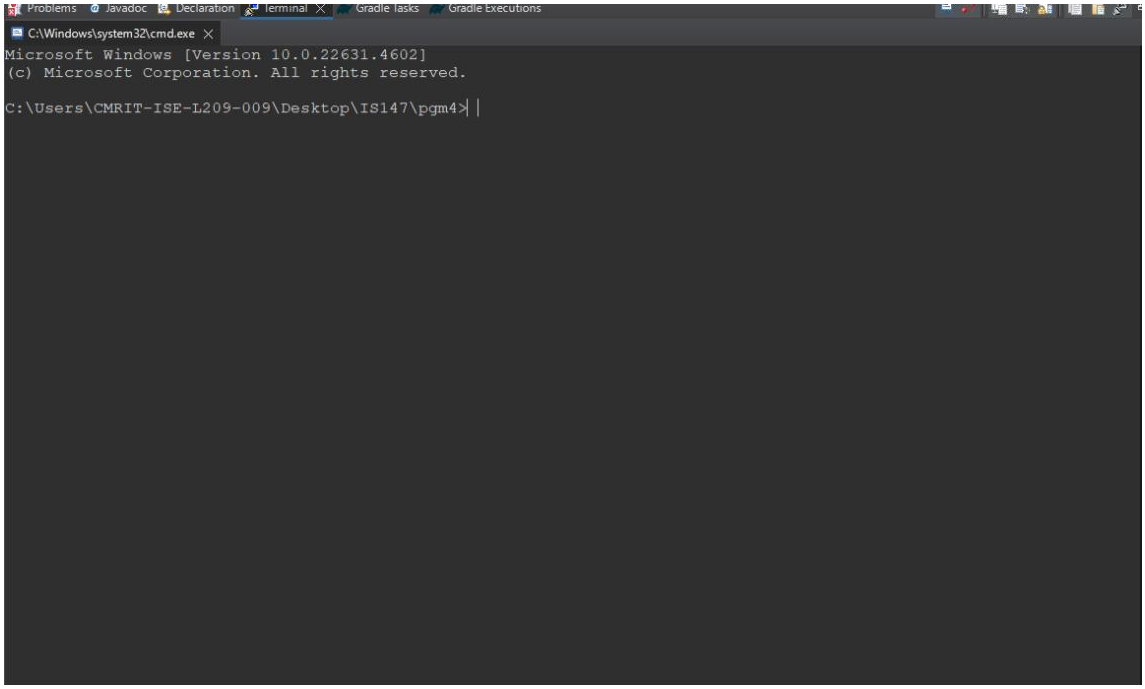
```
C:\Users\CMRIT-ISE-L209-009\gradletest>tree
Folder PATH listing for volume Windows
Volume serial number is CA13-EB08
C:.
├---.gradle
|   ├---8.12.1
|   |   ├---checksums
|   |   ├---executionHistory
|   |   ├---expanded
|   |   ├---fileChanges
|   |   ├---fileHashes
|   |   └---vcsMetadata
|   ├---buildOutputCleanup
|   ├---configuration-cache
|   |   ├---87330068-729b-48ed-8a38-57771bbaae67
|   |   └---8qybe7c3ykh3sf9t2sllkie4w
|   └---vcs-1
├---.settings
├---app
|   ├---build
|   |   ├---classes
|   |   |   └---groovy
|   |   |       └---main
|   |   |           └---org
|   |   |               └---example
|   |   ├---generated
|   |   |   └---sources
|   |   |       └---annotationProcessor
|   |   |           └---groovy
|   |   |               └---main
|   |   └---tmp
|   |       └---compileGroovy
|   |           └---groovy-java-stubs
|   └---src
|       ├---main
|       |   ├---groovy
|       |   |   └---org
|       |   |       └---example
|       |   └---resources
|       └---test
|           ├---groovy
|           |   └---org
```

PROGRAM 4:

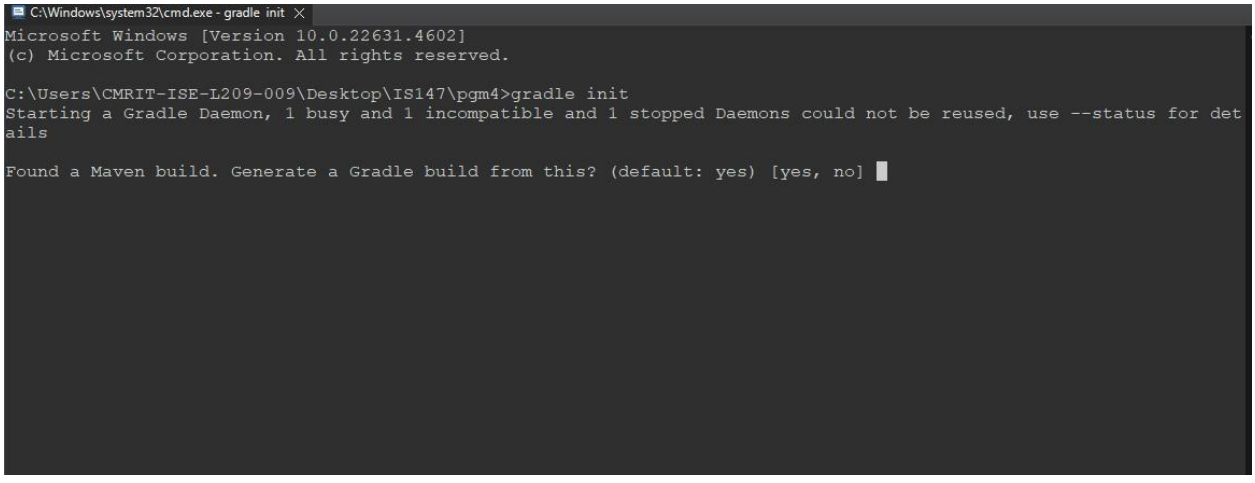
Practical Exercise: Build and Run a Java Application with Maven, Migrate the Same Application to Gradle

STEP1: First create a Maven Project as in PROGRAM2 then build the project and run java application you will get Hello World Message

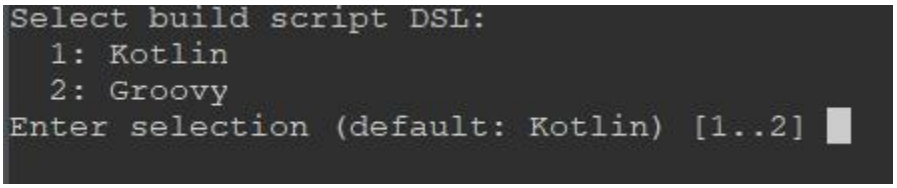
STEP2:Then to migrate to gradle use shortcut Key Ctrl+Alt+Shif+T To get Terminal screen as in below:



STEP3: Type command gradle init it will ask for migrate from maven to gradle type yes

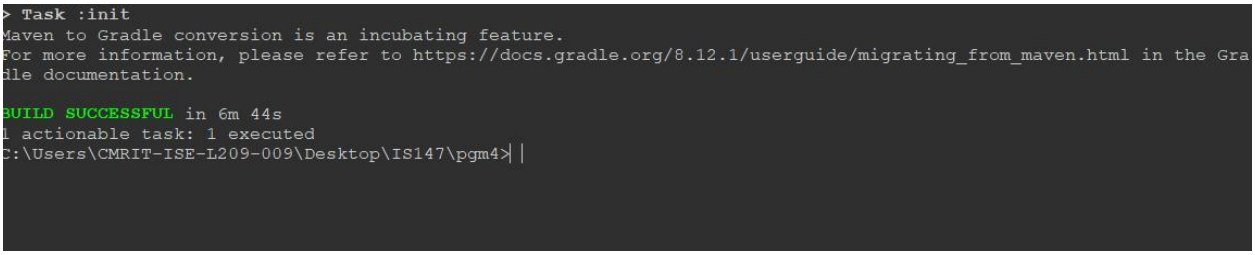


STEP4: After the above command is validated to yes it prompts to select Domain Specific Language as in screen below select 2 (as we have done for Kotlin)



STEP5: After selecting Groovy it asks for validating prompt for API Generator just validate as yes

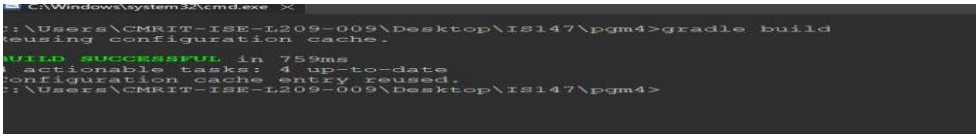
Finally it runs the init phase as been selected



STEP6:

Type the command

gradle build



Now to get exact program output of our java file Locate to build gradle File from ur local repository and Copy paste the code as in below shown in red color

```
plugins {
id("java-library")
id("maven-publish")
id("application")
}

application {
mainClass.set("com.pgm4.test.App") // Use .set() for properties
}

repositories {
mavenCentral()
// Uncomment if you need to publish locally
// mavenLocal()
}

dependencies {
testImplementation("junit:junit:4.13.2") // Use Kotlin syntax for dependencies
}

group = "com.pgm4.test"
version = "0.0.1-SNAPSHOT"
description = "pgm4"
java.sourceCompatibility = JavaVersion.VERSION_11 // Consider upgrading

publishing {
publications {
create<MavenPublication>("maven") {
from(components["java"])
}
}
}

tasks.withType<JavaCompile>().configureEach {
options.encoding = "UTF-8"
}
```

```
tasks.withType<Javadoc>().configureEach {
options.encoding = "UTF-8"
}
```

AFTER DOING ALL CHANGES FINAL STEP

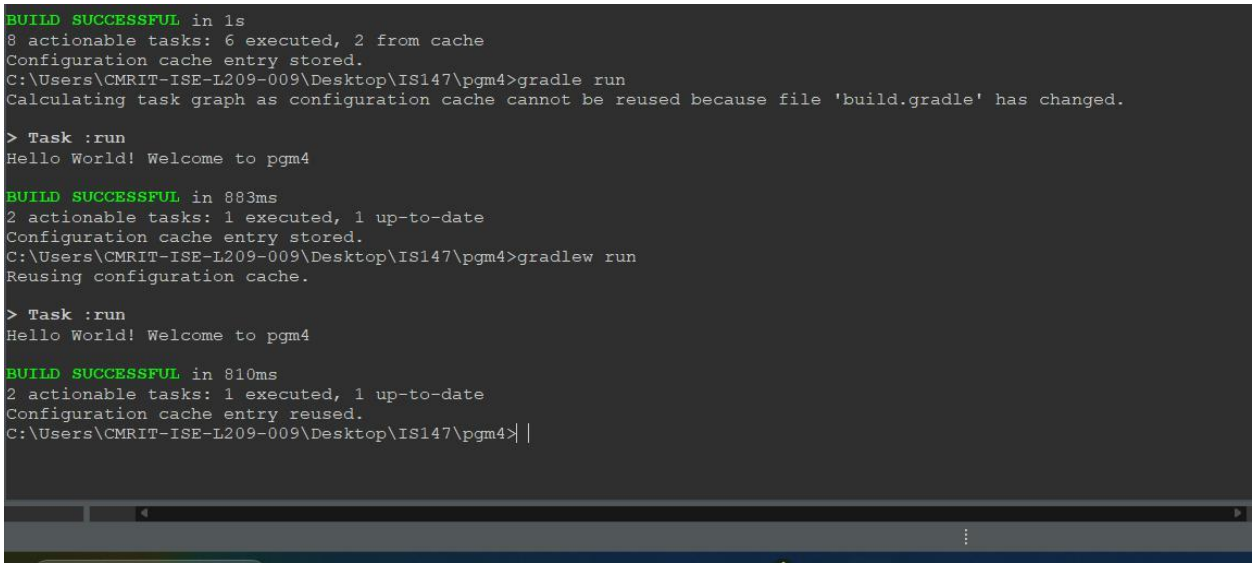
To run commands

gradle clean build

gradle run

You will get Output as

Hello World! Welcome to pgm4

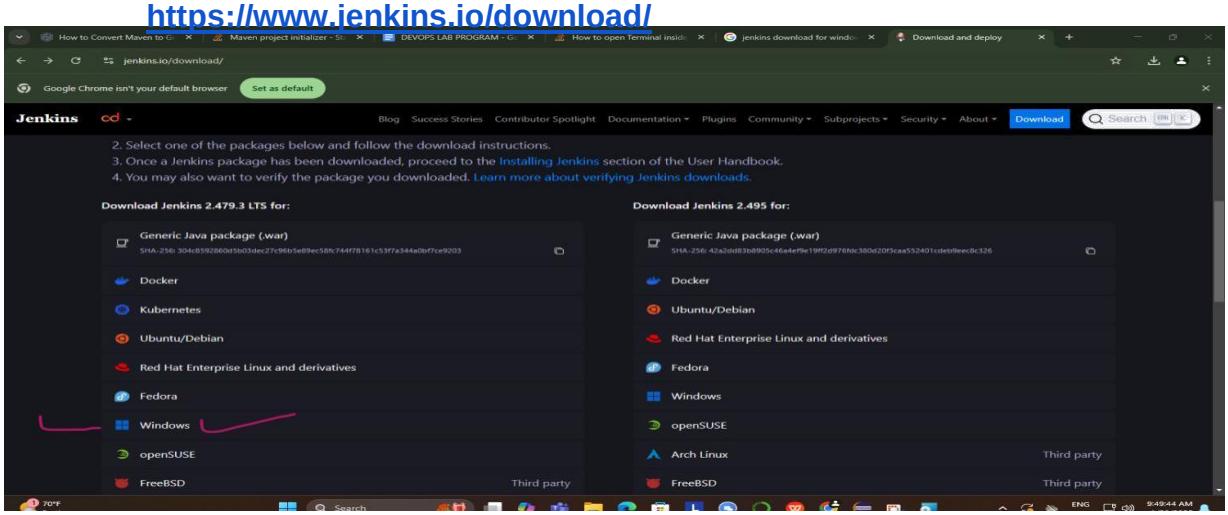


PROGRAM5:

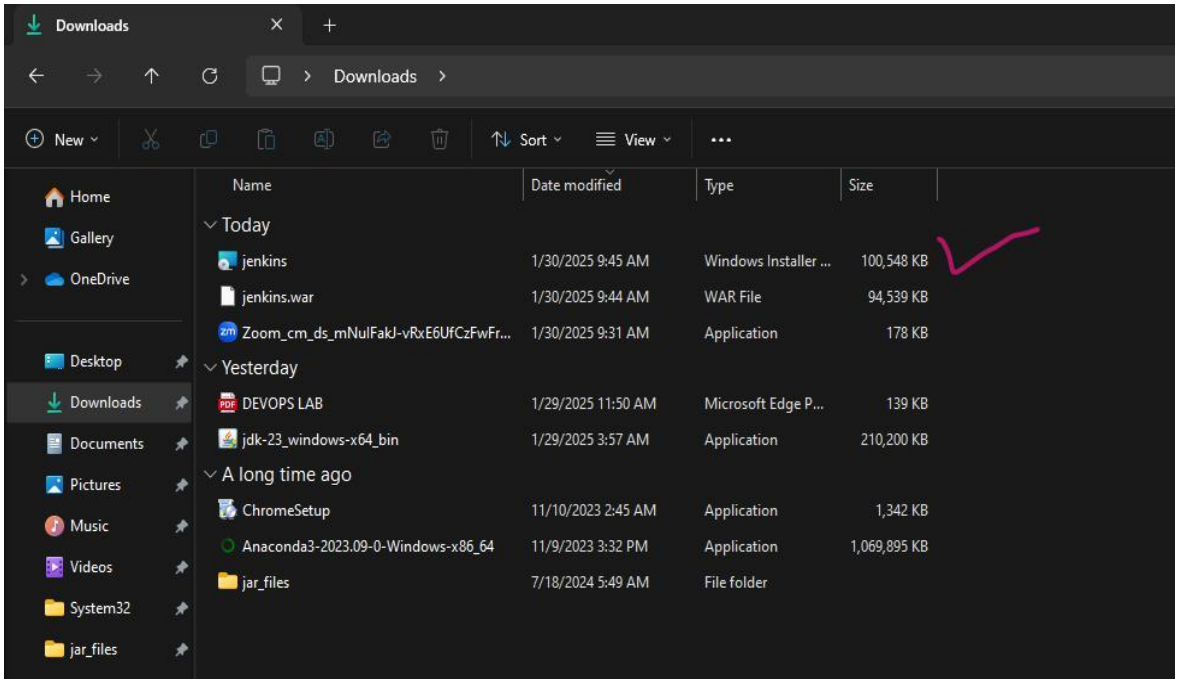
Introduction to Jenkins: What is Jenkins?, Installing Jenkins on Local or Cloud Environment, Configuring Jenkins for First Use .

STEP1: Type jenkins download for windows

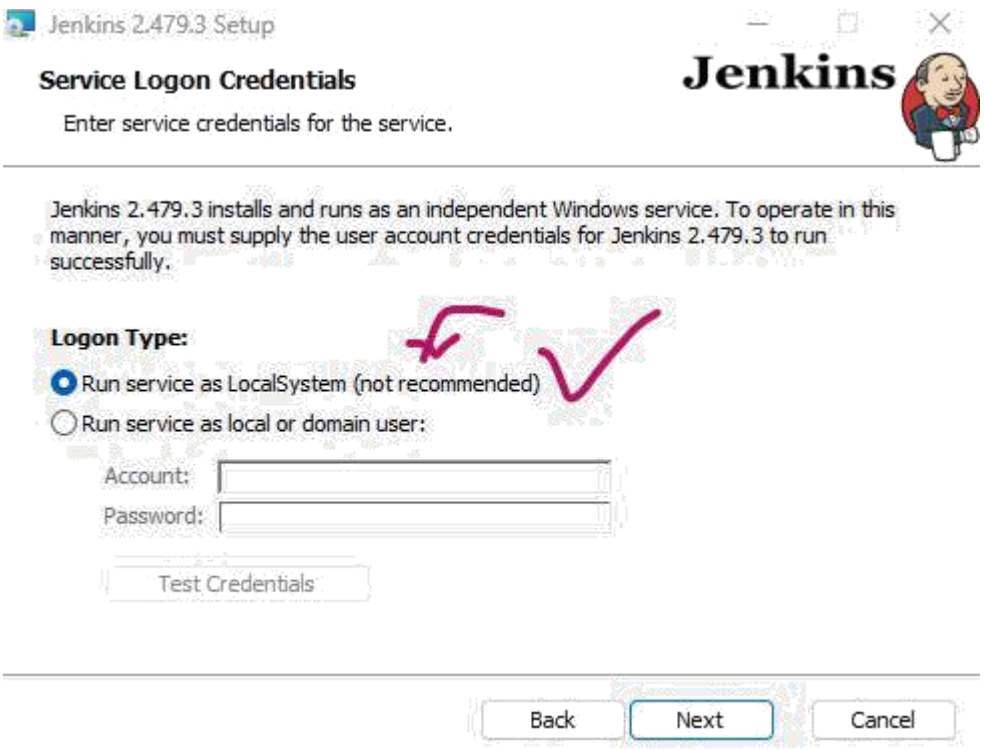
https://www.jenkins.io/download/



STEP2: After clicking on Windows Jenkins MSI Installer exe file be installed



STEP3: Goto Jenkins MSI Installer click on it u opt for "Run service as Local System"



XX Need not to Provide Account & Password XX

STEP4: Choose a port as 8080 and test the port and click Next

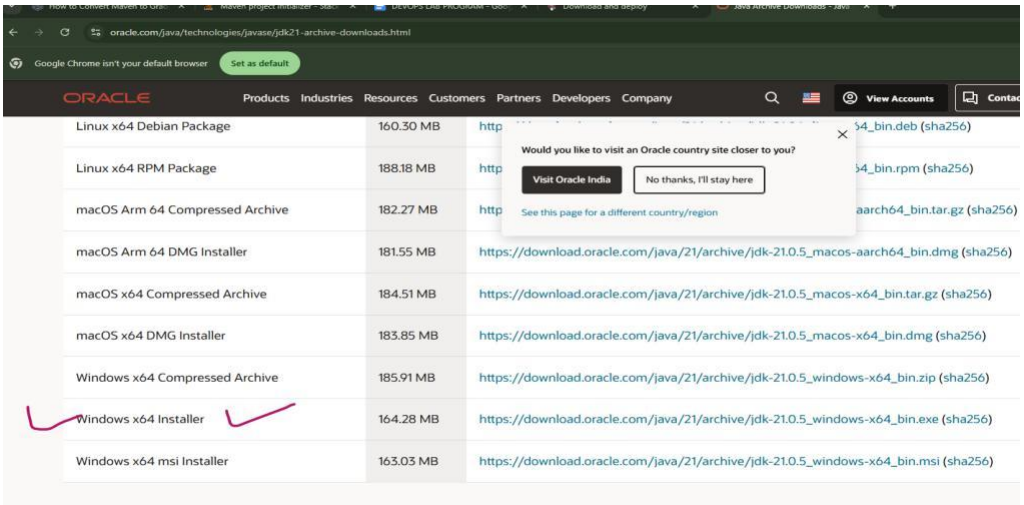
STEP5:It takes current jdk version thats available for safer side once goto cmd prompt and type command

java –version

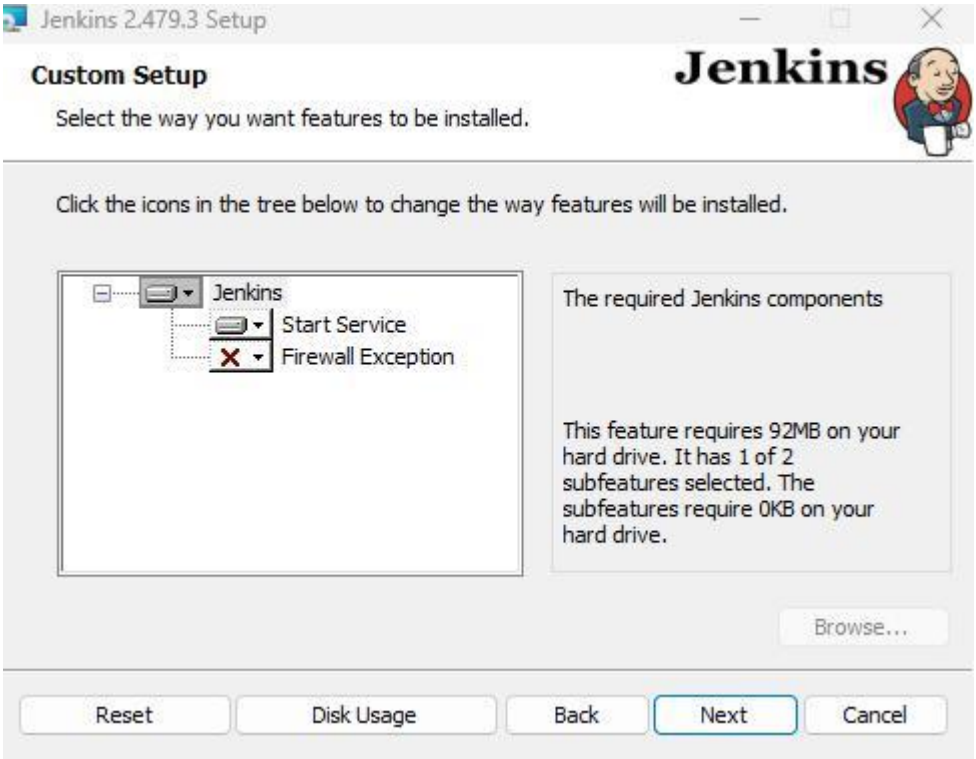
If matching click next

If failed to accept download jdk version 17 to 21 any of it

https://www.oracle.com/java/technologies/javase/jdk21-archive-downloads.html

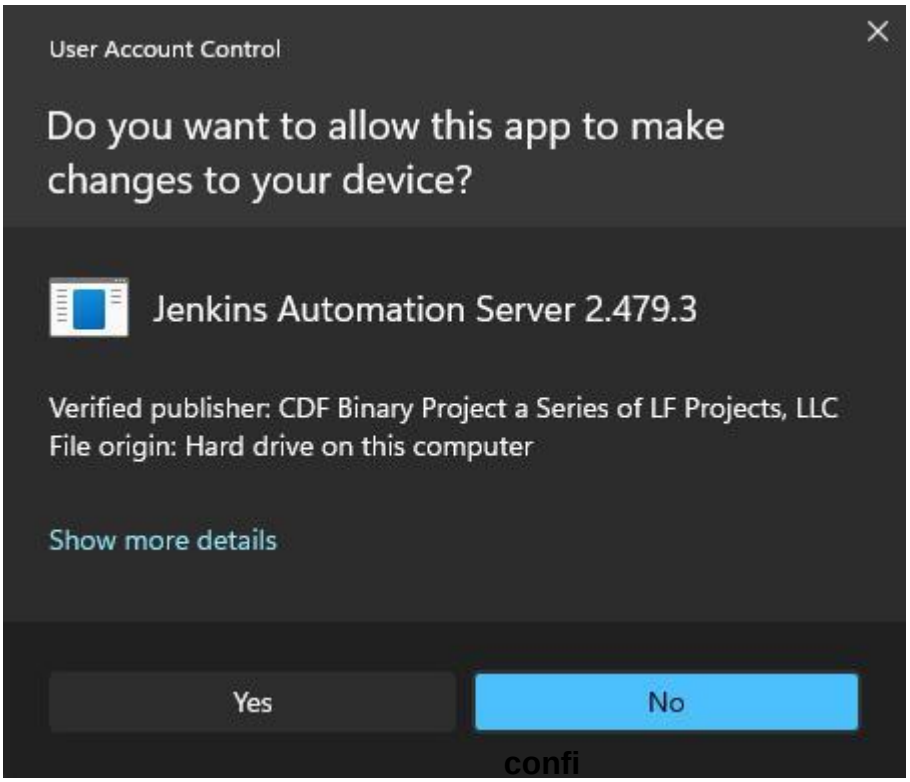


STEP6: Click NEXT after doing above step you will get screen as in Below again continue to click Next



STEP7: The popup allow format comes for Java Automation Server allow it click install —-----> Finally

Click Finish

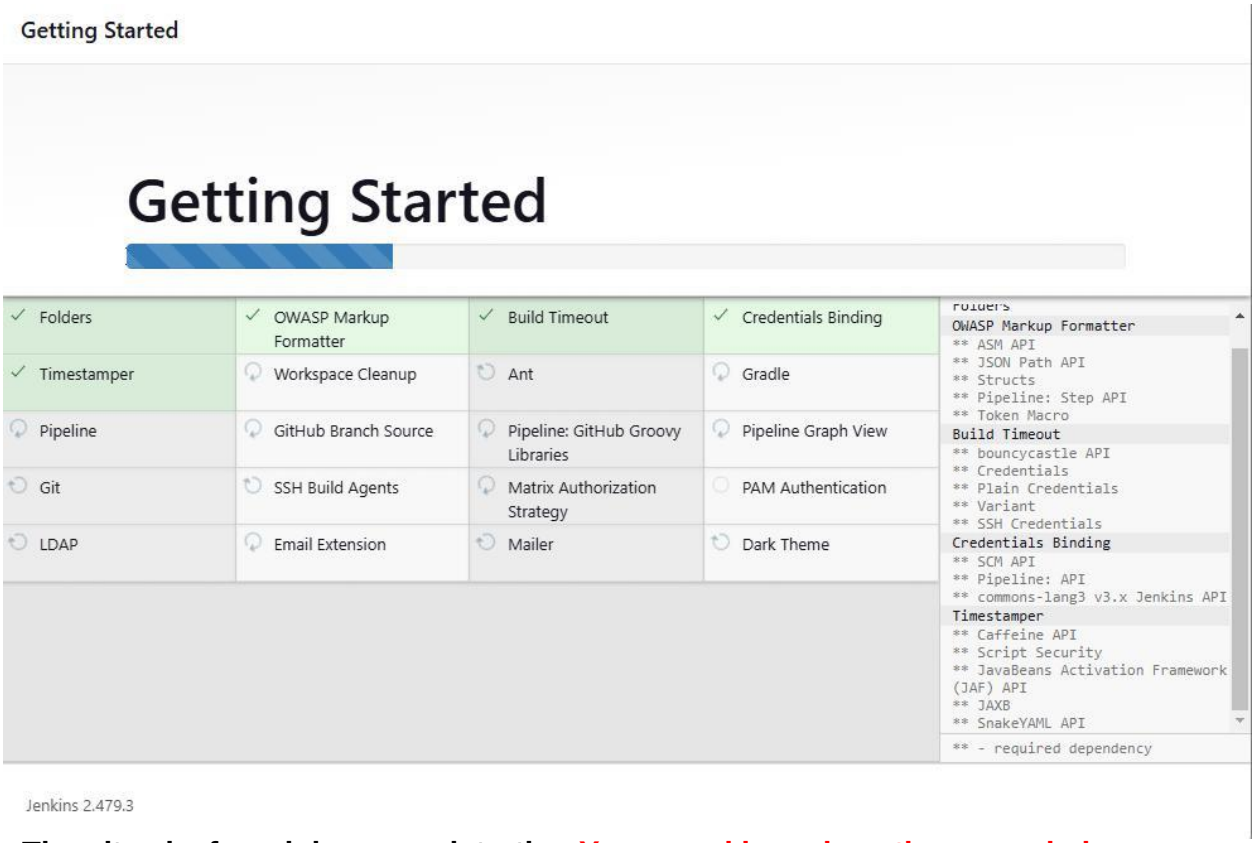


confi

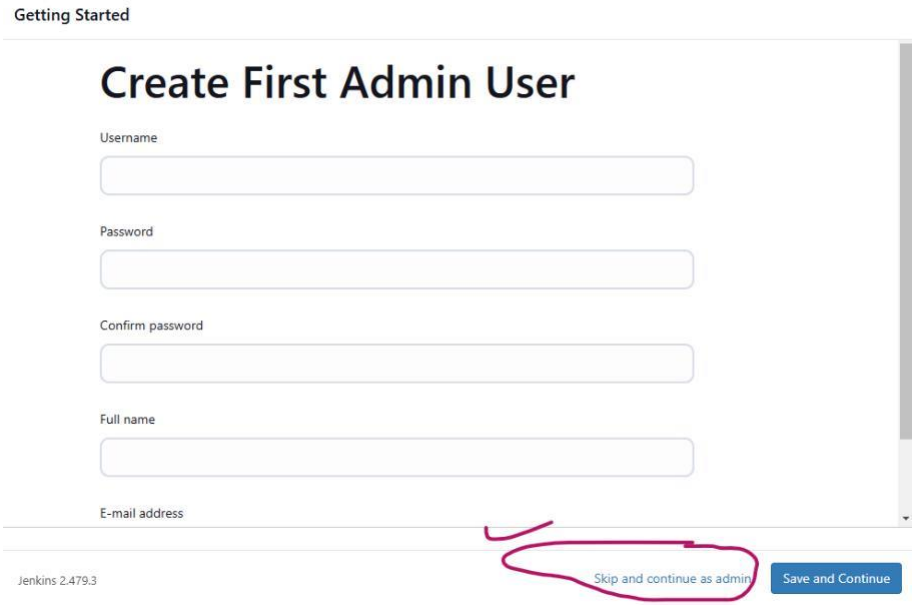
Now By default Our Jenkins run at
http://localhost:8080/

Final step very important Once  **It will ask for Administrator Passowrd so u should locate as in directory mention copy paste as in mention in file location: `C:\ProgramData\Jenkins\.jenkins\secrets\initialAdminPassword` and paste password as in**
mentioned belows administration passowrd

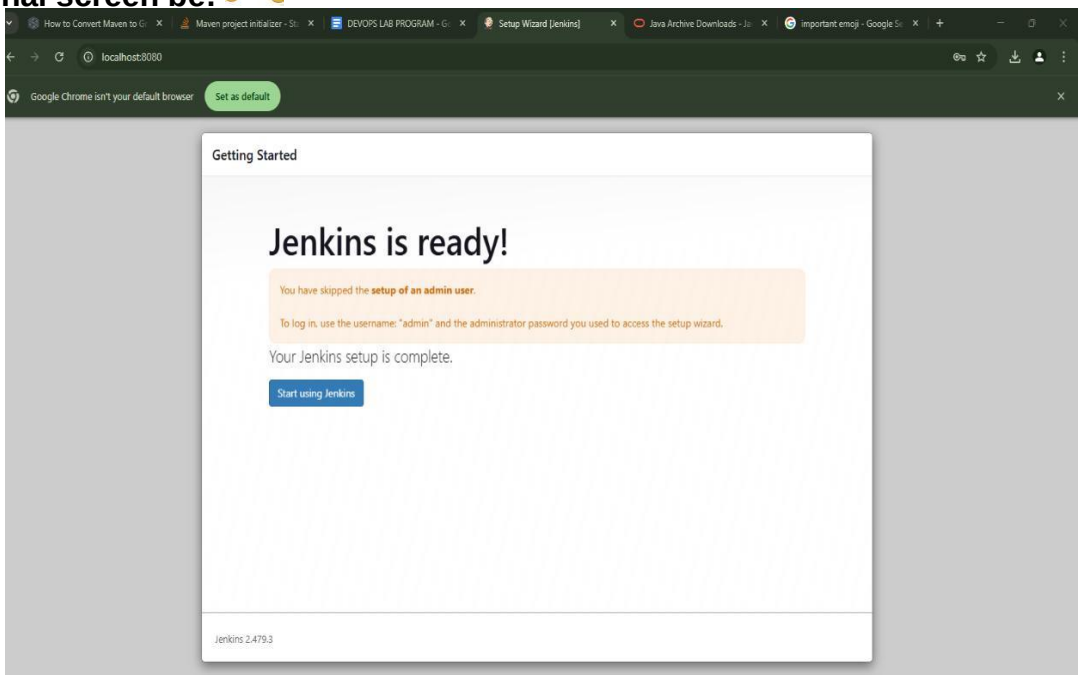
Then select Install Suggested Plugins it starts to install as in shown below



Then it asks for minimum registration You can skip and continue as admin



Final screen be: 



PROGRAM 6 :

Continuous Integration with Jenkins: Setting Up a CI Pipeline, Integrating Jenkins with Maven/Gradle, Running Automated Builds and Tests

How Is Jenkins Used for Continuous Integration?

Continuous Integration (CI) is a software development practice where developers integrate code into a shared repository frequently, usually several times a day. Jenkins is an open-source automation server that facilitates CI by automating the build, testing, and deployment processes.

With Jenkins, developers can easily detect and fix integration issues early, improving collaboration and accelerating software delivery. By continuously integrating code, teams can maintain a high level of code quality, reduce development time, and minimize the risk of release failures.

Continuous Integration Features in Jenkins

Continuous integration involves the automatic building and testing of code whenever changes are committed to the version control system. Jenkins provides several features that facilitate CI, including:

- Version control system integration: Jenkins integrates with various version control systems (VCS) such as Git, Subversion, and Mercurial. This allows Jenkins to monitor repositories for changes, trigger builds, and incorporate updates automatically.
- Build automation: Jenkins supports build automation using build tools like Maven, Gradle, and Ant. It can compile, package, and deploy code, ensuring that the latest changes are continuously integrated into the software project.
- Automated testing: Jenkins can execute automated tests for each build, using testing frameworks like JUnit, TestNG, and Selenium. This ensures that any issues introduced during development are quickly detected and reported, allowing developers to address them promptly.
- Pipeline as code: Jenkins Pipeline allows users to define their entire CI/CD pipeline as code using a domain-specific language called “Groovy.” This makes the pipeline easily versionable, shareable, and more maintainable.
- Distributed builds: Jenkins supports distributed builds across multiple build agents, which

h allows for faster and more efficient build processes by distributing the workload across multiple machines.

- Plugins and extensibility: Jenkins offers a vast ecosystem of plugins that extend its functionality, allowing users to customize and adapt Jenkins to their specific needs. Plugins are available for various tasks, such as integrating with different VCS, build tools, notification systems, and more.
- Notifications and reporting: Jenkins can send notifications through various channels like email, Slack, or other messaging systems to keep the team informed about build status, test results, and potential issues. It also generates reports and visualizations for various metrics, such as test results, code coverage, and build trends.

- Access control and security: Jenkins provides fine-grained access control and user management, allowing administrators to control who can access specific projects, pipelines, or configuration settings. It also supports integration with LDAP and Active Directory for centralized user management.
- REST API: Jenkins exposes a REST API that enables users to interact with Jenkins programmatically, allowing for integration with external tools, automation, and custom applications.

Benefits and Drawbacks of Using Jenkins for CI

Jenkins CI offers numerous benefits that can streamline software development processes and improve overall efficiency:

- Shorter development cycles: By automating repetitive tasks such as building, testing, and deployment, Jenkins CI reduces the time developers spend on manual tasks, enabling them to focus on writing code and addressing critical issues. This accelerates the development cycle and speeds up time-to-market.
- Fast code integration: Jenkins CI facilitates frequent code integration into a shared repository, making it easier to detect and fix integration issues early on. This prevents the accumulation of integration problems, leading to more stable and reliable software.
- Short feedback loops: The automation provided by Jenkins CI allows developers to receive immediate feedback on the success or failure of their code changes. Rapid feedback helps in identifying problems early, ensuring that they can be addressed before they become more difficult and time-consuming to resolve.

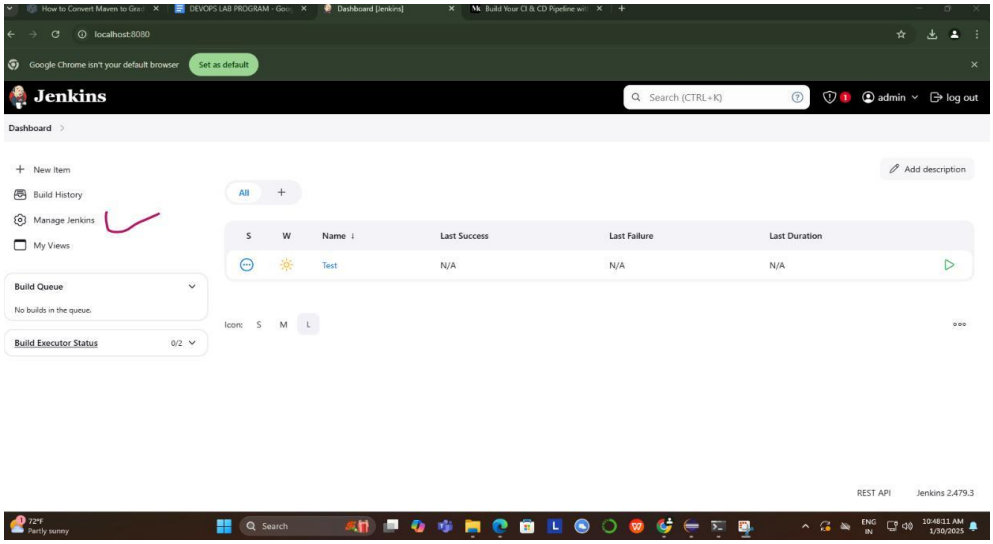
- Automated workflows: Jenkins CI can be configured to trigger automated workflows based on specific events, such as code commits or pull requests. This enables a seamless and efficient flow of work, helping teams maintain a high level of productivity and consistency.

However, there are potential concerns associated with using Jenkins CI:

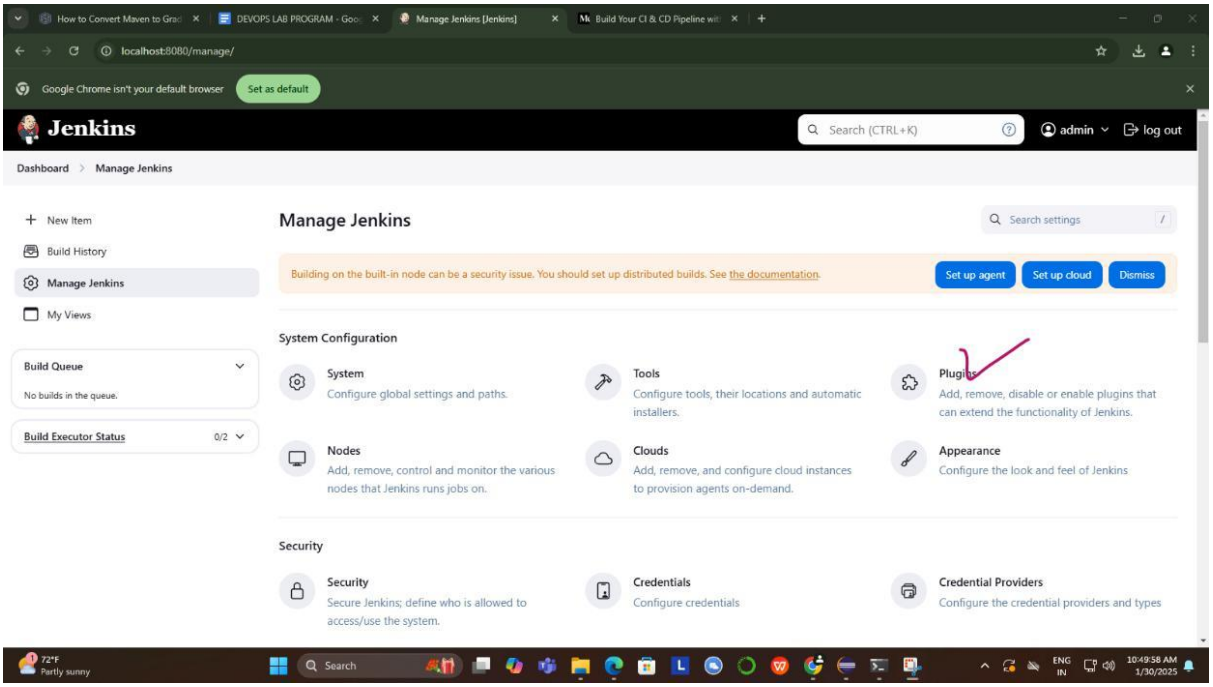
- Expense: Although Jenkins itself is an open-source tool, the resources and infrastructure required to run and maintain it can be costly, especially for larger projects or organizations. Costs may include hardware, cloud services, or additional plugins and integrations needed for specific use cases.
- Maintenance: Jenkins CI requires regular maintenance to ensure its optimal performance, including updating plugins, monitoring the system for potential issues, and troubleshooting any problems that arise. This maintenance can be time-consuming and may require dedicated personnel with expertise in Jenkins and the underlying technologies.
- Not cloud native: Jenkins was designed before the advent of cloud computing, which means it doesn't naturally lend itself to cloud-based environments. To make Jenkins work in a cloud environment, substantial customization and additional tooling may be needed.

STEP1: Now coming to our Program to set CI Pipeline for Maven

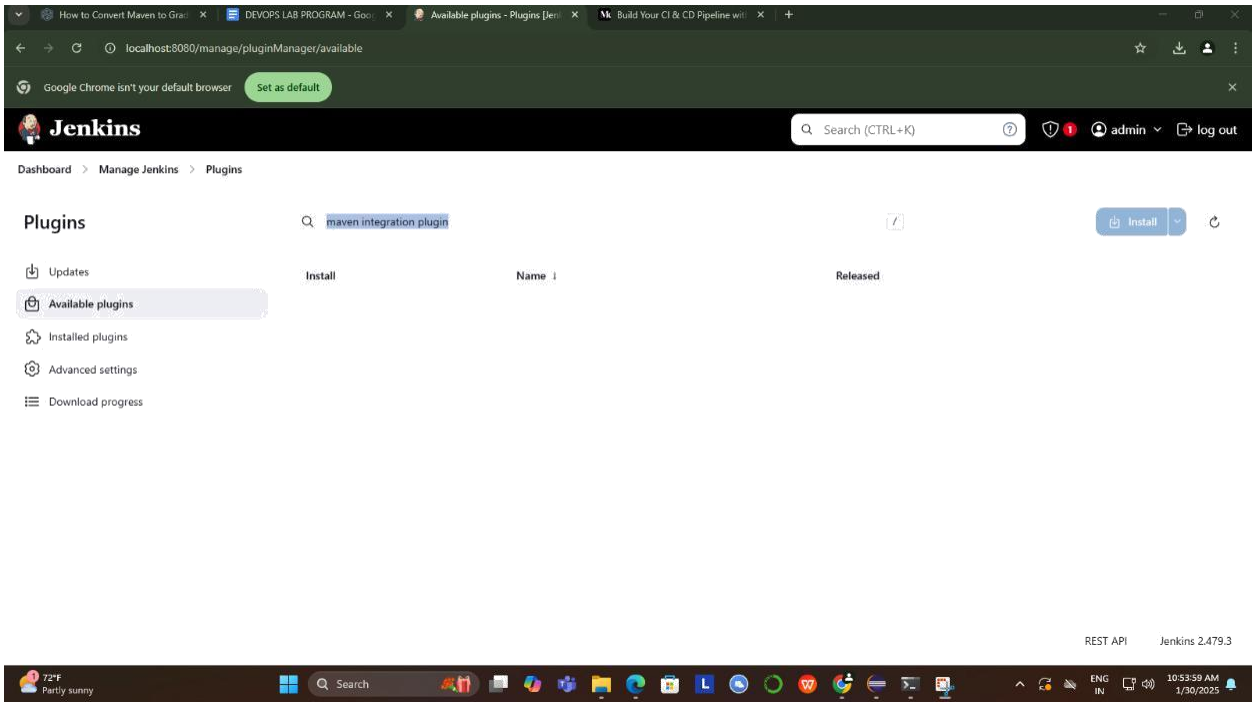
Go to Jenkins Dashboard and Click on Manage Jenkins



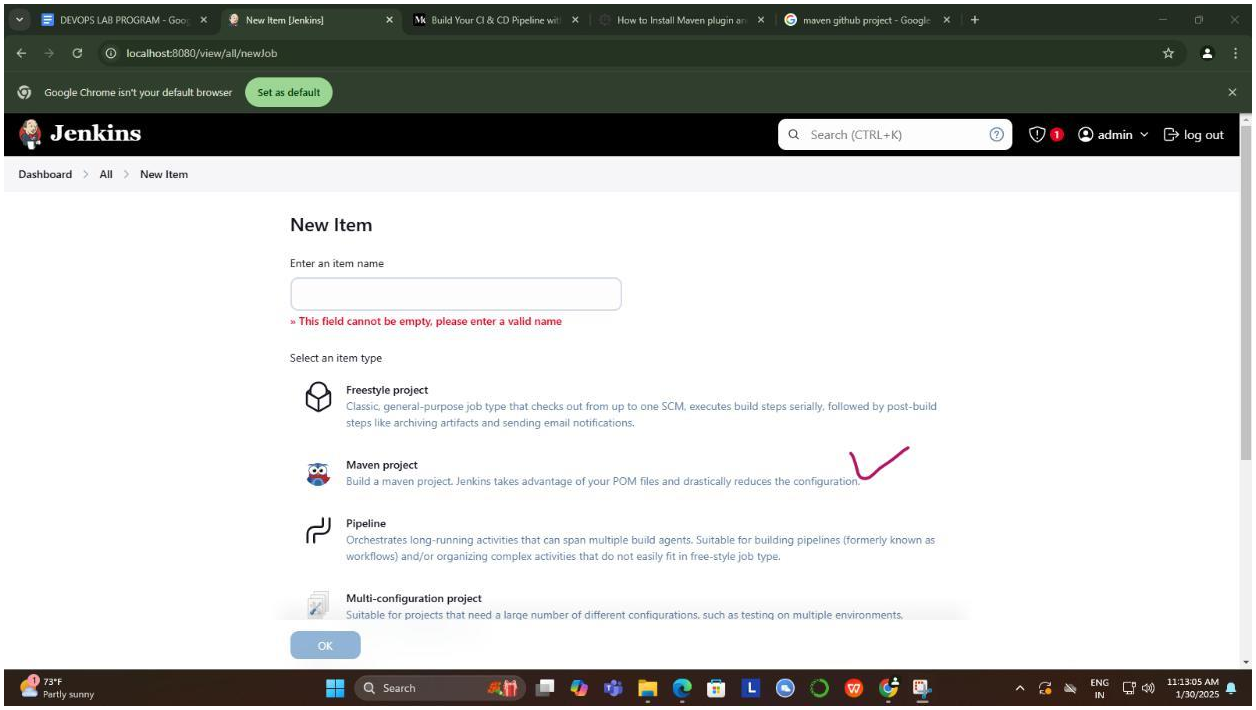
STEP2: Select Plugins



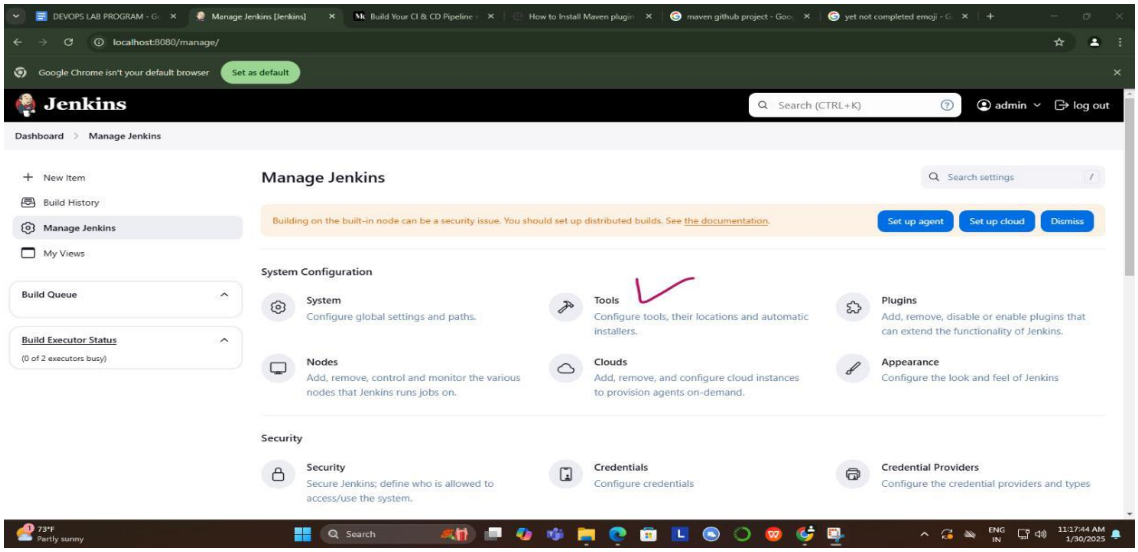
STEP3: Search for Maven IntegrationPlugin in Available Plugins and Install



STEP4: After Maven Integration Plugin is Installed We able to see Maven Project as New Item



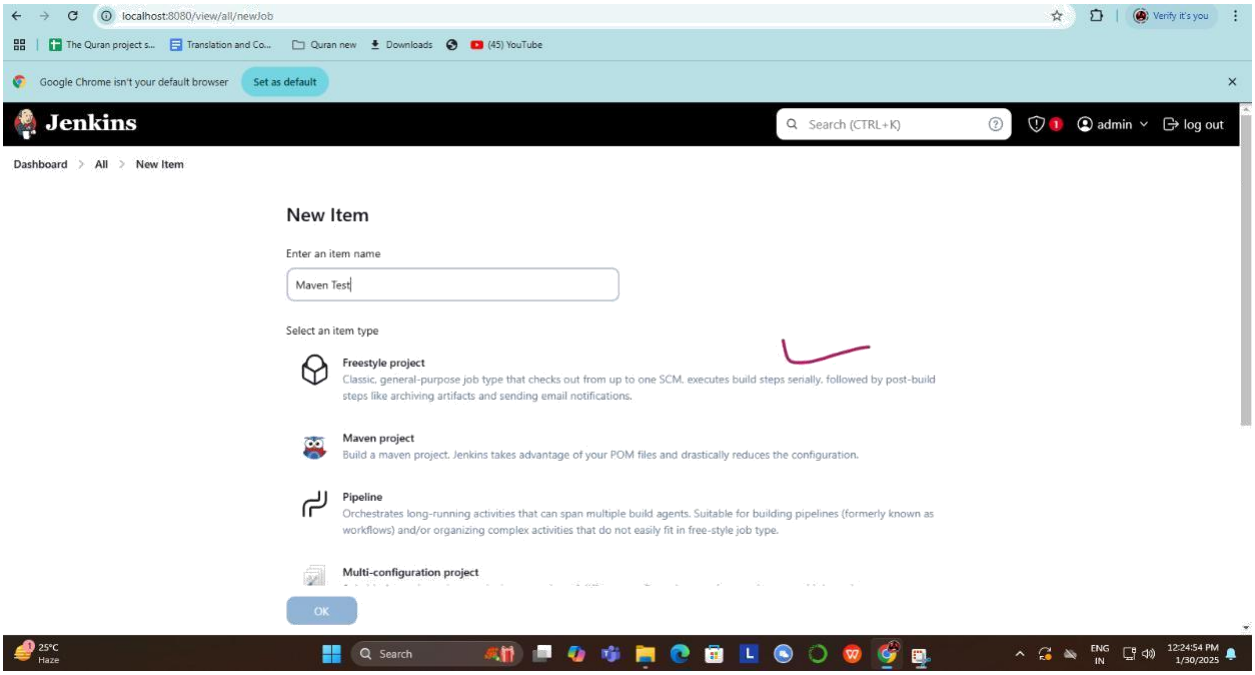
STEP5: YET not completed  **we have to configure the Location to properly Build and Run Maven Project**
So again click on Manage Jenkins and select Tools



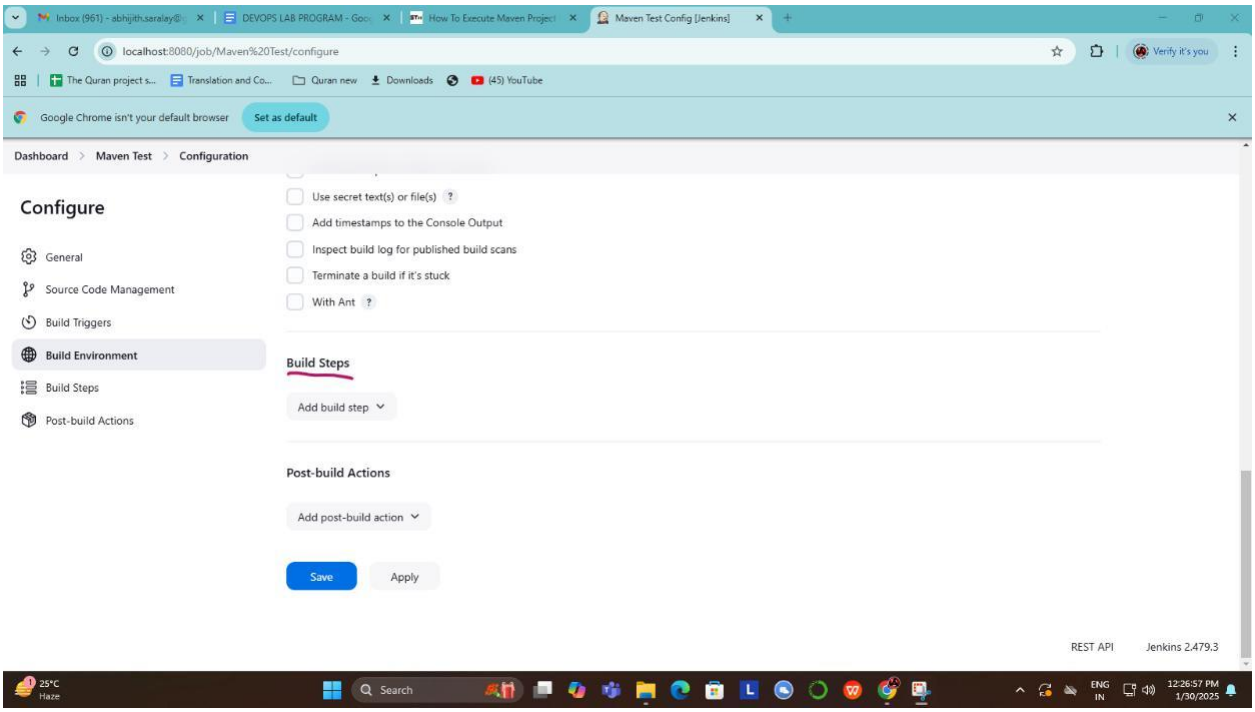
STEP6: Now lets not select Maven Project as new Item as we already have Maven project in local systems lets see how we can run the Maven Project with POM.XML

a) Click on New Item

b) Provide Item Name and select Freestyle Project



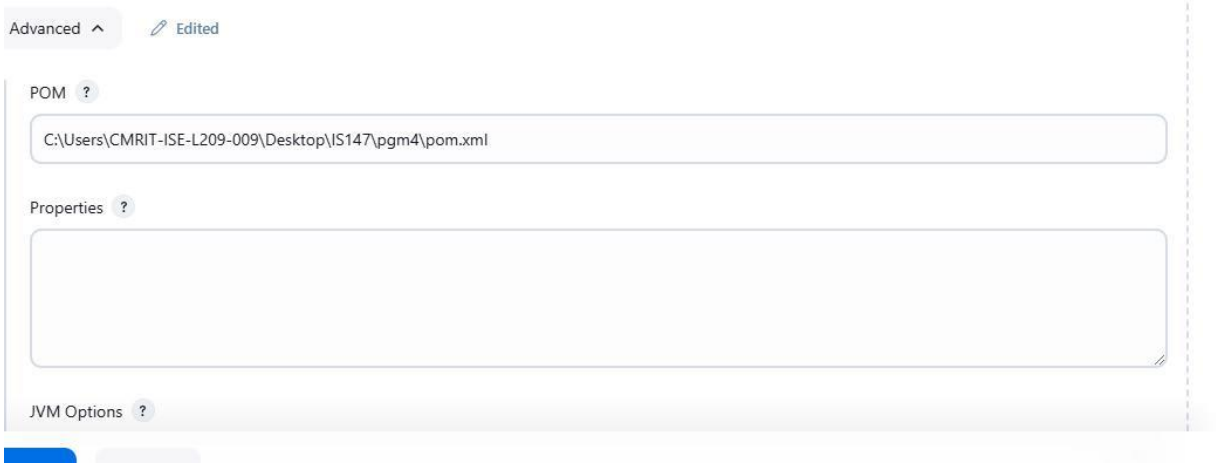
c) Scroll down to 'Build' option. Click on 'Add Build Step' and choose the value 'Invoke top-level Maven targets' from the drop down list.



d) After selecting Invoke top-level Maven targets opt for proper environment version as in set in previous steps in my case its MAVEN_HOME

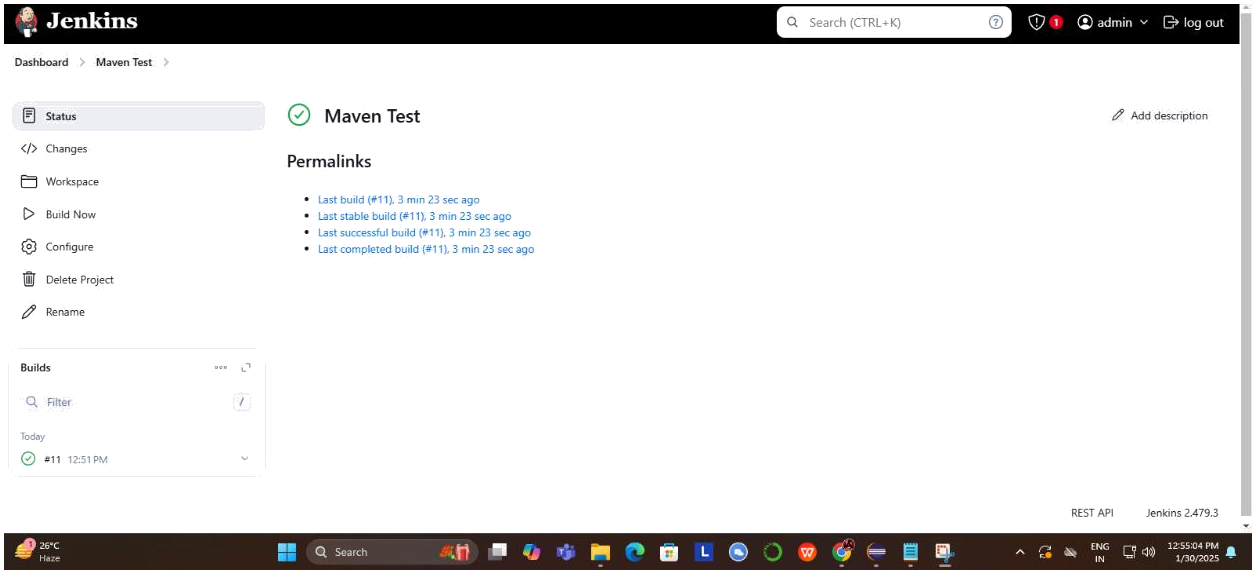
e) Enter Goal as
clean install

f) Before you save and apply just below Goal there is Advance option add pom.xml path

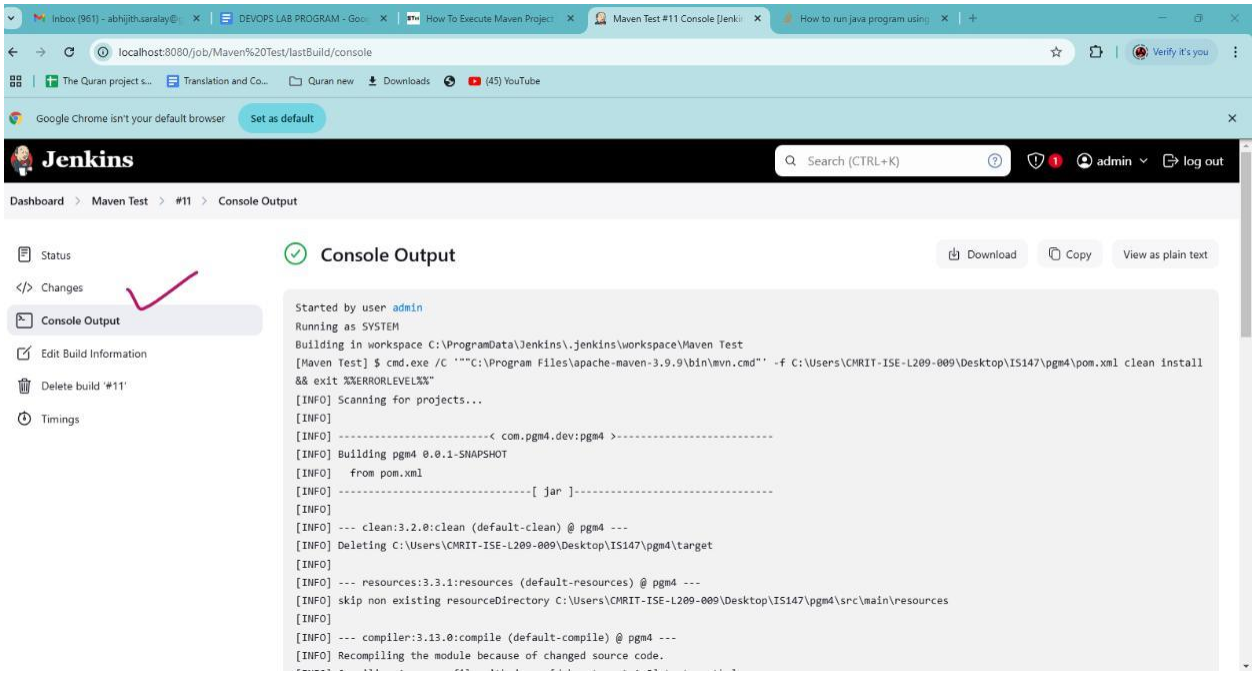


Goto pom.xml of your particular pgm and take path in my case its C:\Users\CMRIT-ISE-L209-009\Desktop\IS147\pgm4\pom.xml

After all Steps is over click on Build button the output be as in below



To see either click on build texts and goto console output or u can goto dashboard and opt to see build scripts.



PROGRAM 7:

Configuration Management with Ansible : Basics of Ansible: Inventory, Playbooks, and Modules, Automating Server Configurations with Playbooks, Hands-On: Writing and Running a Basic Playbook.

How Do I Install Ansible on Ubuntu?

Installing Ansible on Ubuntu requires setting up an Ansible control node and connecting it to one or more Ansible hosts. The following steps describe how to perform the necessary configuration and test the new Ansible installation.

STEP 1: Configure Ansible Control Node

The Ansible control node is a system used to connect to and manage Ansible host servers. Proceed with the steps below to set up the control node on the main server:

1. Create an administrator-level user for the control node. Use the adduser command:

sudo adduser [username]

2. When prompted, define a strong account password.

```
marko@phoenixnap:~$ sudo adduser ansible
[sudo] password for marko:
Adding user `ansible' ...
Adding new group `ansible' (1001) ...
Adding new user `ansible' (1001) with group `ansible' ...
Creating home directory `/home/ansible' ...
Copying files from `/etc/skel' ...
New password:
Retype new password:
passwd: password updated successfully
Changing the user information for ansible
Enter the new value, or press ENTER for the default
        Full Name []:
        Room Number []:
        Work Phone []:
        Home Phone []:
        Other []:
Is the information correct? [Y/n] y
marko@phoenixnap:~$
```

Optionally, provide more details about the user by answering questions.

Press Enter to skip a question.

3. Use the following usermod command to assign superuser privileges to the account:

sudo usermod -aG sudo [username]

A membership in the sudo group allows the user to utilize the sudo command to perform administrative tasks.

4. Switch to the newly created user on the control node:

sudo su [username]

> **Note: The Ansible control node can be a dedicated server, a local machine, or a virtual machine running Ubuntu.**

STEP 2: Set up an SSH Key pair

The Ansible control node uses SSH to connect to hosts. Generate an SSH key pair for the Ansible user by executing the following steps:

1. Enter the command below using the Ansible control node command line:

ssh-keygen

> **Note: If an SSH key pair with the same name already exists, SSH displays a warning asking the user to decide whether to overwrite it. Overwriting makes the previous SSH key pair unusable, so ensure the old keys are no longer needed before confirming.**

2. When prompted, provide a passphrase. While adding a strong passphrase is recommended, pressing Enter allows the user to skip the passphrase creation.

The system generates the public/private key pair and prints the randomart image.

```
ansible@phoenixnap:~$ ssh-keygen
Generating public/private rsa key pair.
Enter file in which to save the key (/home/ansible/.ssh/id_rsa):
Created directory '/home/ansible/.ssh'.
Enter passphrase (empty for no passphrase):
Enter same passphrase again:
Your identification has been saved in /home/ansible/.ssh/id_rsa
Your public key has been saved in /home/ansible/.ssh/id_rsa.pub
The key fingerprint is:
SHA256:89D+0mk6VsCbHevu/klK0oiWrrvnjsW+Lsgt3jCdRrE ansible@phoenixnap
The key's randomart image is:
+---[RSA 3072]----+
|                 |
|                 |
|      .  .       |
|       o .o .    |
|      E S .= o   |
|     o o Boo+    |
|   .oo+ * =+o..  |
|    +=o*. ++=o . |
|   ...*XBo.O*.o  |
+----[SHA256]-----+
ansible@phoenixnap:~$
```

STEP 3: Configure an Ansible Host

Ansible hosts are remote servers managed by the Ansible control node. Each host must have the control node's SSH public key into authorized_keys directory. Apply the steps below for each new Ansible host:

1. Use the following ssh-copy-id command on the control node to copy the public key to a host:

ssh-copy-id [username]@[remote-host]

Replace [username] with an existing administrative user on the host system and [remote-host] with the remote host domain or IP address. For example, to copy the key to the user ansible on the host with the local IP address 192.168.0.81, type:

To know IP type command

```
cat /etc/resolv.conf or hostname -i
```

ssh ansible@192.168.0.81

2. Type yes and hit Enter when asked whether to continue connecting to an authenticated host.

3. Enter the remote host account password.

```
ansible@phoenixnap:~$ ssh-copy-id ansible@192.168.0.81
/usr/bin/ssh-copy-id: INFO: Source of key(s) to be installed: "/home/ansible/.ssh/id_rsa
.pub"
The authenticity of host '192.168.0.81 (192.168.0.81)' can't be established.
ED25519 key fingerprint is SHA256:fG67eTA0FjkEJlRAcQyxna/MDc7zX4fOdABzt+aktGM.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
/usr/bin/ssh-copy-id: INFO: 1 key(s) remain to be installed -- if you are prompted now i
t is to install the new keys
ansible@192.168.0.81's password:

Number of key(s) added: 1

Now try logging into the machine, with:   "ssh 'ansible@192.168.0.81'"
and check to make sure that only the key(s) you wanted were added.

ansible@phoenixnap:~$
```

The utility uploads the public key to the remote host account.

STEP4 : Install Ansible

Use the APT package manager to install the Ansible package on the control node system:

1. Ensure the package index is up to date

sudo apt update

2. Install Ansible on Ubuntu with the following command:

sudo apt install ansible -y

STEP 5: Verify the Installation

Check that Ansible was successfully installed on your Ubuntu system using the ansible command:

ansible --version

The output displays the Ansible version number, the location of the configuration file, the path to the executable, and other information.

```
ansible@phoenixnap:~$ ansible --version
ansible 2.10.8
  config file = /home/ansible/ansible.cfg
  configured module search path = ['/home/ansible/.ansible/plugins/modules', '/usr/share
/ansible/plugins/modules']
  ansible python module location = /usr/lib/python3/dist-packages/ansible
  executable location = /usr/bin/ansible
  python version = 3.10.12 (main, Nov 20 2023, 15:14:05) [GCC 11.4.0]
ansible@phoenixnap:~$
```

STEP 6: Set up the Inventory File

Once Ansible is installed on the control node, set up an inventory file to allow Ansible to communicate with remote hosts. The inventory file contains all the information about the remote hosts managed through the Ansible control node.

Note: For an in-depth overview of creating files on remote hosts, refer to our article How to Create a File In Ansible.

Follow the steps below to create an inventory file on the control node:

1. Create the ansible subdirectory in the etc directory:

sudo mkdir -p /etc/ansible

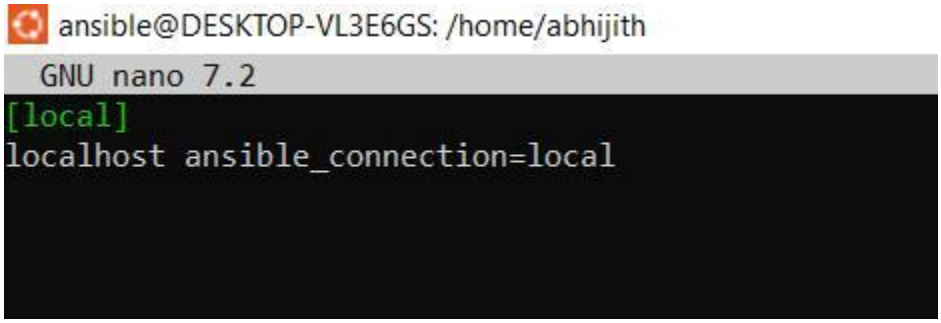
2. Use a text editor such as Nano to create a file named hosts:

```
sudo nano /etc/ansible/hosts
```

3. Add localhost that the control node will manage. Use the following format:

```
[local]
localhost ansible_connection=local
```

The [local] line allows for the creation of categories to organize local hosts. The following example adds a local host using its local IP address 192.168.0.81 and sorts it into the servers category:

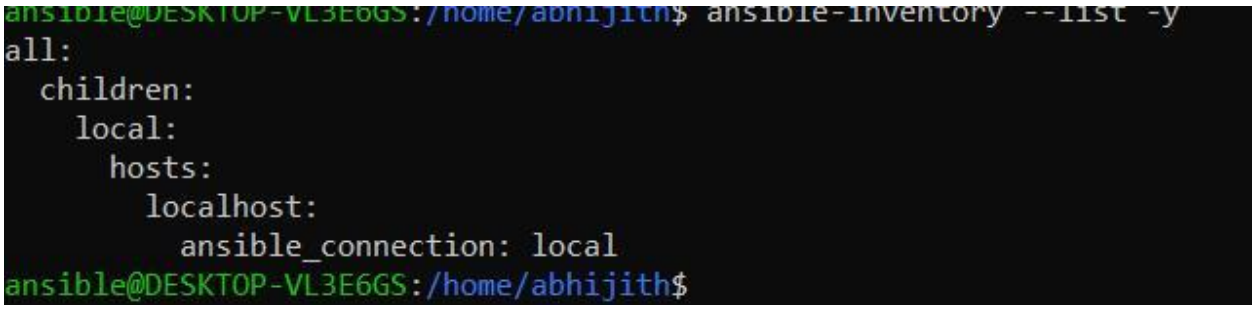


4. Save the file and exit.

5. Enter the command below to check the items in the inventory:

```
ansible-inventory --list -y
```

The output lists the hosts:



STEP 7: Test the Connection

To ensure the Ansible control node can connect to the local hosts and run commands, use the following ansible command to ping the hosts from the control node:

sudo ansible all -m ping

Note: When a user connects to the remote hosts for the first time, Ansible asks for confirmation that the hosts are authentic. To confirm the authenticity, enter yes when prompted.

The output confirms the successful connection.

```
ansible@DESKTOP-VL3E6GS:/home/abhijith$ sudo ansible all -m ping
localhost | SUCCESS => {
    "ansible_facts": {
        "discovered_interpreter_python": "/usr/bin/python3"
    },
    "changed": false,
    "ping": "pong"
}
ansible@DESKTOP-VL3E6GS:/home/abhijith$
```

The Ansible control node is now set up to control the connected remote hosts.

Conclusion

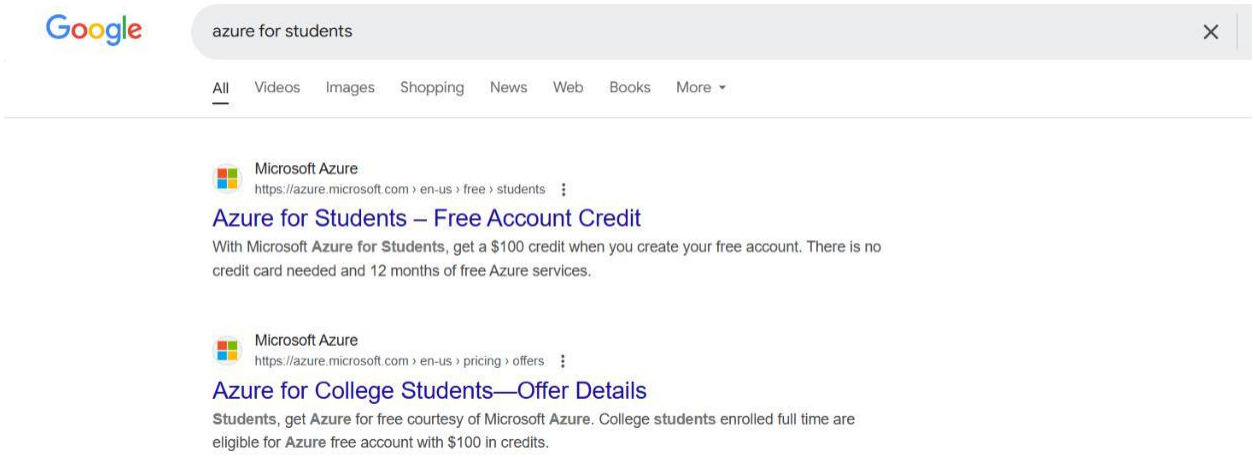
After following the steps in this guide, you have successfully installed Ansible on Ubuntu and can execute commands and playbooks on remote hosts. The guide provided instructions for setting up the Ansible control node and connecting it with the hosts via SSH.

PROGRAM 9:

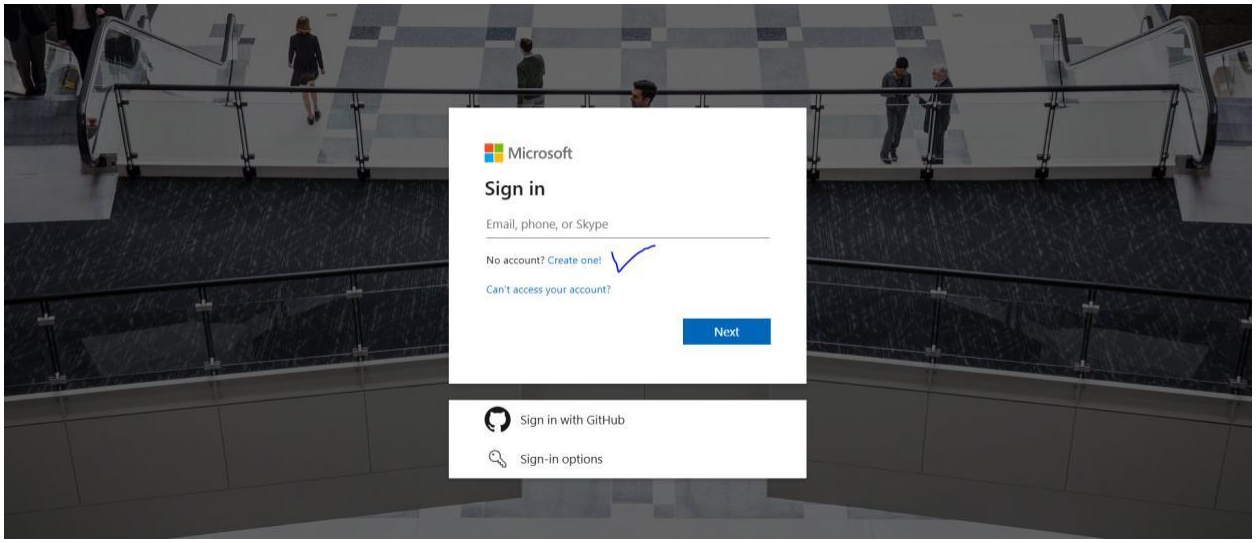
Introduction to Azure DevOps: Overview of Azure DevOps Services, Setting Up an Azure DevOps Account and Project.

STEP1:Go to Google chrome and type azure for students

https://azure.microsoft.com/en-us/free/students

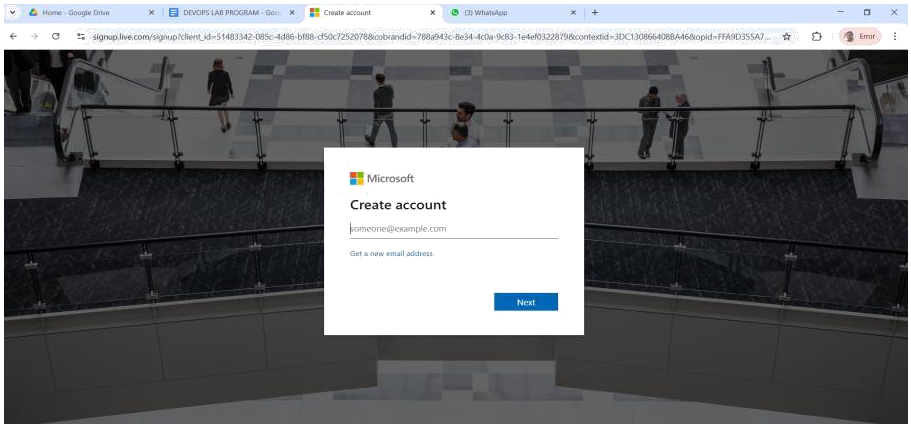


STEP2: Click on Start Free after that u get screen as in below

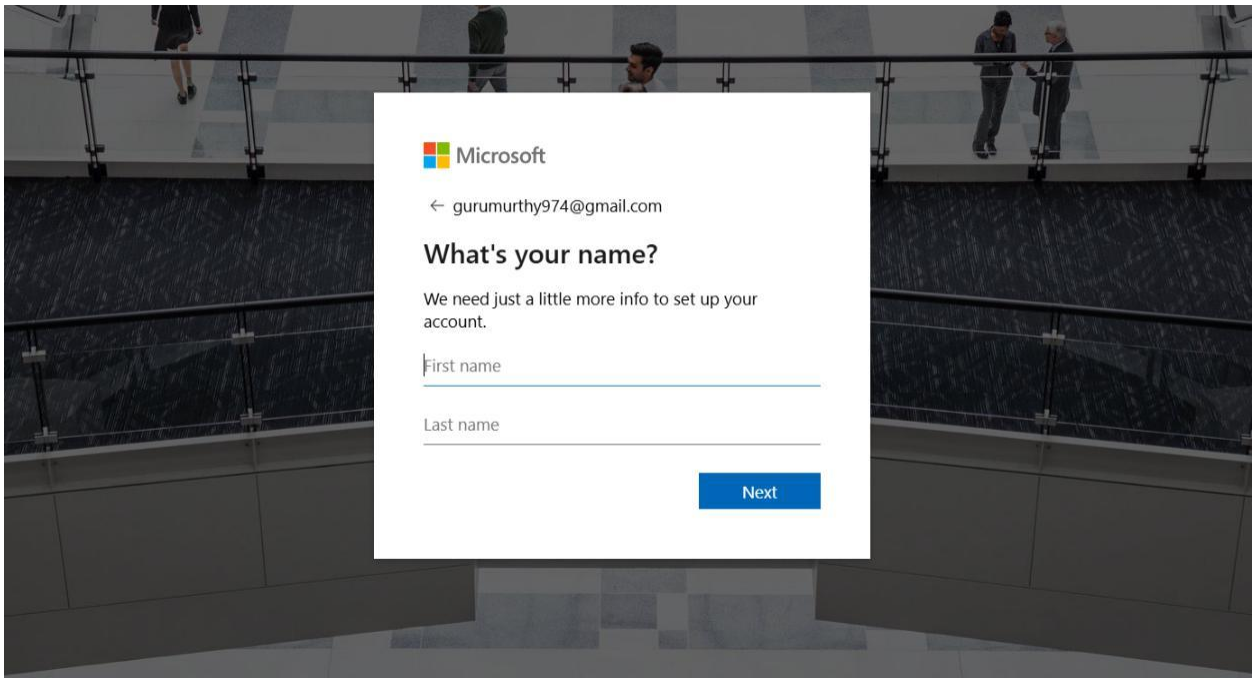


Click on Create one, If u have Github account u can Sign in using github account better way is to create one account

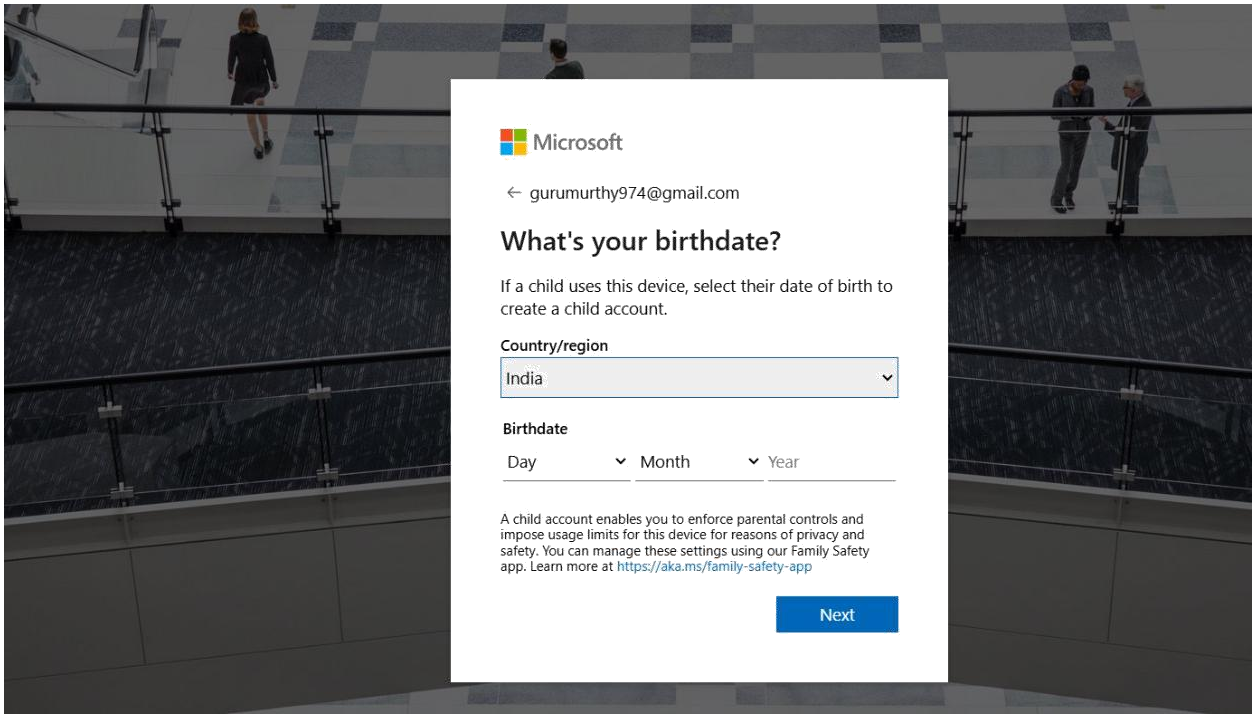
STEP3: Provide your email id at place of create account



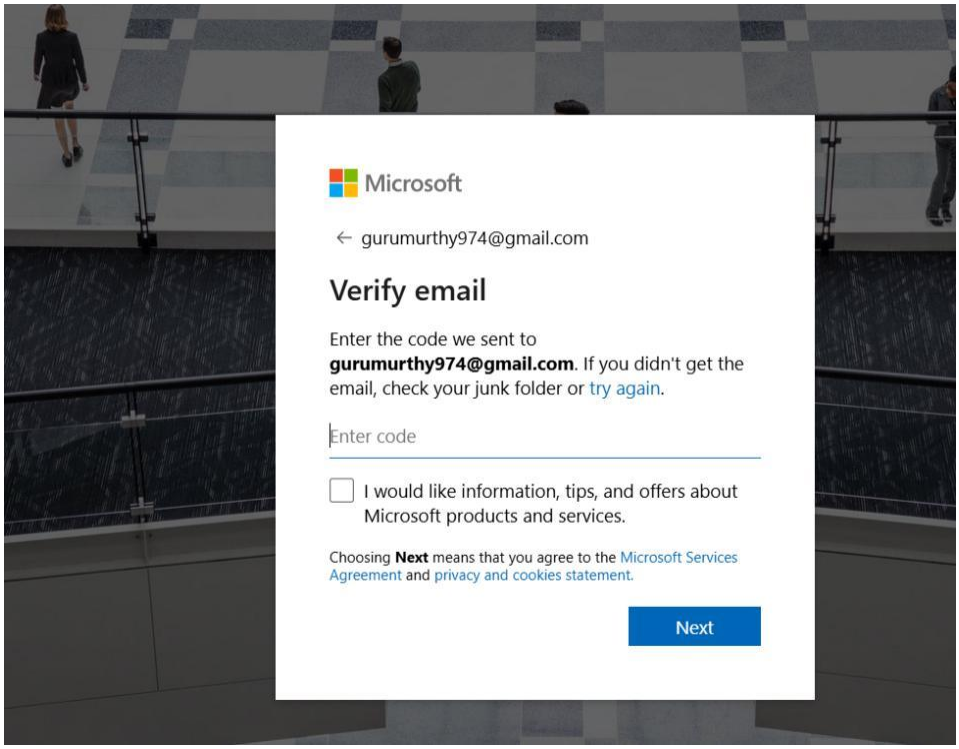
STEP4:After password is set provide your First name Last name



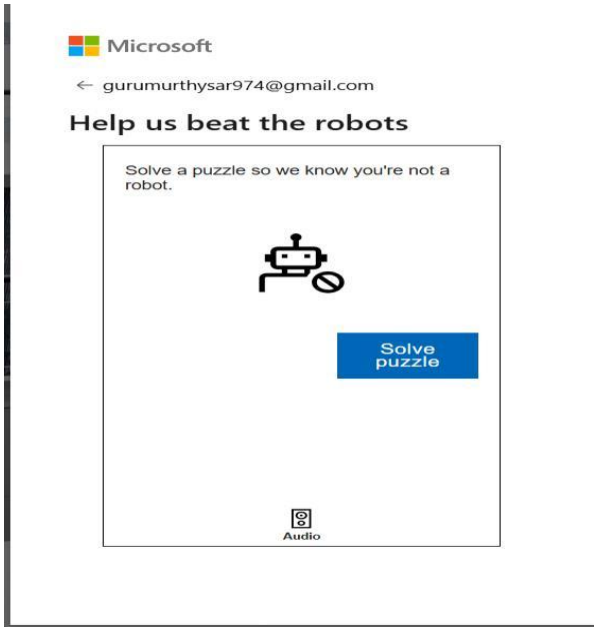
Then provide Country,Date of Birth



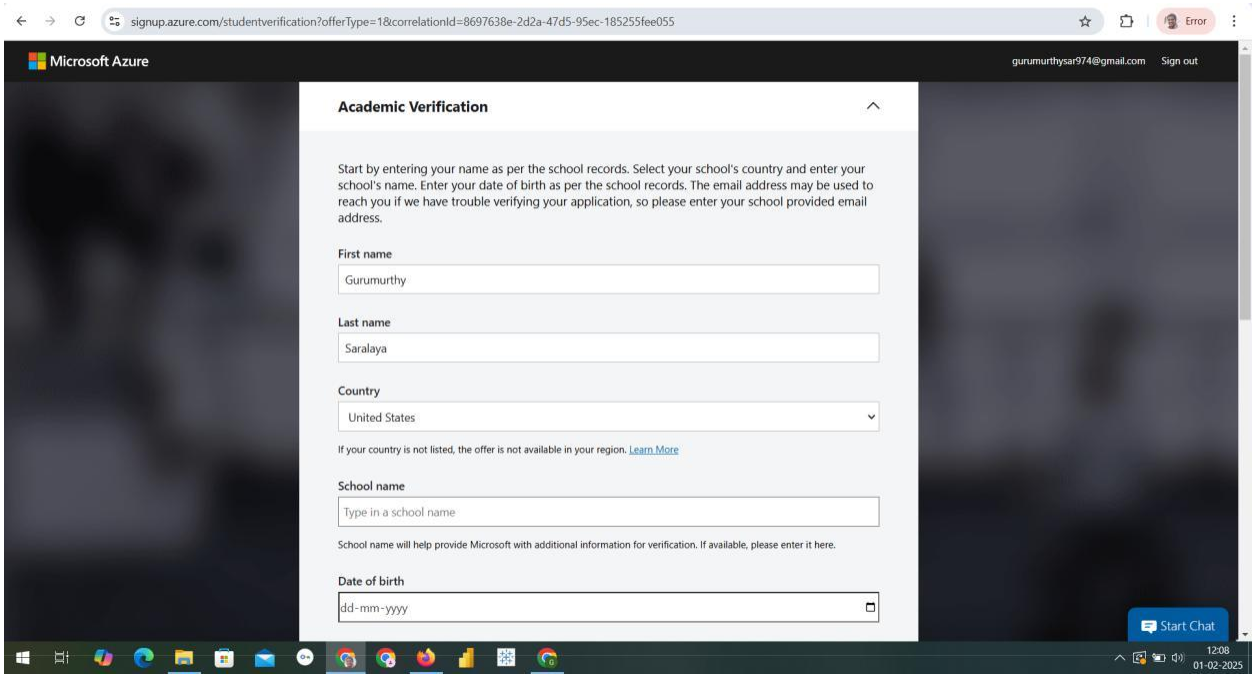
STEP5: Verification code be mailed to the mentioned once kindly type it



STEP6:After code is verified as u got in the mail referred U be given an option to solve puzzlegame



STEP7:This step is the important once where u fill your Academic Details properly where u provide College email id as in provided by your Individual colleges later the verification code again comes



After proper college email is given u get verification mail with link to mail u have provided

Hello,

You have received this email because you recently requested verification via **Microsoft's Academic Verification** service. If you did not submit your email for this program, please disregard this email.

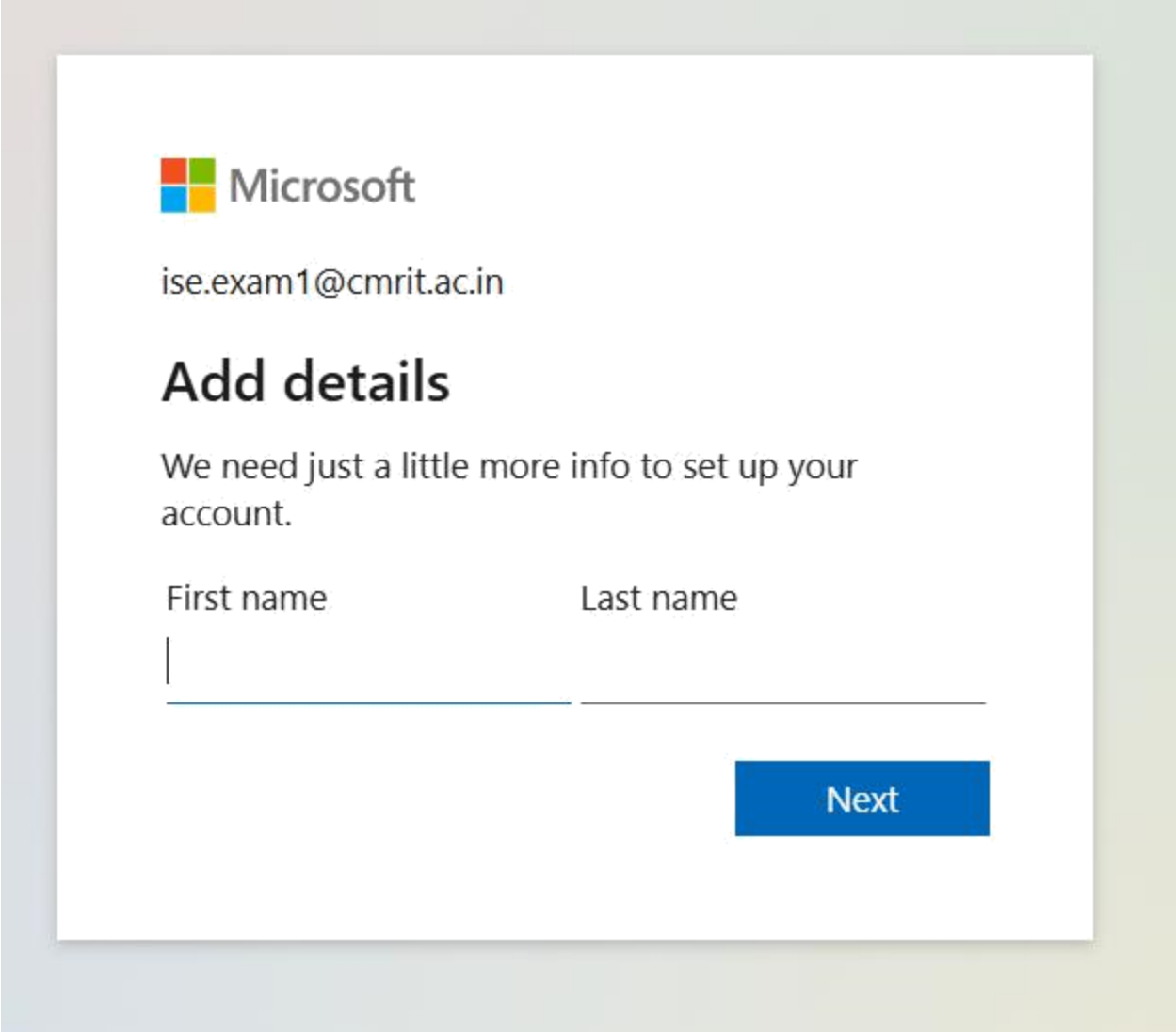
To complete your academic status verification, please click the link below. The link will automatically expire if not used within 5 days.
After clicking the link, your verification status will be confirmed and you will return to the site.

-Navigate to: https://verifyemail.microsoft.com/v1.0/tokenverification/verify?signature=YPQIdNoTloPJ8nJy8QXZhbyR5Y5wAfwKVaNqhX5hgX6Yb0hOyqw5Aa5CsLqDGTWbHGIFSKjx37ROJFB7B0BoqKqDTCsJ3ADClXL9McGPZs97Ms2qbP54fx0AGGTgdu7Y2SGVdpLBk98PiP33rVZf%2F2ES3z4lR8zM%2BjjuRvGxNuTK%2B4lM2tfFKm2kSsbp%2Bi754BLlZSJW4216NcWohhks8i%2Fdd2qk7fgLurMrUhi8MaiPwQjLzyBmWbd9bjRY4PtX%2FfhwpOZTPGdROYFUpjsYuf6vwYojSylbtfBATxAI1se5jIzZsAL2qdHWV03x8Yhm3gjN4TGYdxzizDLE0CGCn6h8GVjyls%2BQEIO96N0Rvqi%2FnlccNibsdcmtAN0u9ivHcdpoHRnwX22Q58JgggCzyefDnDbFgxuiteaHQn%2BPkgKnOs26OHSdeVVEc%2B0MBsBAOjBTFiHeL7XEkYdahHXReTh8a77XxbRAQAdXGXIfW0caHpUHafaNKxiQBM28dR%2BPgZB0n3kKFMiR20ItYQtxpSkOGa6DOssh38bumS2WrSQ%3D

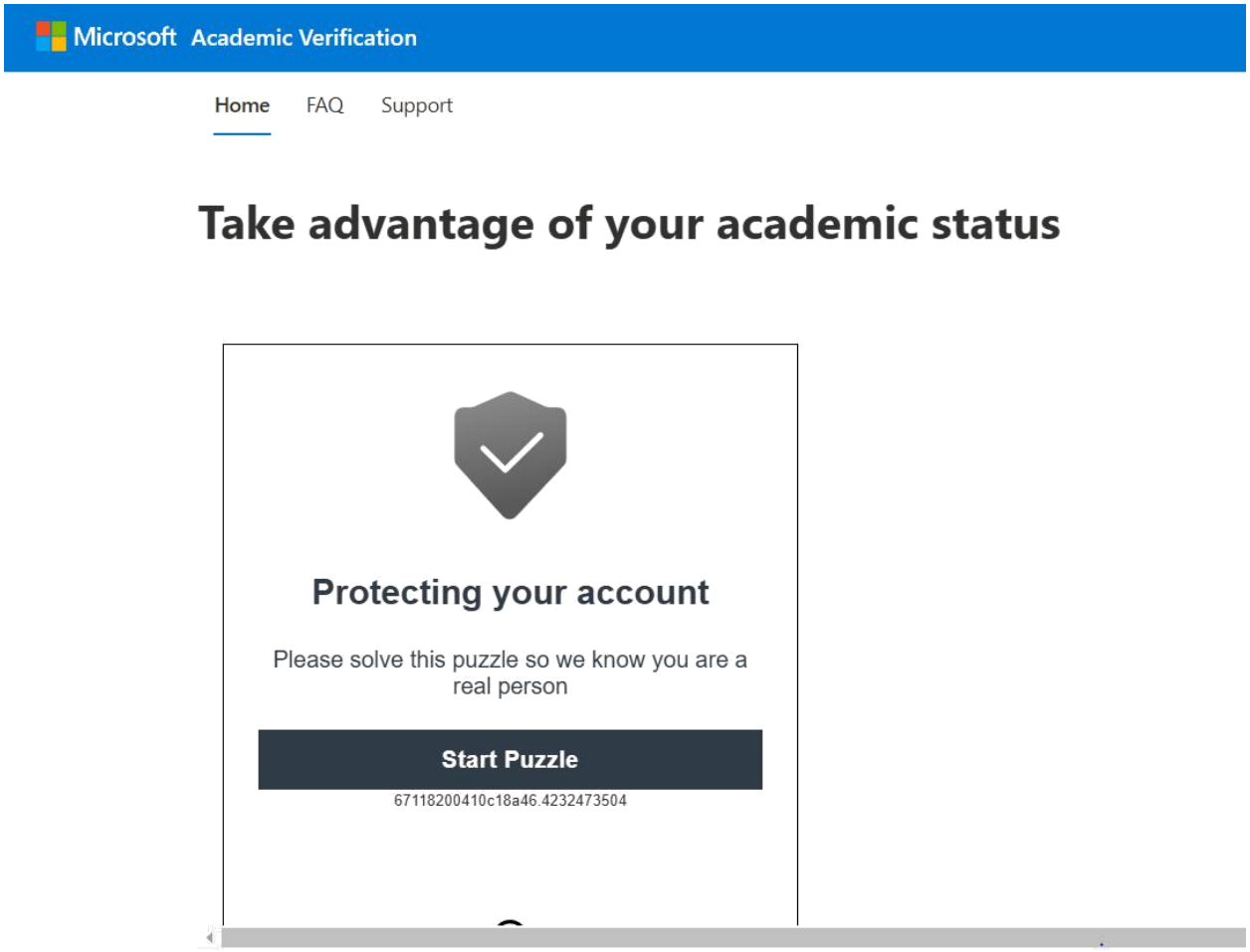
Thank You,
The **Microsoft Academic Verification Team**

Click on link sent

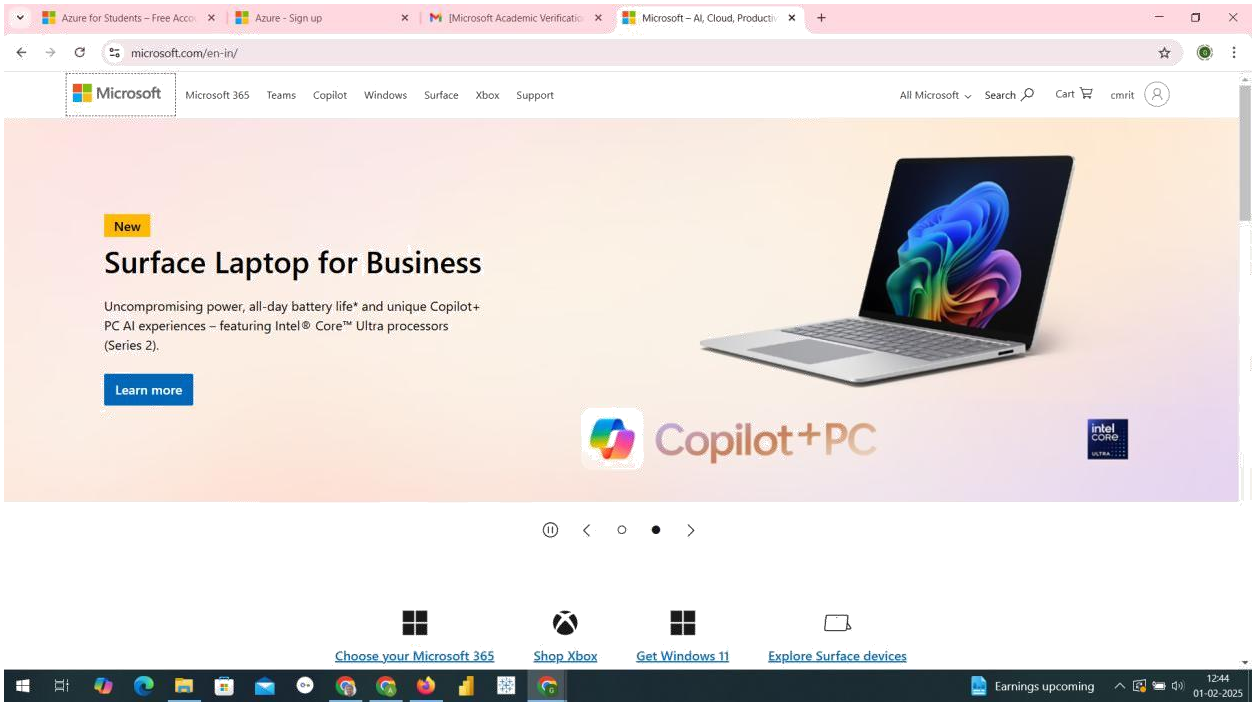
After u Click The screen be as in Below



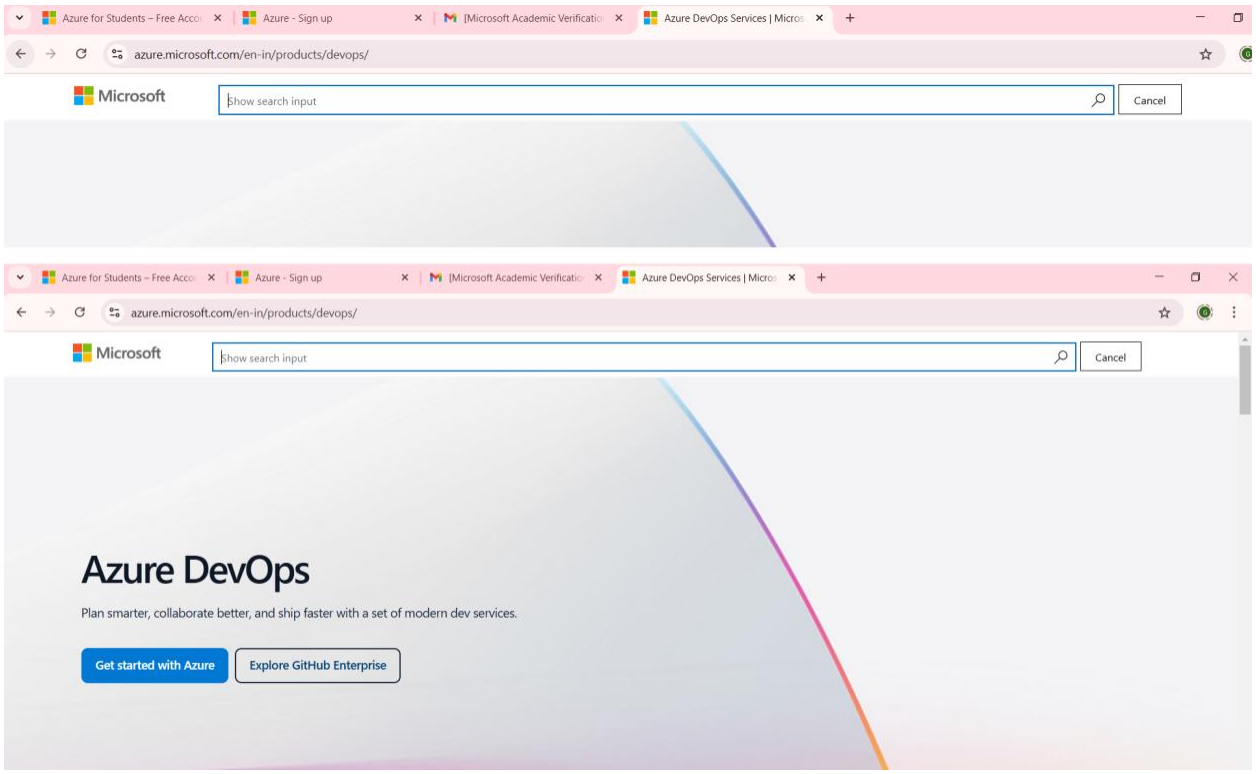
TO MAKE UR ACCOUNT SECURE IT AGAIN HAVE PUZZLE



Finally ur screen be like this

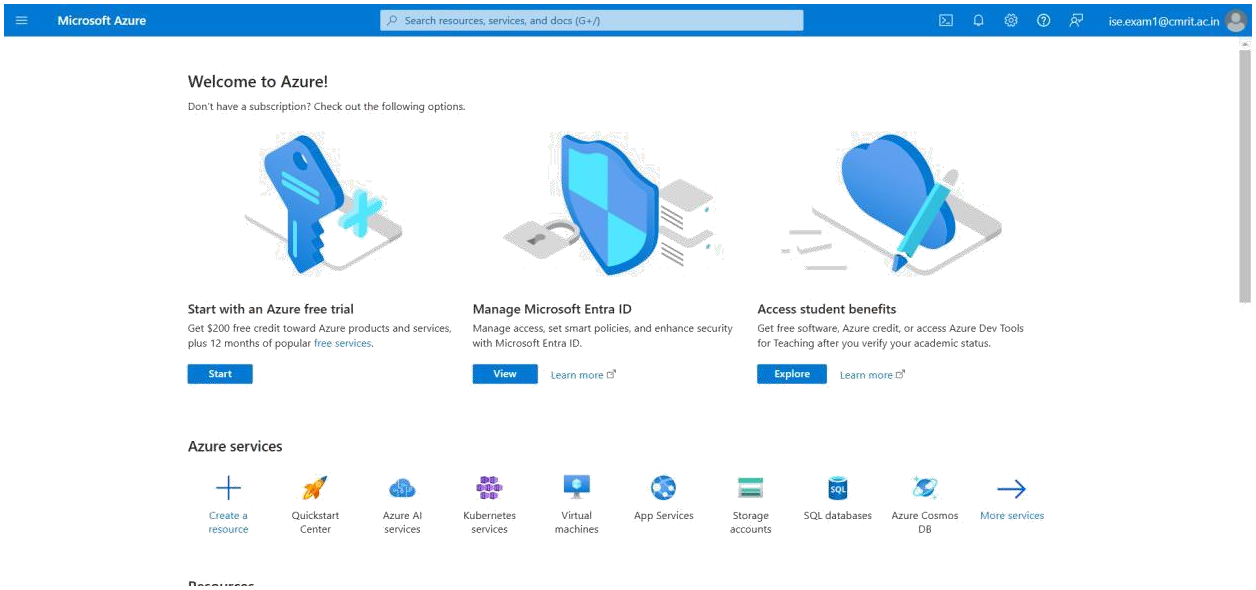


Go To search and type Azure Devops



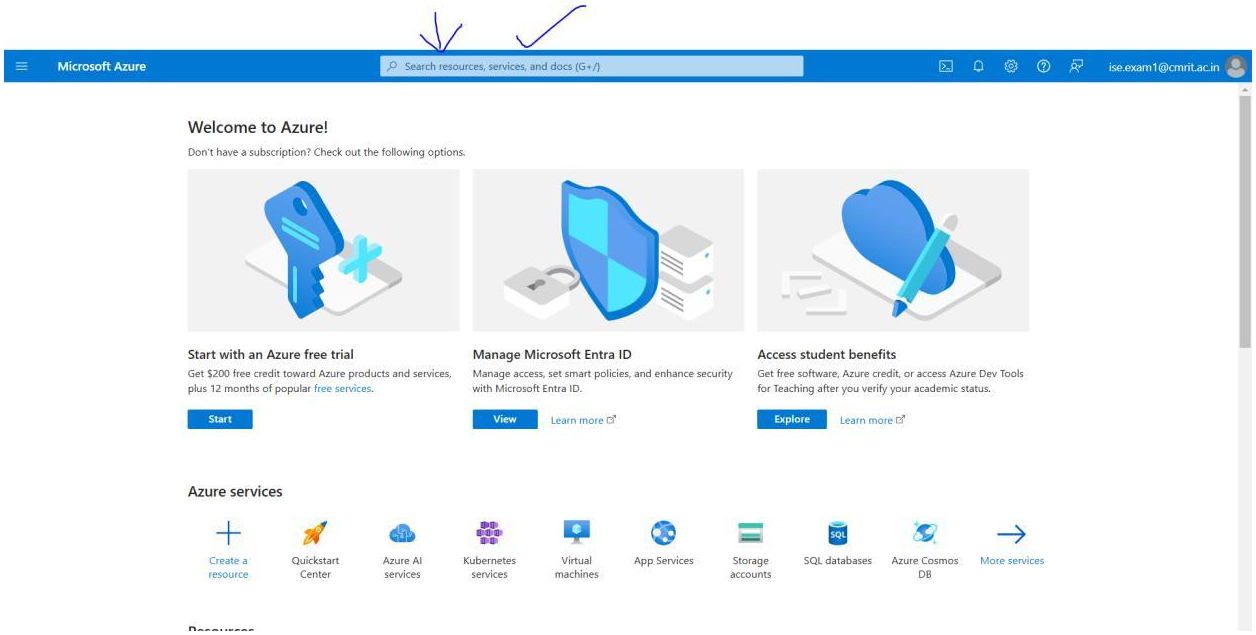
Click on Get started with Azure

After the click u get the screen of Get free need not to do anything just click on Signin You will get screen as in below



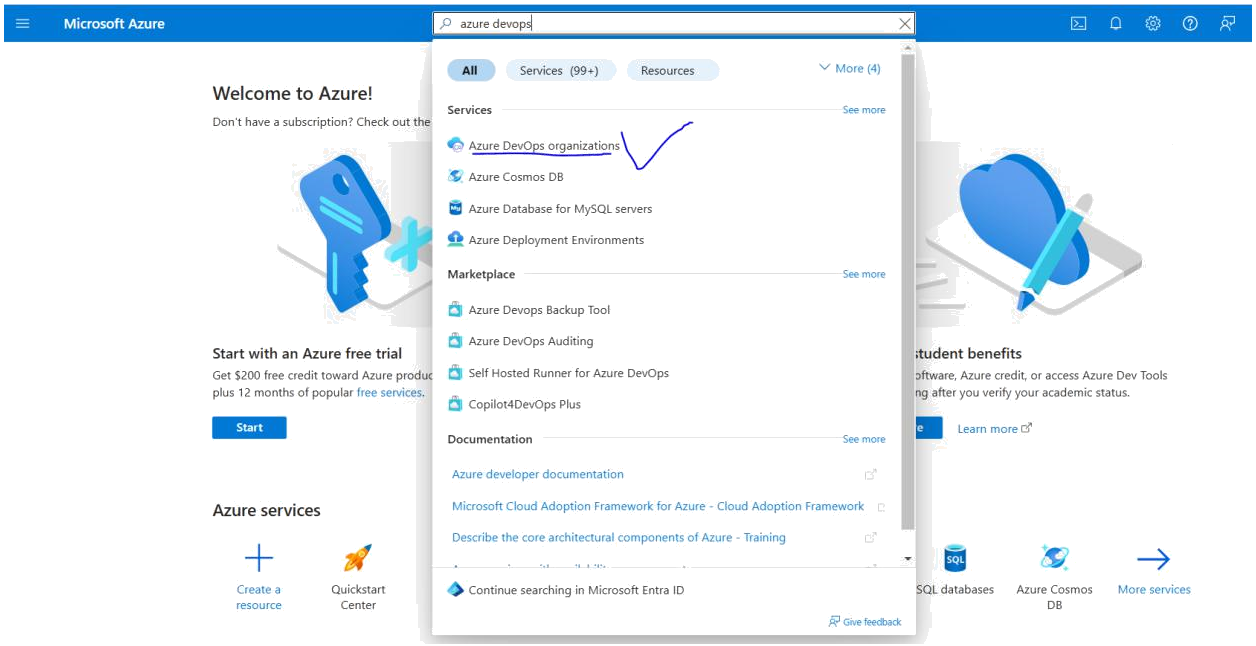
THIS IS THE HOME PAGE OF THE MICROSOFT AZURE where you can see n number of services now our target is Azure Devops

In top where have search for services



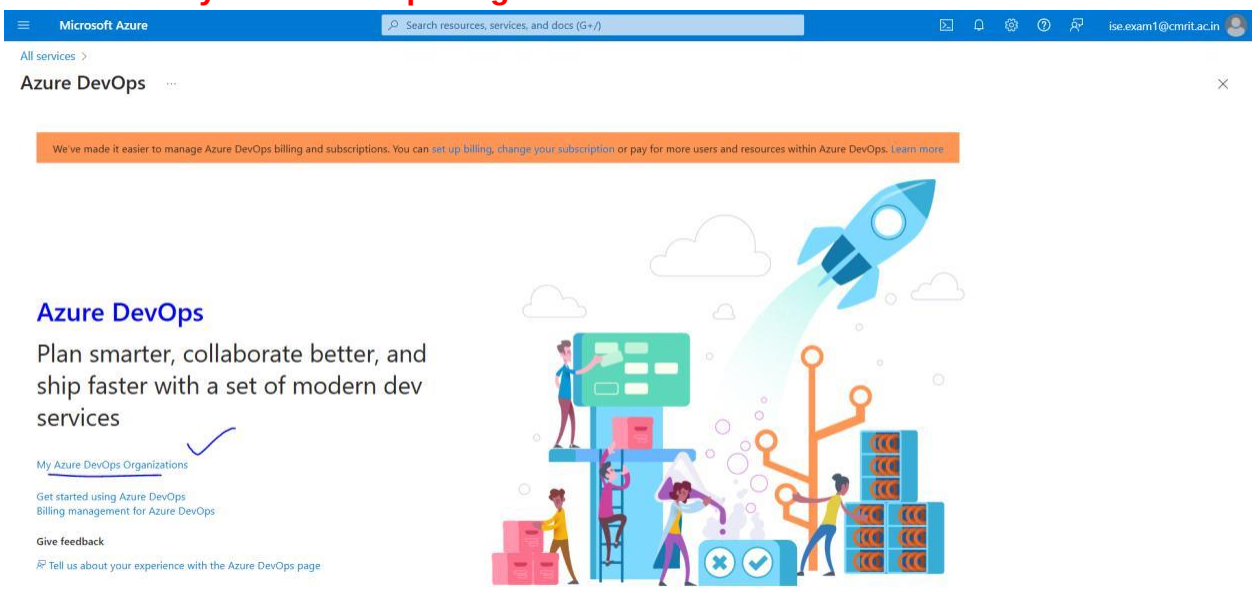
Type Azure Devops

STEP8:Select Azure Devops Organization



STEP9:

After u opting for Azure Devops Organizations u get a screen as in below now select My Azure DevOps Organizations

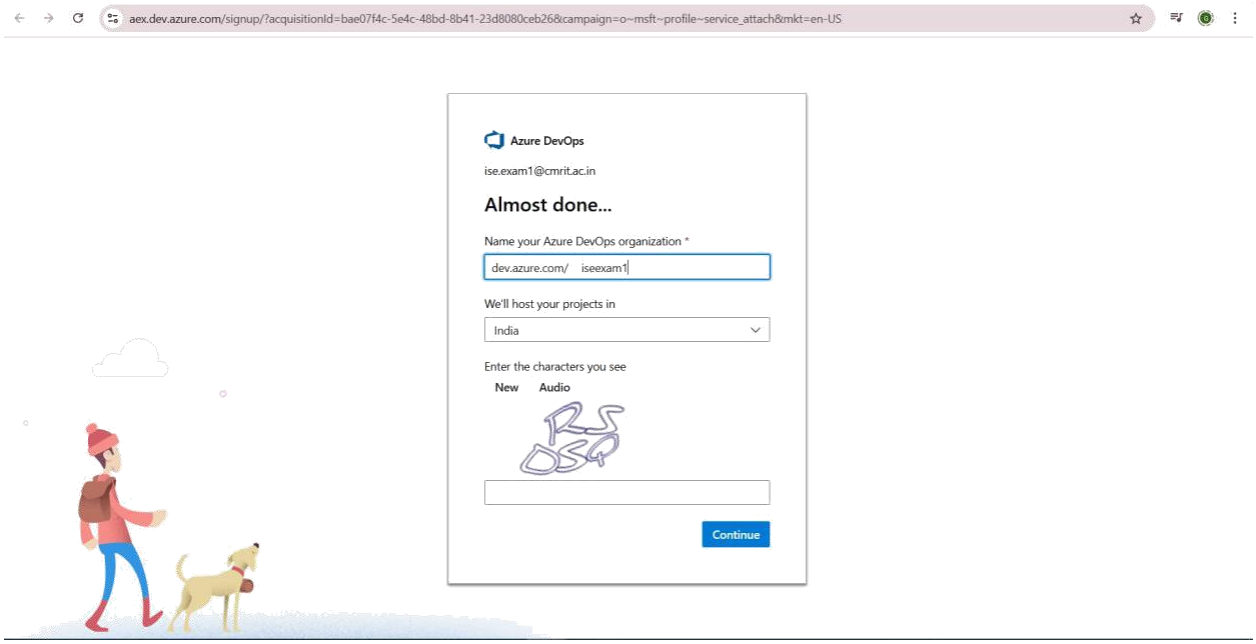


After above selection it once again reverifies name and email just click Continue After it U get a Screen

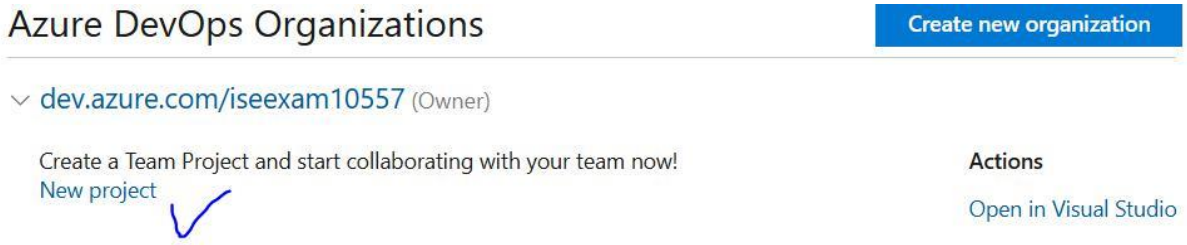
Get started with Azure DevOps

Plan better, code together, ship faster with Azure DevOps

Create new organization



You will be able to see Organization is Created



Finally After Creating a New Organization

U can create Project of ur choice as per requirement

Every time u need not to signin u can bookmark or add the below link as shortcut

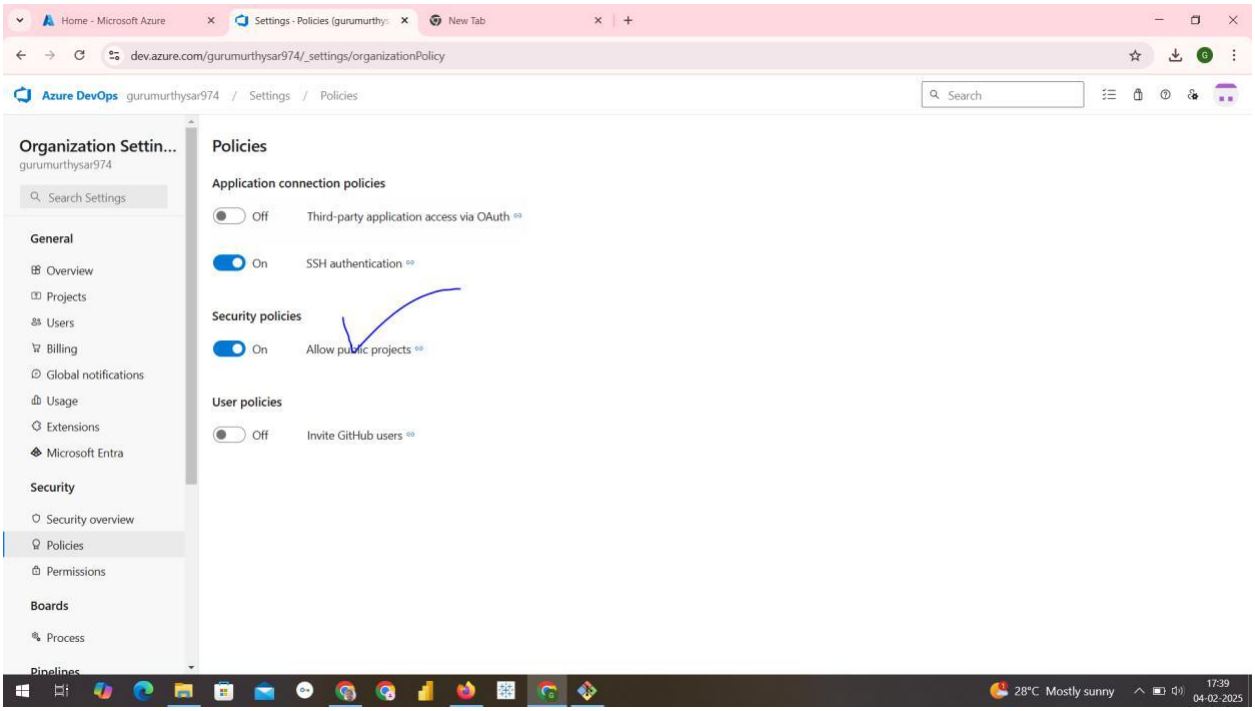
https://aex.dev.azure.com/

https://portal.azure.com/#home

PROGRAM 10:

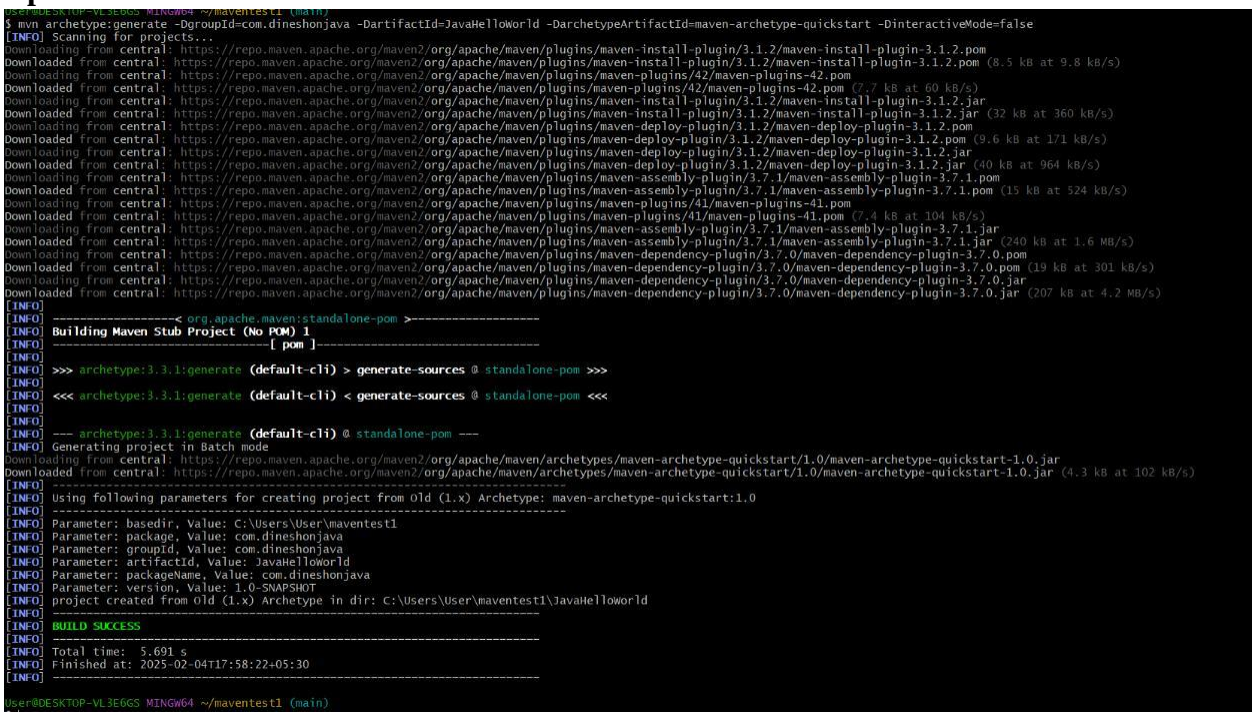
Creating Build Pipelines: Building a Maven/Gradle Project with Azure Pipelines, Integrating Code Repositories (e.g., GitHub, Azure Repos), Running Unit Tests and Generating Reports.

STEP1:On creating organization goto Organization settings goto Policy And Allow Public Projects active



STEP2: GOTO GITBASH
TYPE COMMANDS AS IN BELOW
mkdir maventest1
cd maventest1

STEP3: to create simple hellow world maven project type command as in below mvn archetype:generate -DgroupId=com.dineshonjava -DartifactId=Javateam -DarchetypeArtifactId=maven-archetype-quickstart -DinteractiveMode=false



STEP3: to add files from local to github Follow the procedure

a) First create a repository in github as maventestazure

b) Then come to gitbash and type

git init

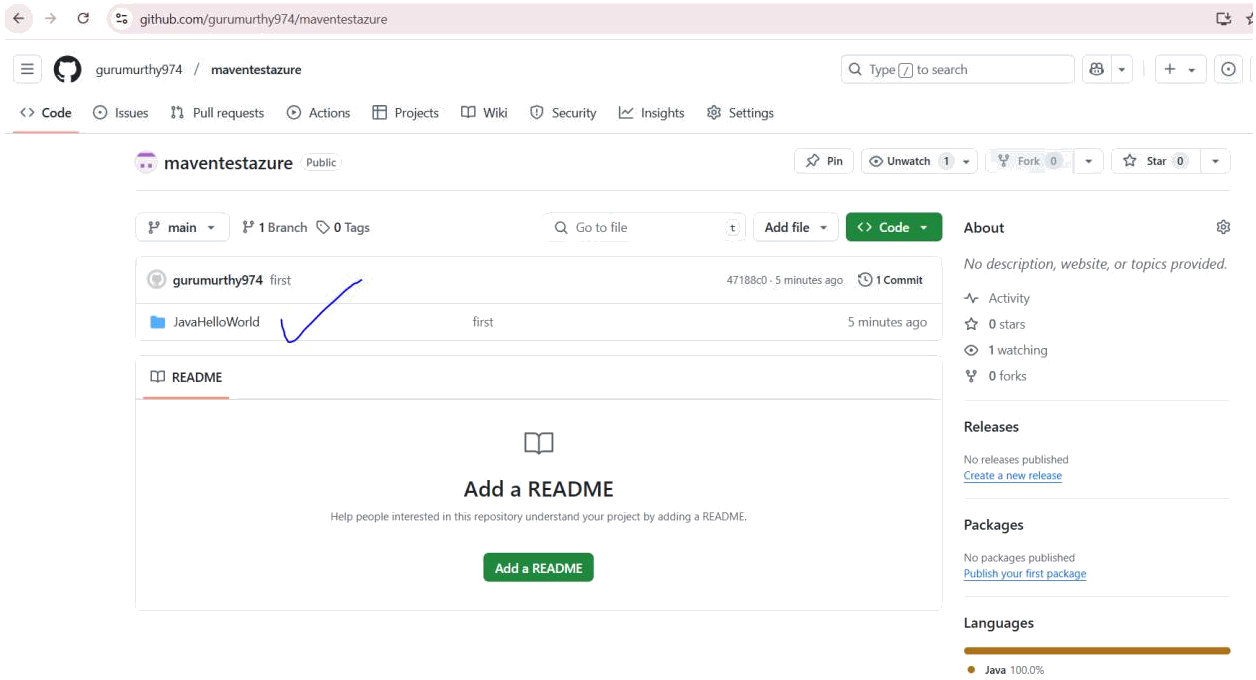
git add .

git commit -m “azure pipeline example”

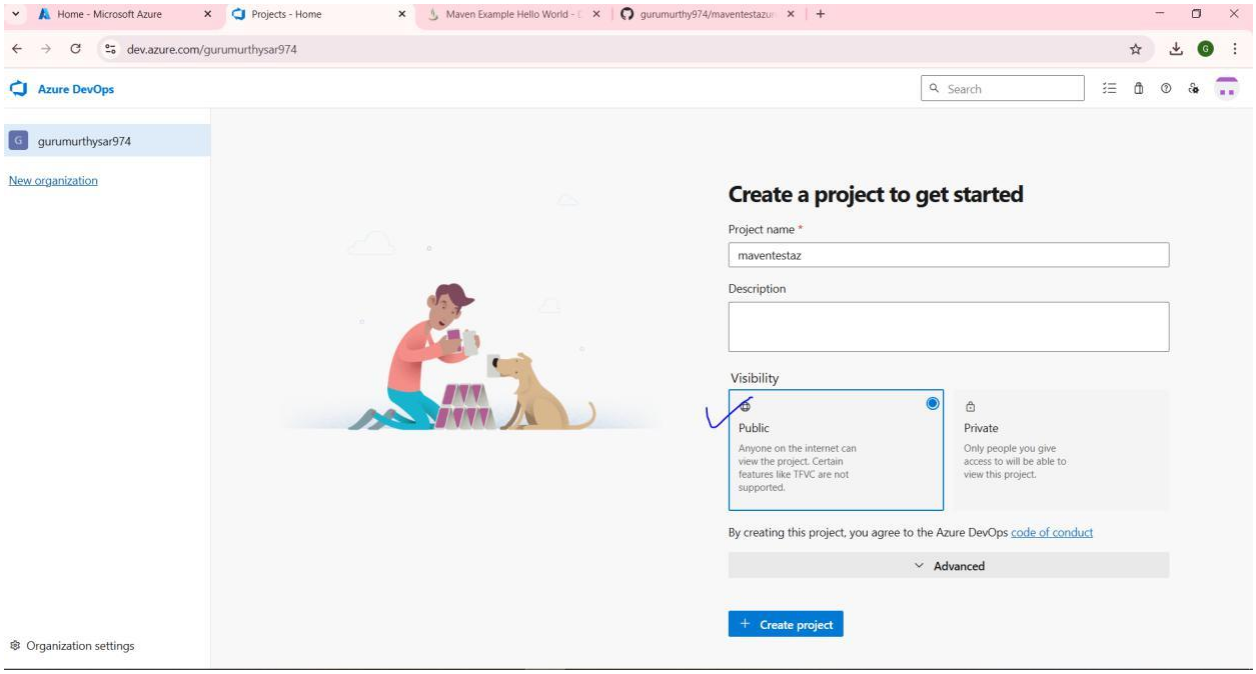
git branch -M main

git remote add origin https://github.com/gurumurthy974/maventestazure.git git push -u origin main

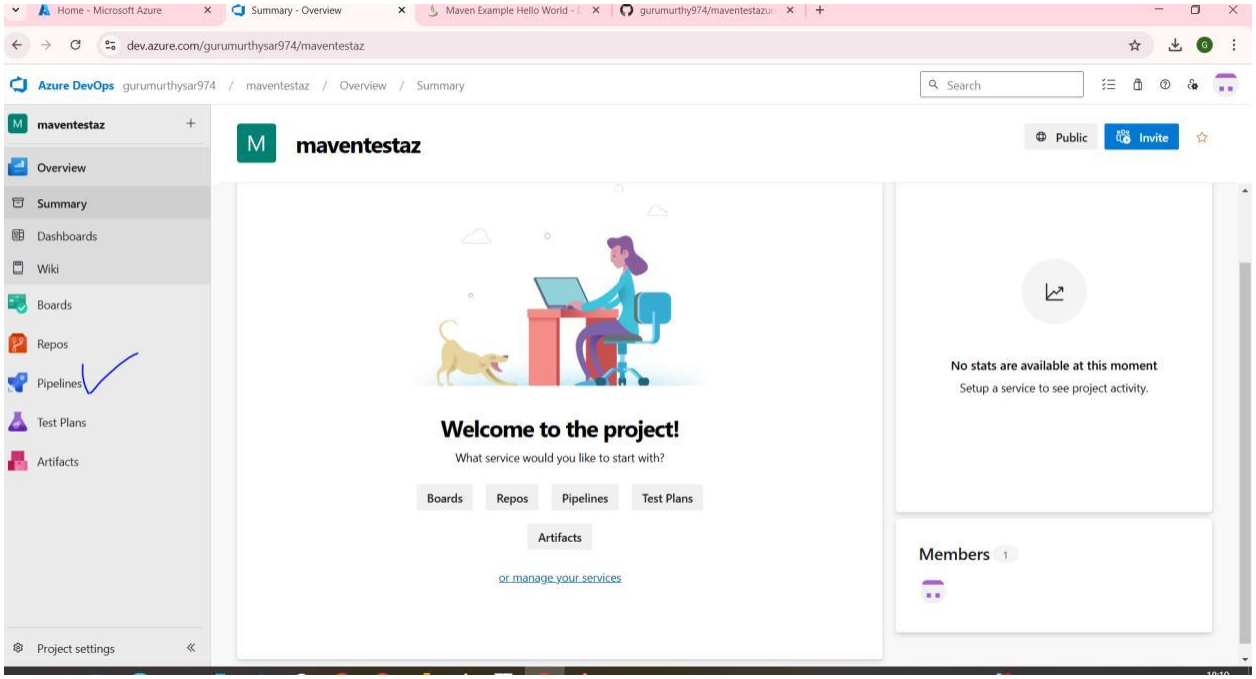
After completion of above command my repository looks



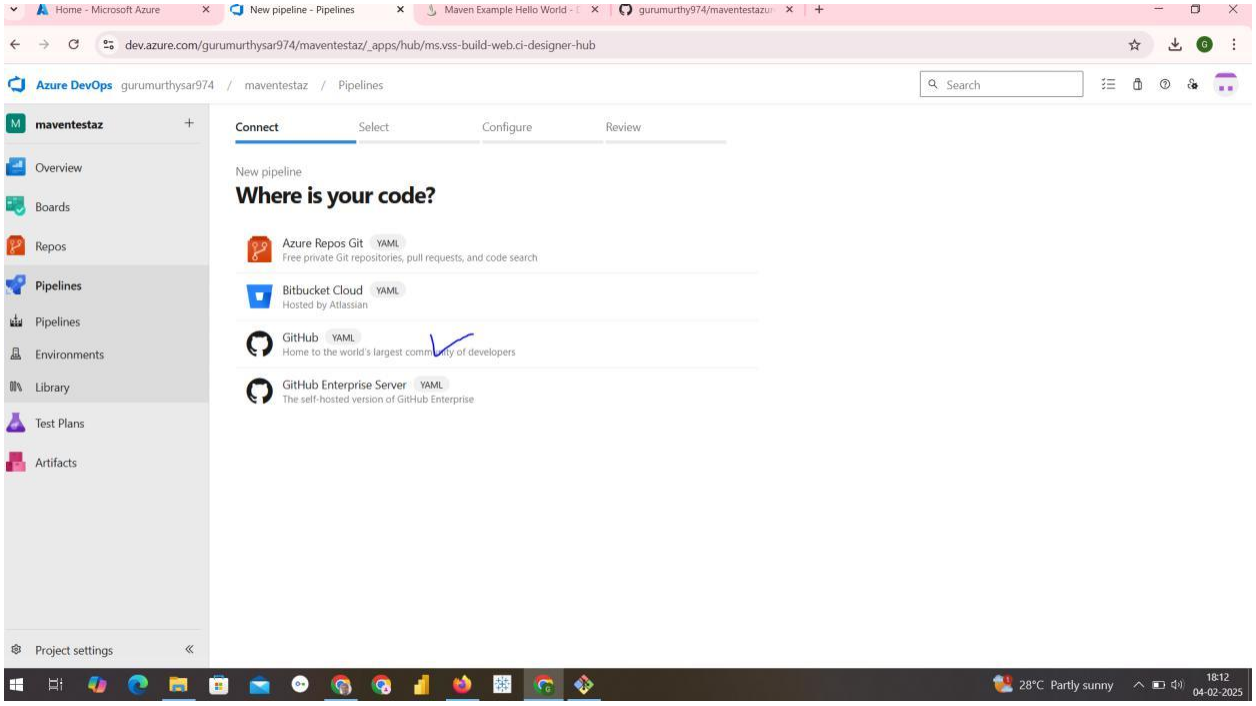
STEP4: Now goto Azure Devops Organization create Public Project



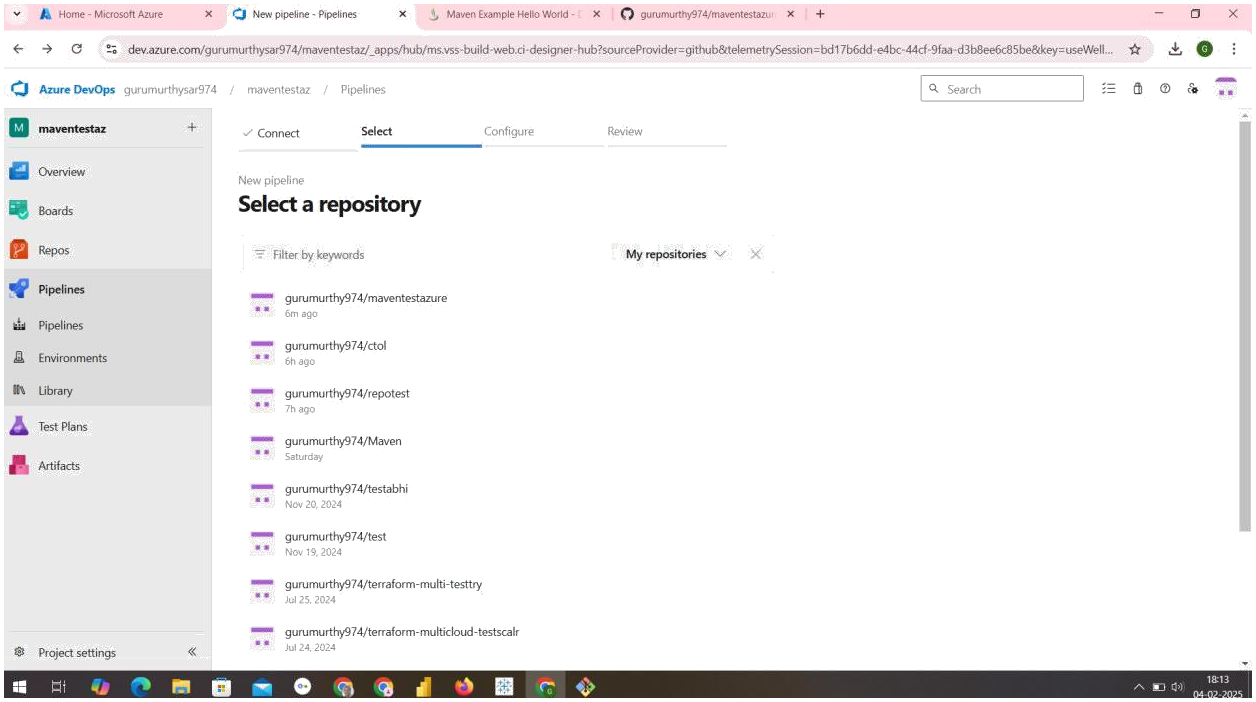
STEP5: SELECT PIPELINE and then click on create pipeline



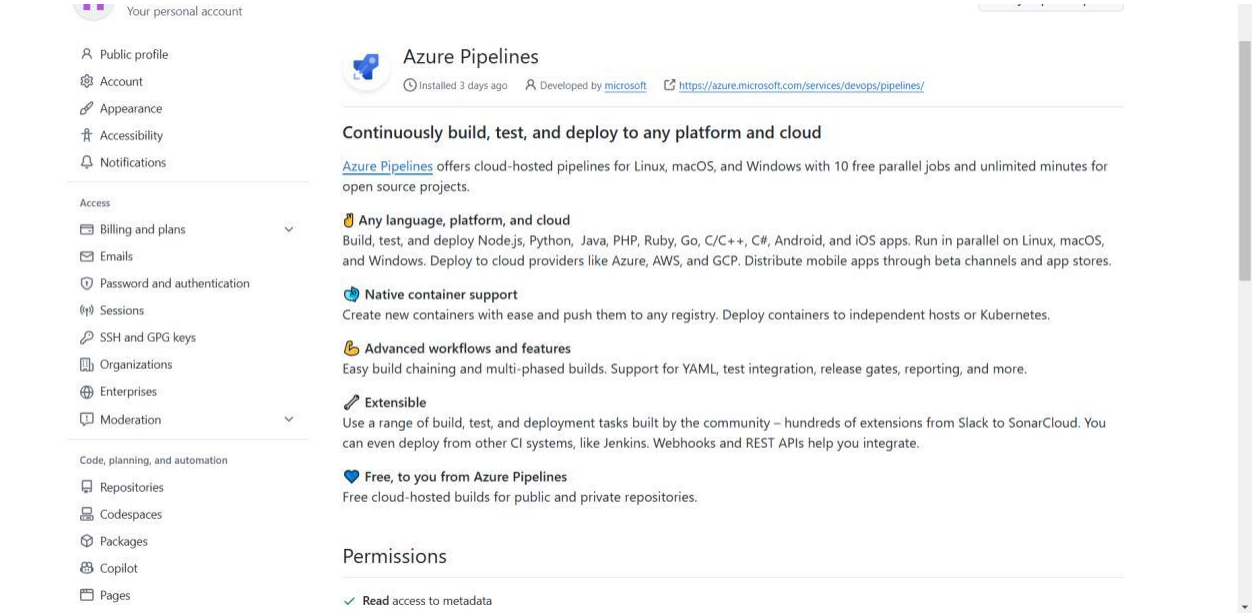
STEP6: After creating Pipeline select type of repo as Github



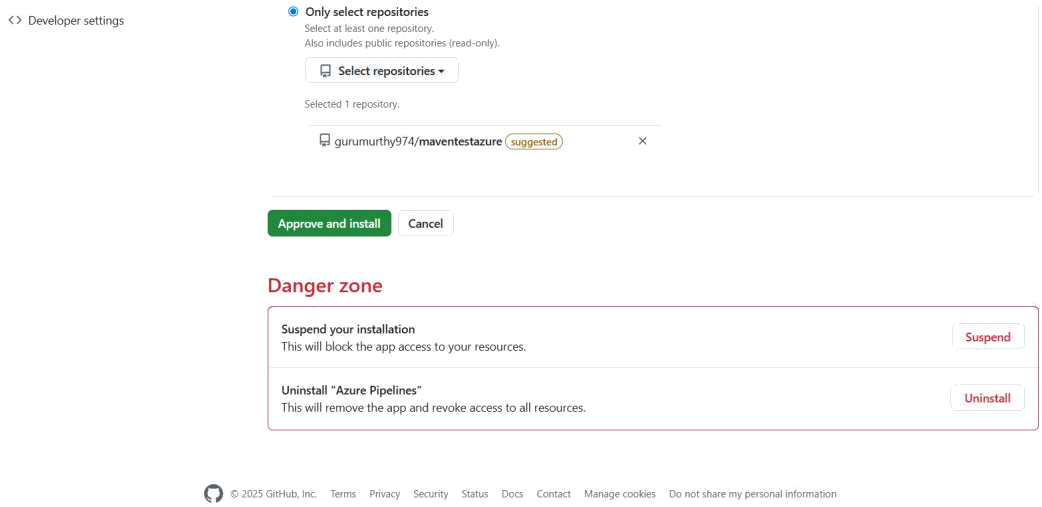
STEP7: It asks for minimum signin verification after that ur screen be as in below select required repository there to run maven project in my case its maventest123



STEP8: AFTER REQUIRED REPO IS SELECTED the screen be as in below

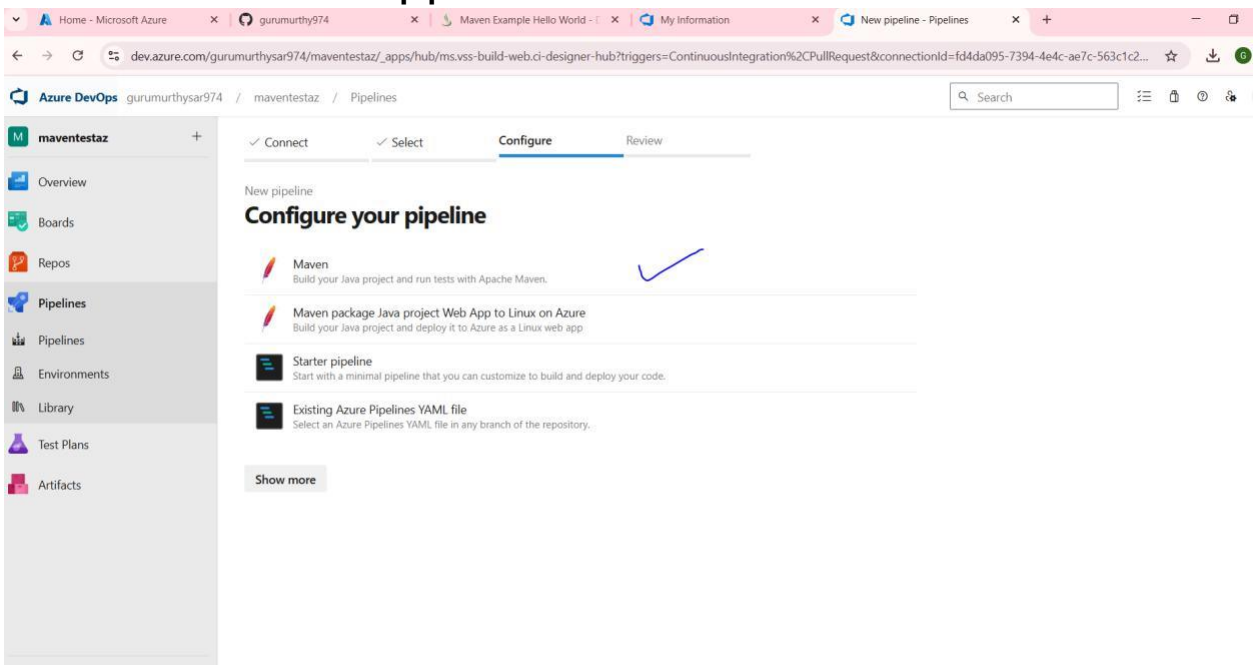


Drag the screen down check once again the selected repository is correct or not then click on Approve and Install

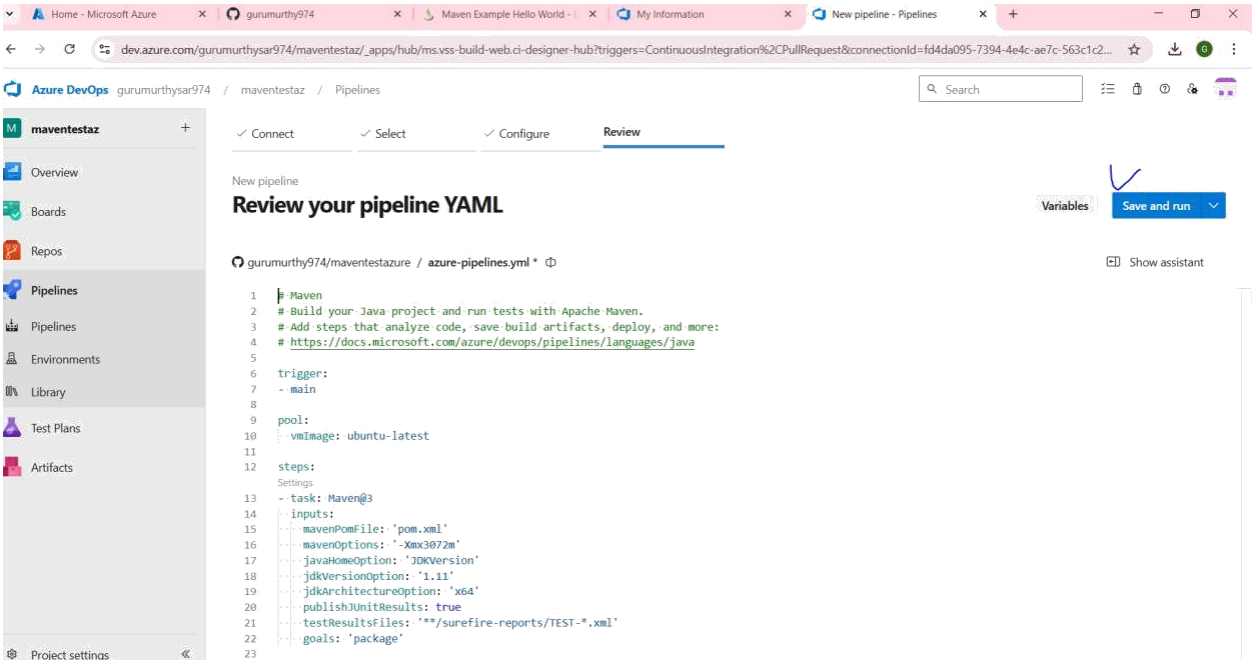


STEP9: It again verifies signin verification of microsoft account

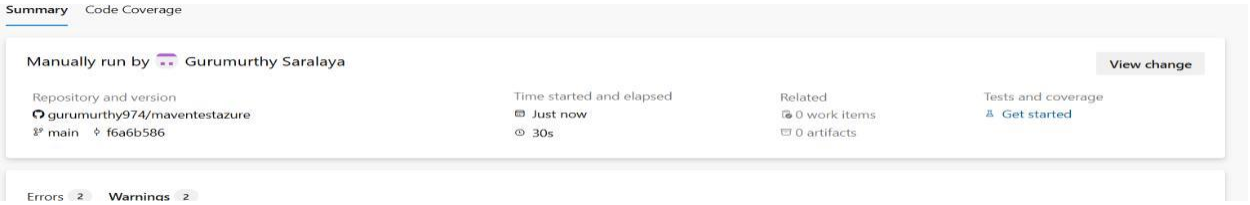
You be able to see starter pipeline select for Maven

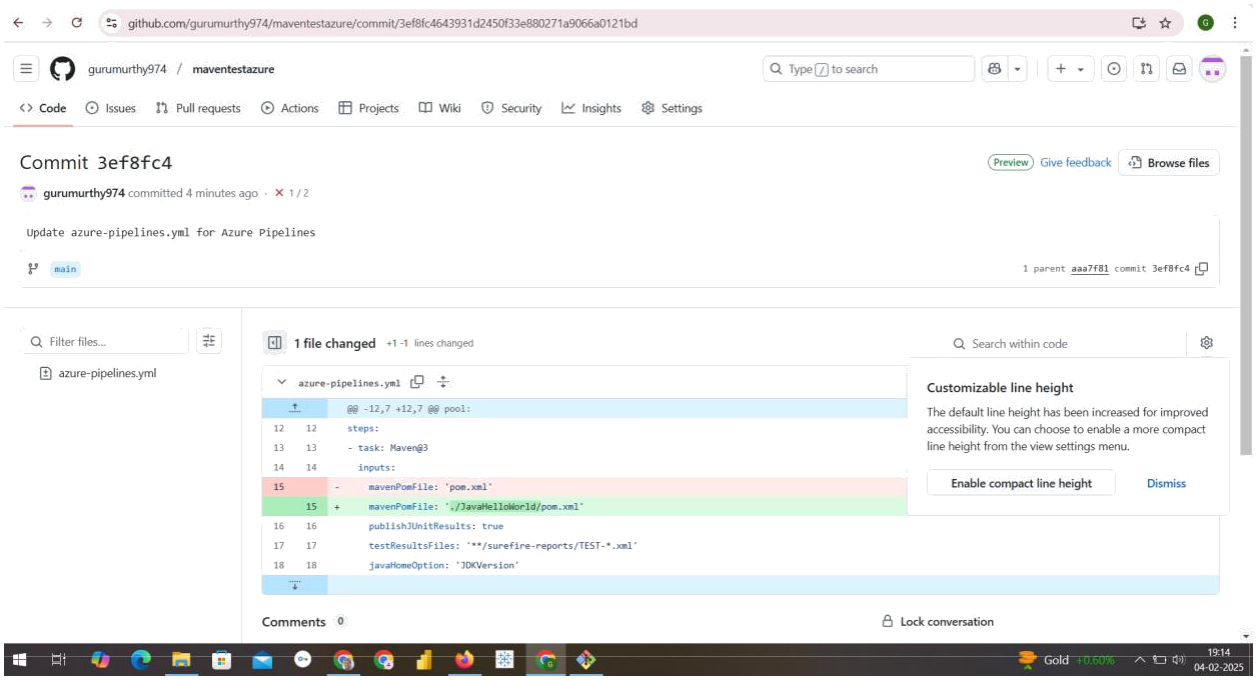


After selecting maven it asks for save and run just click on it



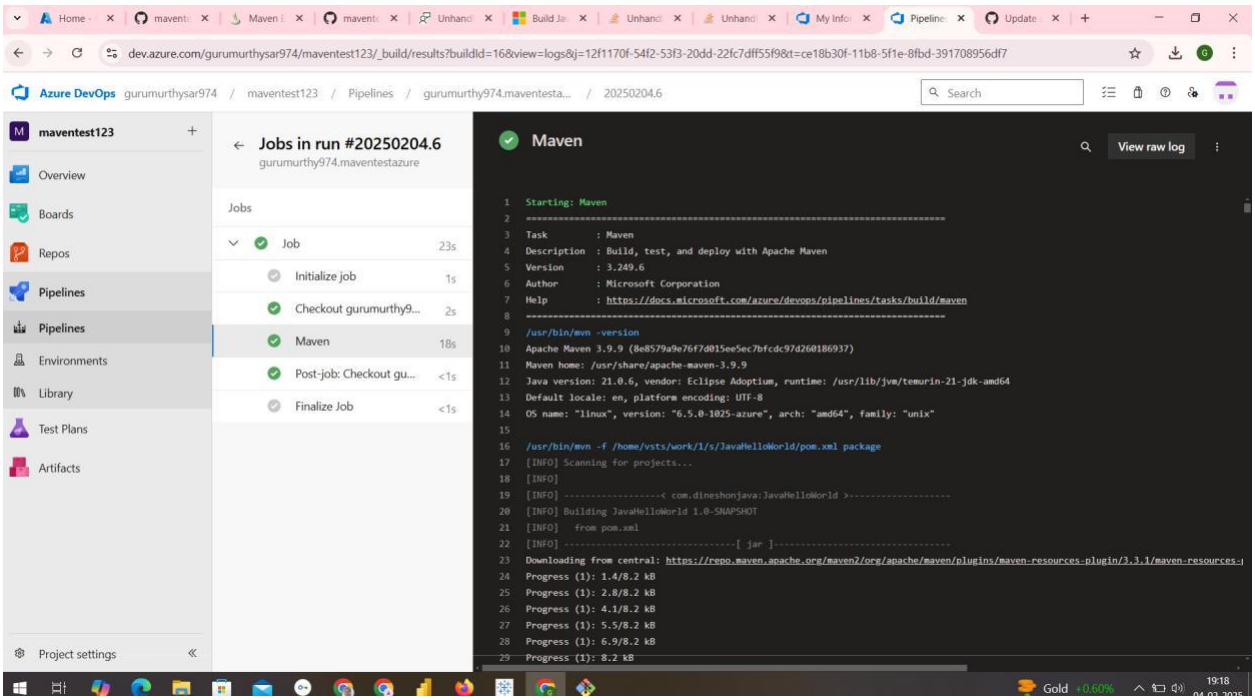
Finally You be able to see tasks running its failed bec we shld mention proper path For pom.xml





The commits will also be visible in github

WE can download and also see individual Raw Log Reports

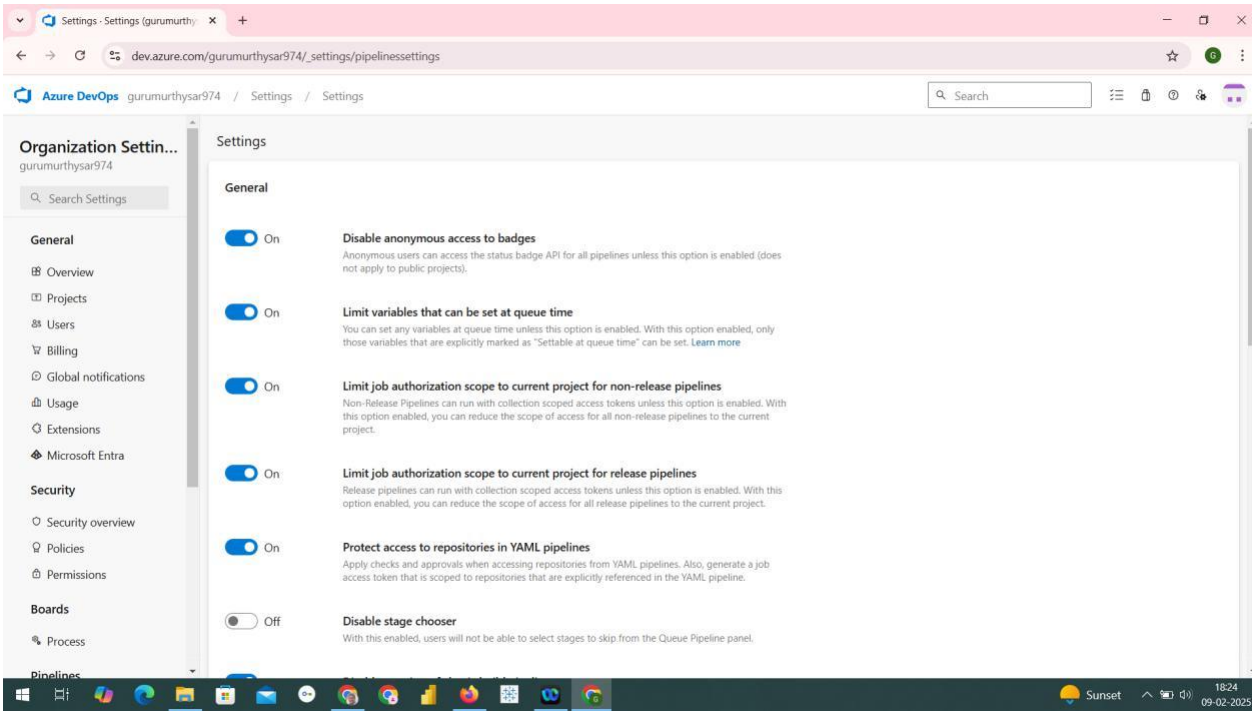


If pipeline permission error comes please complete the registration form of Parallel Jobs after 2 working days (48hrs) u be able to run pipelines for private projects same happens to be for public Projects.

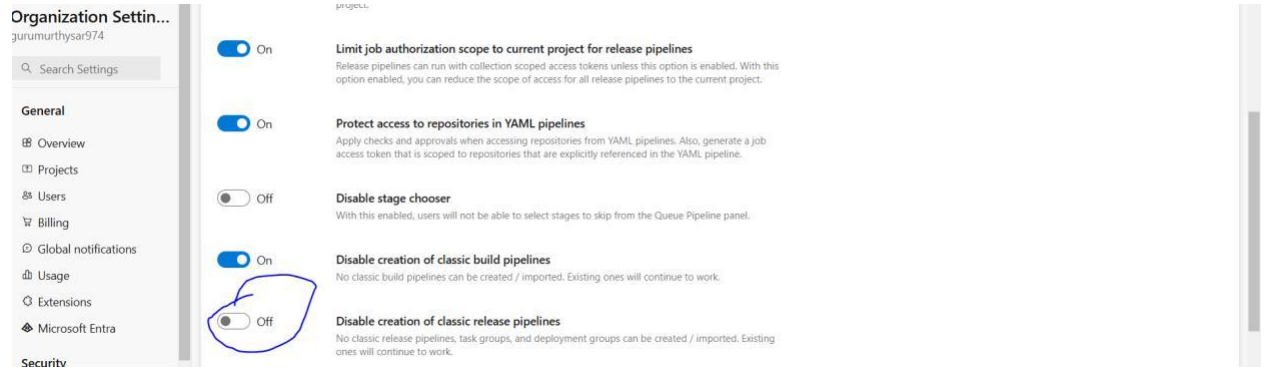
Program 11:

Creating Release Pipelines: Deploying Applications to Azure App Services, Managing Secrets and Configuration with Azure Key Vault, Hands-On: Continuous Deployment with Azure Pipelines.

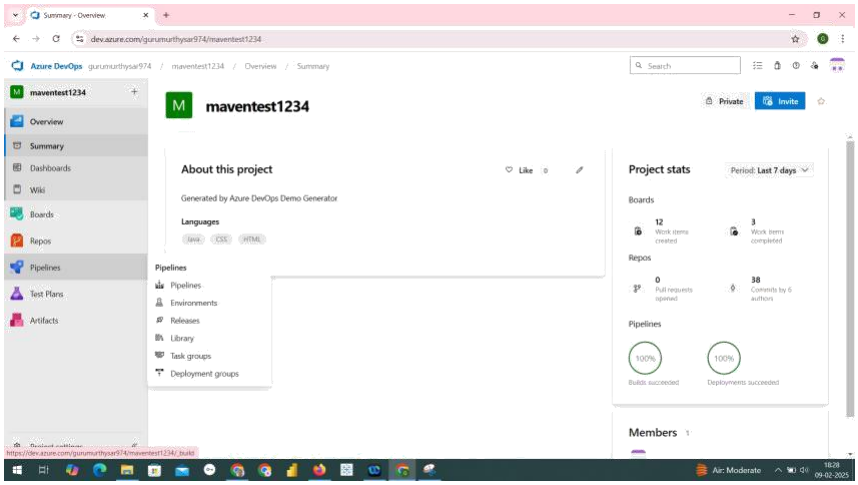
STEP1: Click on Organization setting and click on Pipeline Settings You get screen as in below



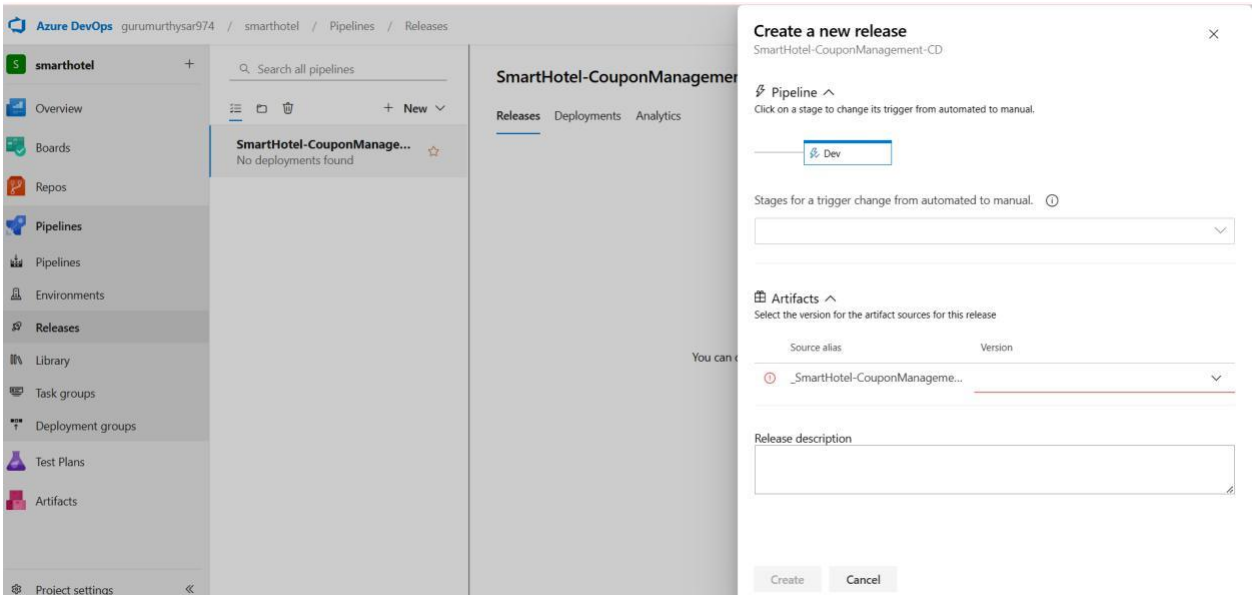
STEP2: Off the Disable creation of classic pipeline



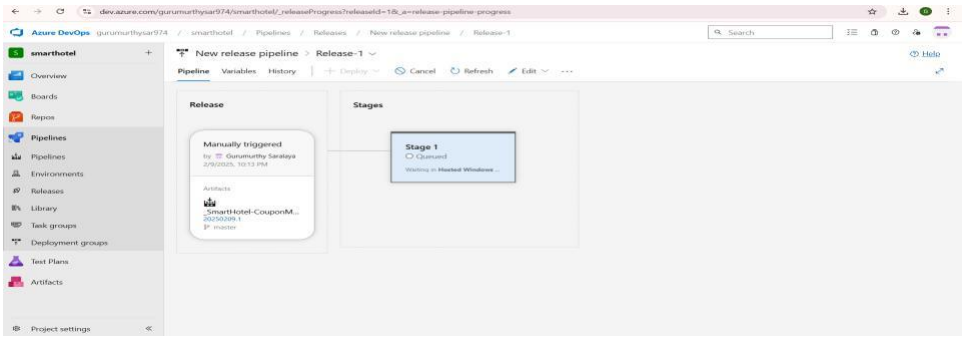
STEP3: NOw you be able to see the visibility of Release for any pipeline creation as in screen below.

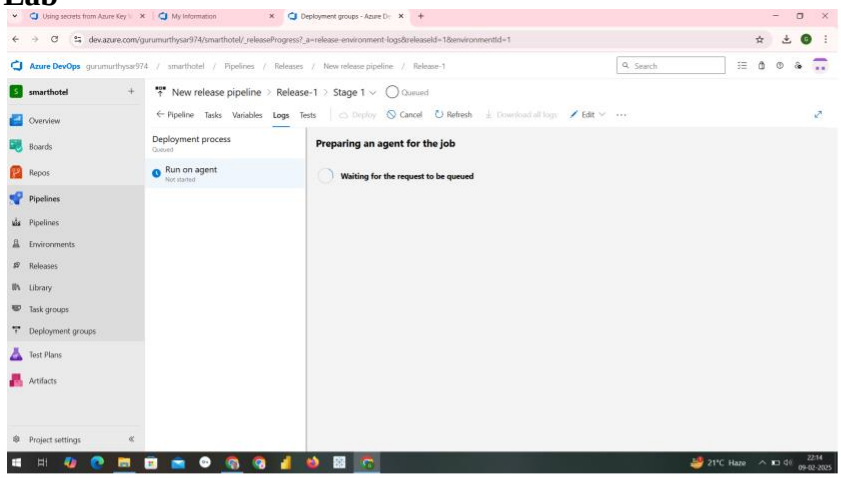


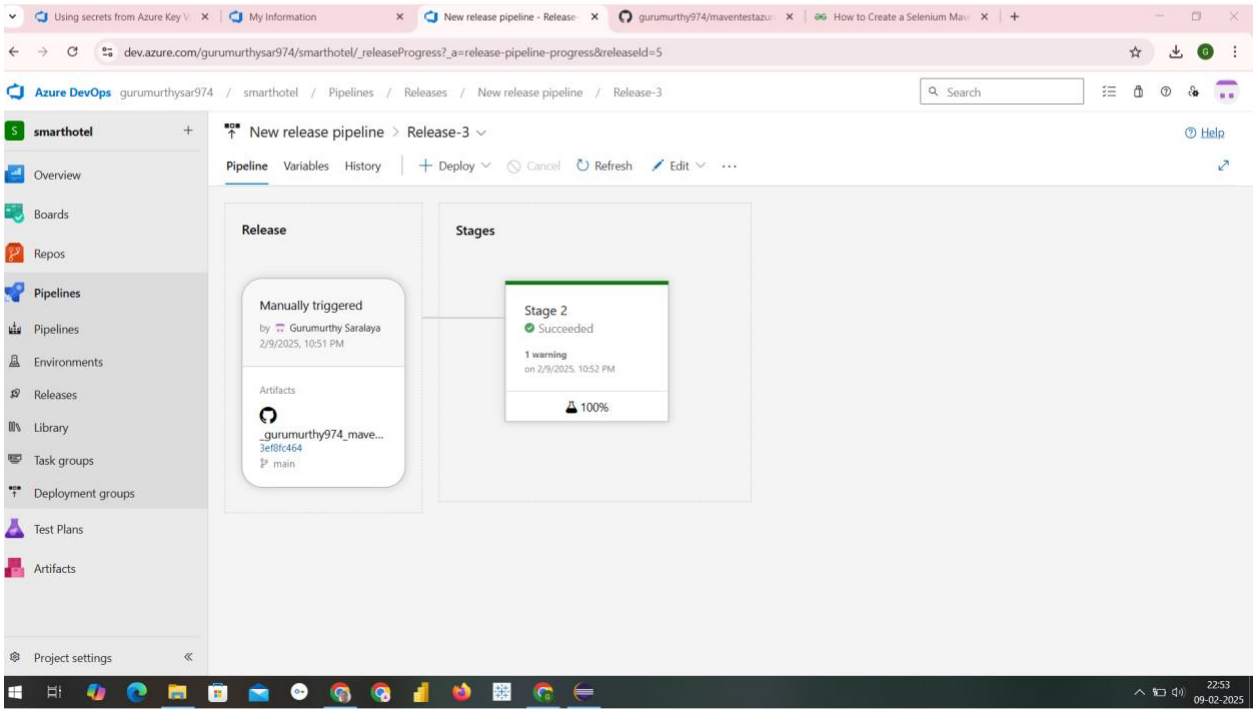
STEP4: YOu can run simple test plans



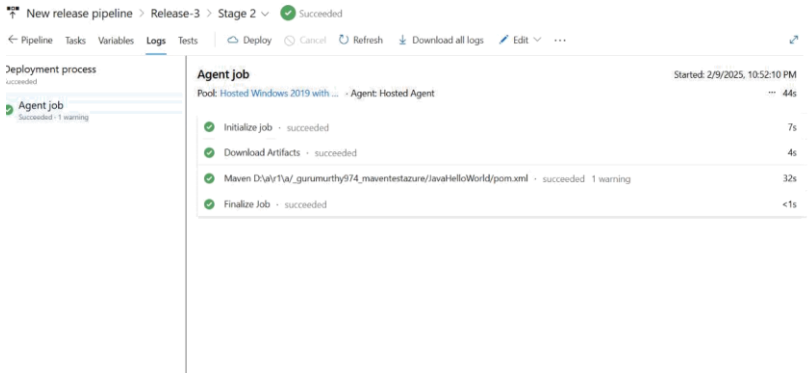
We can build tasks and run them







We can see our Agent Job releases logs



VIVA Question & Answers

1. Introduction to Maven and Gradle

Q1: What is Maven, and what is it used for?

A: Maven is a build automation tool used primarily for Java projects. It simplifies project management, dependency management, and build processes using a standardized approach through a Project Object Model (POM).

Q2: How does Gradle differ from Maven?

A: The key differences are:

- **Maven** uses XML-based POM files, while **Gradle** uses a Groovy/Kotlin DSL.
- Gradle is faster due to incremental builds and caching mechanisms.
- Gradle allows more flexibility in defining tasks compared to Maven's rigid lifecycle.

Q3: How do you install Maven and Gradle?

A:

- **Maven:** Download from Apache Maven's official website, set up MAVEN_HOME environment variable, and add bin directory to the system path.
- **Gradle:** Download from the Gradle website or use a package manager (e.g., sdk install gradle via SDKMAN).

2. Working with Maven

Q4: What is the POM file in Maven?

A: The POM (Project Object Model) file is an XML configuration file that defines a Maven project's dependencies, build configuration, and plugins.

Q5: How does Maven manage dependencies?

A: Maven uses a central repository (mvnrepository.com) and a local repository to resolve and cache dependencies. It fetches dependencies based on their groupId, artifactId, and version.

Q6: What are Maven plugins?

A: Plugins extend Maven's functionality by adding specific tasks like compiling code (maven-compiler-plugin), running tests (surefire-plugin), and packaging applications (maven-jar-plugin).

3. Working with Gradle

Q7: What are the two types of Gradle build scripts?

A:

1. **Groovy DSL (build.gradle)** – Uses Groovy scripting for configuration.
2. **Kotlin DSL (build.gradle.kts)** – Uses Kotlin, providing better type safety and autocompletion.

Q8: How does Gradle handle dependency management?

A: Gradle fetches dependencies from repositories (e.g., Maven Central, JCenter) and uses a dependencies block in build.gradle to define them.

Q9: What is task automation in Gradle?

A: Gradle allows users to define tasks (task myTask { doLast { println "Hello, Gradle!" }}) and automate builds, testing, and deployments efficiently.

4. Jenkins and Continuous Integration

Q10: What is Jenkins?

A: Jenkins is an open-source automation server used for Continuous Integration/Continuous Deployment (CI/CD). It automates building, testing, and deploying applications.

Q11: How do you install Jenkins?

A: Jenkins can be installed using a .war file (java -jar jenkins.war), as a Docker container, or on cloud environments like AWS, Azure, or Kubernetes.

Q12: What is a Jenkins pipeline?

A: A Jenkins pipeline is a series of automated steps (written in a Jenkinsfile) that define the CI/CD workflow, including building, testing, and deploying code.

Q13: How do you integrate Jenkins with Maven or Gradle?

A: In a Jenkins job, specify Maven or Gradle as a build step and configure the path to the corresponding build file (pom.xml or build.gradle).

5. Configuration Management with Ansible

Q14: What is Ansible?

A: Ansible is an open-source configuration management and automation tool that uses YAML-based playbooks to manage server configurations and deployments.

Q15: What are the key components of Ansible?

A:

- **Inventory:** A list of managed nodes.
- **Playbooks:** YAML files containing automation tasks.
- **Modules:** Pre-built scripts that perform tasks (e.g., apt, yum, copy).

Q16: How do you write a basic Ansible playbook?

A:

```
- name: Install Apache
  hosts: web_servers
  tasks:
    - name: Install Apache
      apt:
```

```
    name: apache2
    state: present
```

Q17: How does Ansible differ from other configuration management tools?

A: Ansible is agentless (no need to install software on remote machines) and uses SSH for communication, unlike Puppet or Chef, which require agents.

6. Azure DevOps and Pipelines

Q18: What is Azure DevOps?

A: Azure DevOps is a cloud-based DevOps platform that provides tools for source control, CI/CD pipelines, testing, and deployment.

Q19: How do you set up an Azure DevOps project?

A:

1. Create an Azure DevOps account.
2. Create a new project and repository.
3. Set up a build pipeline using Azure Pipelines.

Q20: What is an Azure Pipeline?

A: Azure Pipelines automate the building, testing, and deployment of applications using YAML or classic GUI-based workflows.

Q21: How do you deploy an application using Azure Pipelines?

A:

1. Define a **build pipeline** to compile and package the application.
2. Define a **release pipeline** to deploy the application to Azure services like App Service or Kubernetes.

7. Hands-on and Best Practices

Q22: How do you migrate a Maven project to Gradle?

A: Use the command:

gradle init --type pom

This converts pom.xml to build.gradle. Then, manually adjust dependencies and plugins.

Q23: What are best practices for DevOps pipelines?

A:

- Use **Infrastructure as Code (IaC)** (e.g., Ansible, Terraform).
- Implement **automated testing** in CI/CD pipelines.
- Follow **version control** best practices (e.g., Git branching strategies).
- Use **monitoring and logging** for proactive issue detection.

Q24: How does Jenkins work with Ansible for deployment?

A: Jenkins triggers an Ansible playbook to configure servers and deploy artifacts after a successful build.