SPE Mini Project-DevOps Calculator.

Himanshu Shankar Digrase, MT2022155

March 2023

Contents

Introduction

I have developed a command-line scientific calculator application for the SPE mini project. It is a Java language based scientific calculator application with 4 operations -

1. Square root - $\sqrt{x}$
2. Factorial - $x!$
3. Power - x^a
4. Logarithmic - $\log(x)$

The project is built using the maven build tool and, It is following DevOps practices.

What and Why DevOps ? DevOps is a set of practices that combines Software Development (Dev) and IT Operations (Ops). It tries to implement continuous build - continuous integration and continuous deployment which indeed shorten the systems development life cycle and provide continuous delivery with quality software, used mainly for quick fixes.

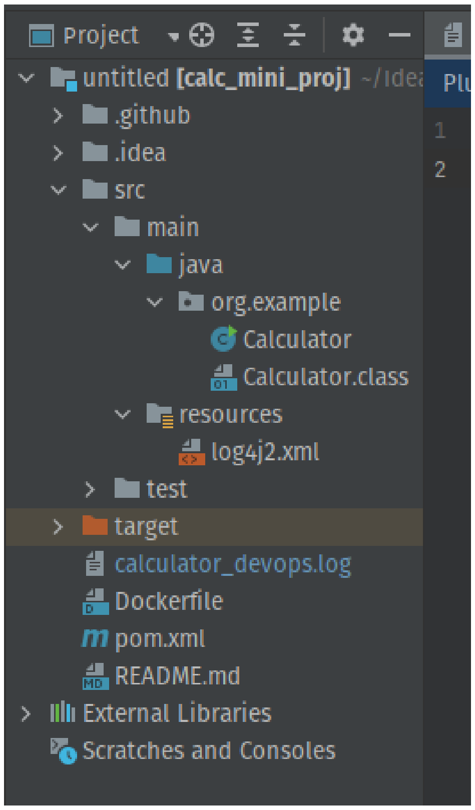
Tools Used -

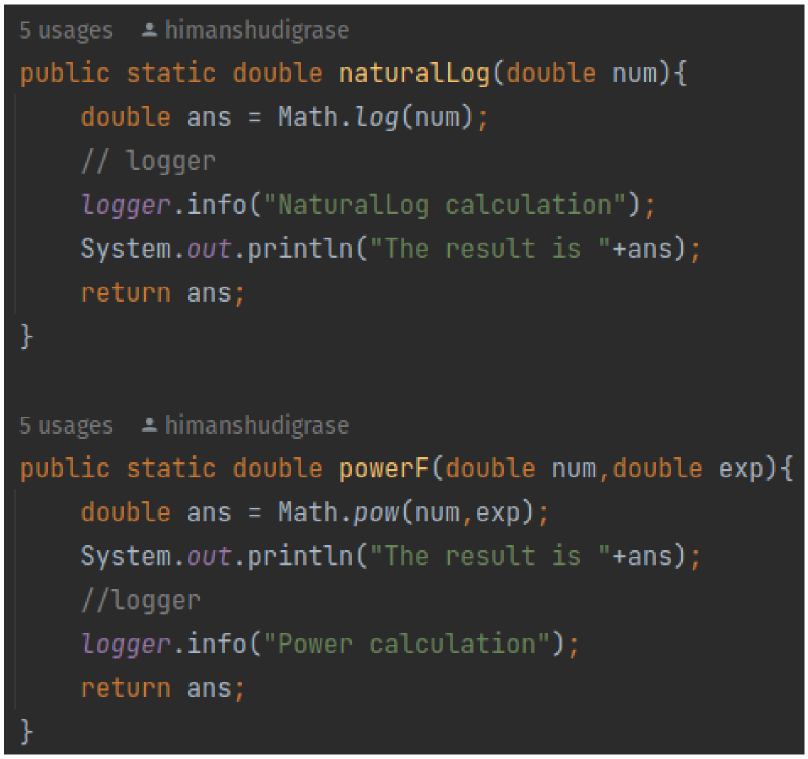
1. **Programming Language:** Java - 1.8 (JDK 8)
2. **Project Build / Project Management Tool:** maven (Apache)
3. **Unit testing Tool:** JUnit - version. 4.13.2
4. **SCM (Source Code Management):** Git with GitHub https://github.com/himanshudigrase/calculatorDevOps
5. **Logger / Log file generator:** log4j - version. 2.17.1
6. **Containerization:** Docker - DockerHub (public cloud repository for storing image) https://hub.docker.com/repository/docker/hims0301/calculator_devops/tags
7. **Continuous Integration:** Github Actions
8. **Continuous Deployment:** Github Actions
9. **Monitoring Tool:** ELK Stack (visualization using - Kibana)

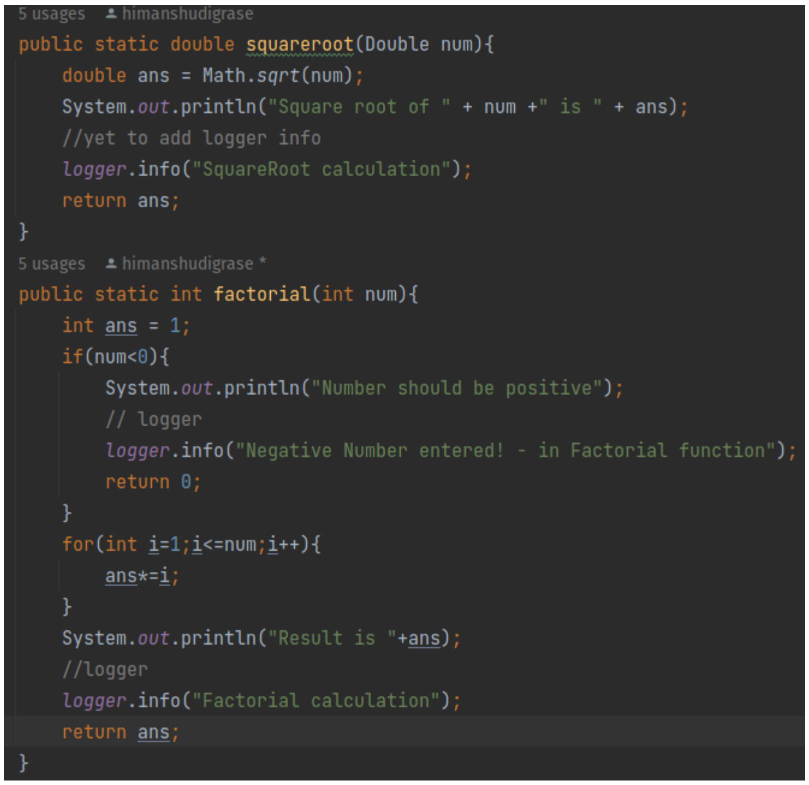
1. Programming Language - JAVA

Implemented 4 functions for scientific calculator operations - added menu to choose which operation is to be performed, implemented switch case control structure to select / choose any one of the 4 operations in application.

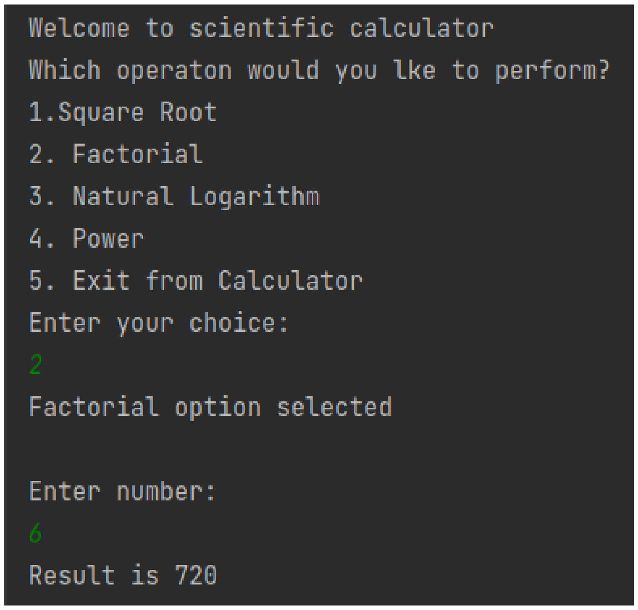
Created maven project on IntelliJ IDE - it has created maven folder structure which contains src folder which will contain main function of application, test folder for JUnit test cases and pom.xml file which will handle the project dependencies.




```
5 usages  himanshudigrase
public static double naturalLog(double num){
    double ans = Math.log(num);
    // logger
    logger.info("NaturalLog calculation");
    System.out.println("The result is "+ans);
    return ans;
}

5 usages  himanshudigrase
public static double powerF(double num,double exp){
    double ans = Math.pow(num,exp);
    System.out.println("The result is "+ans);
    //logger
    logger.info("Power calculation");
    return ans;
}
```


```
5 usages   himanshudigrase
public static double squareroot(Double num){
    double ans = Math.sqrt(num);
    System.out.println("Square root of " + num +" is " + ans);
    //yet to add logger info
    logger.info("SquareRoot calculation");
    return ans;
}
5 usages   himanshudigrase *
public static int factorial(int num){
    int ans = 1;
    if(num<0){
        System.out.println("Number should be positive");
        // logger
        logger.info("Negative Number entered! - in Factorial function");
        return 0;
    }
    for(int i=1;i<=num;i++){
        ans*=i;
    }
    System.out.println("Result is "+ans);
    //logger
    logger.info("Factorial calculation");
    return ans;
}
```

Executing Calculator application on locally on IntelliJ


```
Welcome to scientific calculator
Which operaton would you lke to perform?
1.Square Root
2. Factorial
3. Natural Logarithm
4. Power
5. Exit from Calculator
Enter your choice:
2
Factorial option selected

Enter number:
6
Result is 720
```

2. Project Build / Project Management Tool - Maven

Maven is a powerful project management tool that is based on POM (project object model). It is used for projects build, dependency and documentation. In short terms we can say that maven is a tool that can be used for building and managing any Java-based project also useful in configuring all the dependencies it downloads these dependencies specified in pom.xml once it is downloaded from server it is stored in local project cache, and used for next builds.

Here, I have used maven which will be creating an executable .jar file which will package all dependencies specified in POM file; here dependencies such as JUnit and log4j will be bundled up with this executable binary jar in the target folder. pom.xml file manages the metadata, dependencies and plugins for the project.

Maven commands

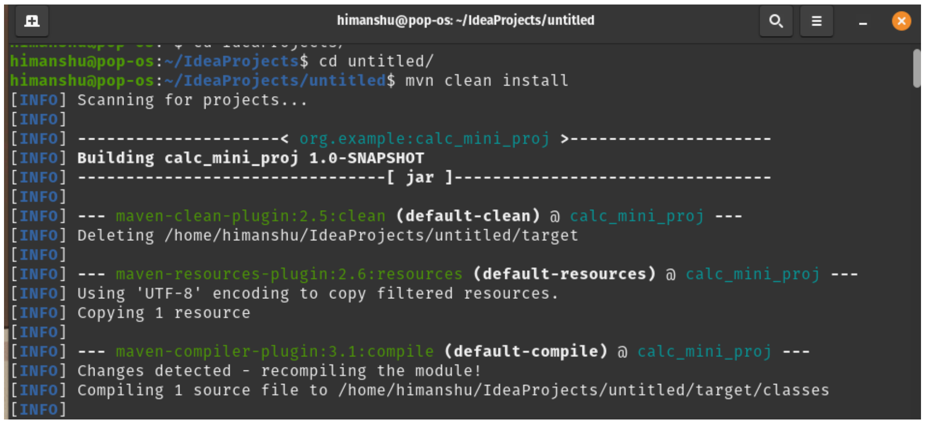
mvn clean - Clean the project hierarchy and clear the cache in the Maven hierarchy, if target folder already present it will delete and create newly for fresh build

mvn compile - The main goal here is to compile all the source code files in the 'src/main/java/Application.Calculator' folder.

mvn install - Installs the package into the local repository, for use as a dependency in other projects locally.

mvn package - take the compiled code and package it in its distributable format, such as a JAR.

Run the command, mvn clean install



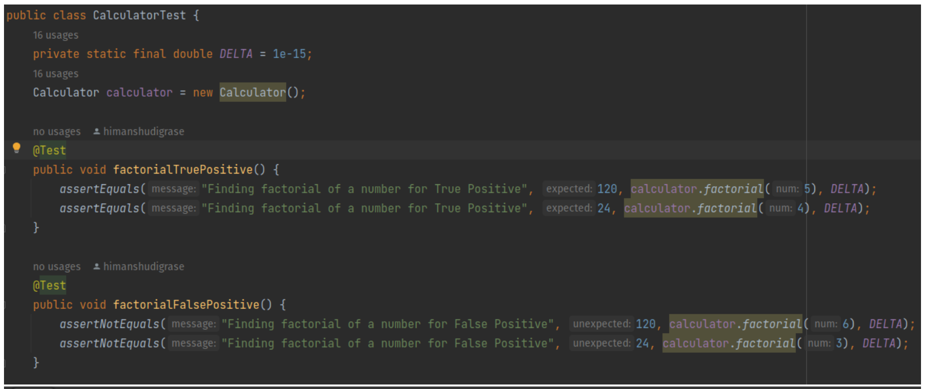
```
himanshu@pop-os:~/IdeaProjects$ cd untitled/
himanshu@pop-os:~/IdeaProjects/untitled$ mvn clean install
[INFO] Scanning for projects...
[INFO]
[INFO] ---------------------< org.example:calc_mini_proj >---------------------
[INFO] Building calc_mini_proj 1.0-SNAPSHOT
[INFO] --------------------------------[ jar ]---------------------------------
[INFO]
[INFO] --- maven-clean-plugin:2.5:clean (default-clean) @ calc_mini_proj ---
[INFO] Deleting /home/himanshu/IdeaProjects/untitled/target
[INFO]
[INFO] --- maven-resources-plugin:2.6:resources (default-resources) @ calc_mini_proj ---
[INFO] Using 'UTF-8' encoding to copy filtered resources.
[INFO] Copying 1 resource
[INFO]
[INFO] --- maven-compiler-plugin:3.1:compile (default-compile) @ calc_mini_proj ---
[INFO] Changes detected - recompiling the module!
[INFO] Compiling 1 source file to /home/himanshu/IdeaProjects/untitled/target/classes
[INFO]
```

3. Unit testing Tool- JUnit (ver. 4.13.2)

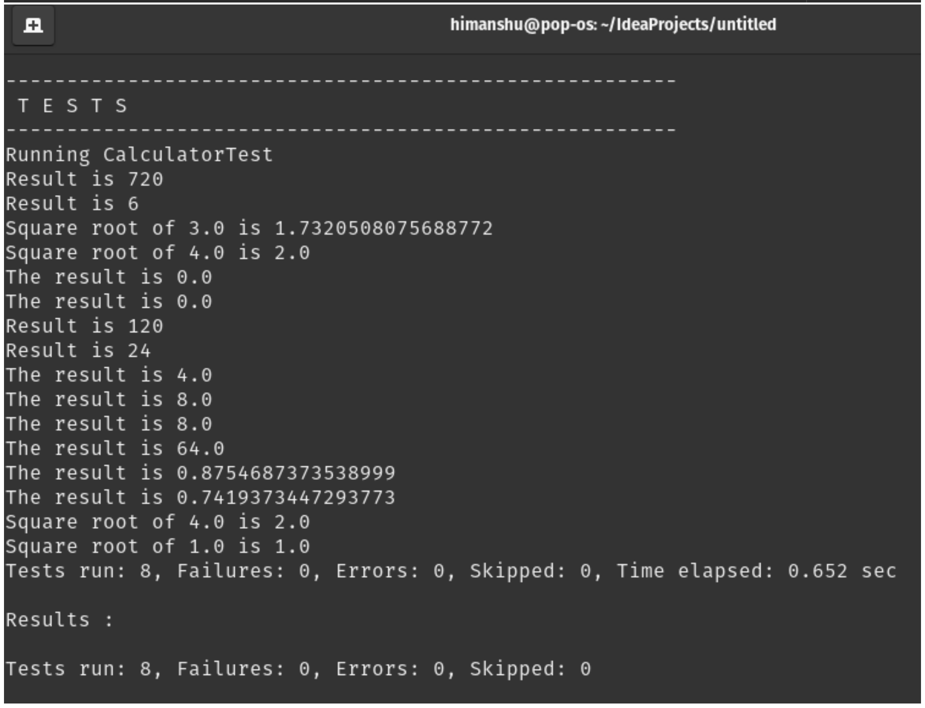
JUnit is a unit testing framework for the Java programming language. JUnit has been important in the development of test-driven development. Following are snippets from the Calculator Project that implements two types of unit test cases for each of the calculator operations - method.

True positive assertEquals, where we expect the output of the method to what we have stated.

True negative, assertNotEquals, where we expect the method to not be equal to what we have stated / expected.



```
public class CalculatorTest {
    16 usages
    private static final double DELTA = 1e-15;
    16 usages
    Calculator calculator = new Calculator();

    no usages   himanshudigrase
    @Test
    public void factorialTruePositive() {
        assertEquals( message: "Finding factorial of a number for True Positive",  expected: 120, calculator.factorial( num: 5), DELTA);
        assertEquals( message: "Finding factorial of a number for True Positive",  expected: 24, calculator.factorial( num: 4), DELTA);
    }

    no usages   himanshudigrase
    @Test
    public void factorialFalsePositive() {
        assertNotEquals( message: "Finding factorial of a number for False Positive",  unexpected: 120, calculator.factorial( num: 6), DELTA);
        assertNotEquals( message: "Finding factorial of a number for False Positive",  unexpected: 24, calculator.factorial( num: 3), DELTA);
    }
```

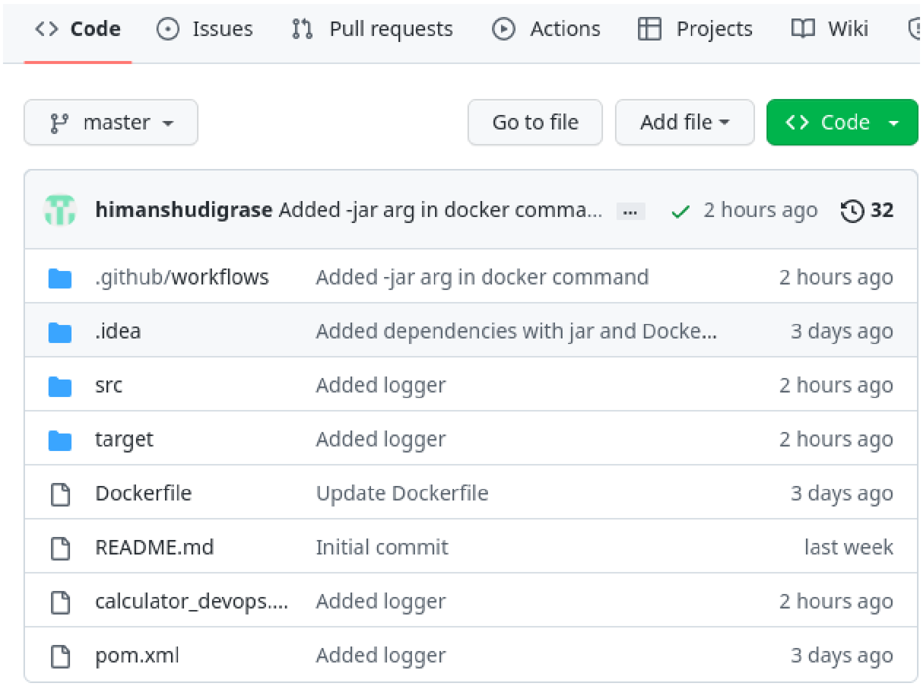


```
himanshu@pop-os: ~/IdeaProjects/untitled

-------------------------------------------------------
 T E S T S
-------------------------------------------------------
Running CalculatorTest
Result is 720
Result is 6
Square root of 3.0 is 1.7320508075688772
Square root of 4.0 is 2.0
The result is 0.0
The result is 0.0
Result is 120
Result is 24
The result is 4.0
The result is 8.0
The result is 8.0
The result is 64.0
The result is 0.8754687373538999
The result is 0.7419373447293773
Square root of 4.0 is 2.0
Square root of 1.0 is 1.0
Tests run: 8, Failures: 0, Errors: 0, Skipped: 0, Time elapsed: 0.652 sec

Results :

Tests run: 8, Failures: 0, Errors: 0, Skipped: 0
```

4 . Source Code management Tool - Git with GitHub

Source code management (SCM) is used to track modifications to a source code repository. SCM is also synonymous with Version Control System (VCS). SCM tracks the running history of changes as well as backup previous checkpoints in project codebase and helps resolve conflicts when merging updates, or any merge conflicts that happen when multiple developers working on the same module of project.

I have created a repository on GitHubhttps://github.com/himanshudigrase/calculatorDevOps and then configured the Maven project of my local repository to update the local folder structure to remote GitHub repo using Git commands.



himanshudigrase Added -jar arg in docker comma... ✓ 2 hours ago 32

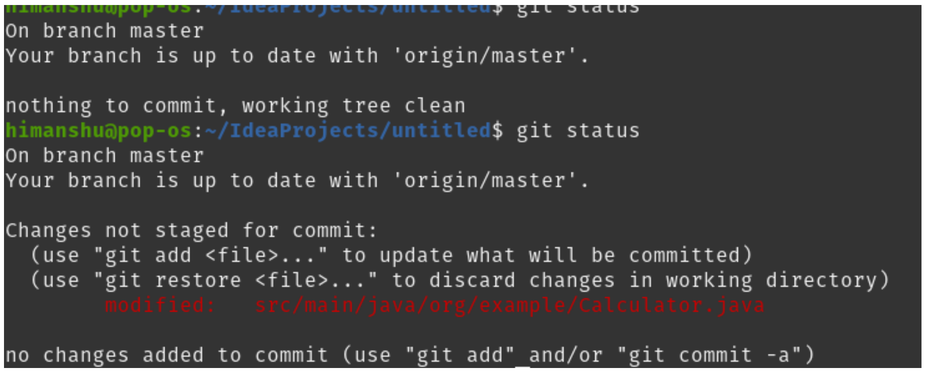
.github/workflows	Added -jar arg in docker command	2 hours ago
.idea	Added dependencies with jar and Docke...	3 days ago
src	Added logger	2 hours ago
target	Added logger	2 hours ago
Dockerfile	Update Dockerfile	3 days ago
README.md	Initial commit	last week
calculator_devops....	Added logger	2 hours ago
pom.xml	Added logger	3 days ago

Git Commands →

git init - it will initialize my java maven project as a Git repository.

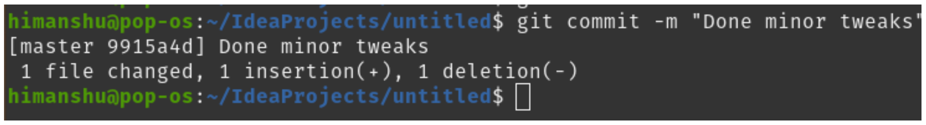
git remote add origin <GitHub_URL>.git - Link the local Git repository to the remote GitHub repository whose URL is specified in the command and the link is given the name origin

git add . - Adds all the unstaged files and untracked changes in the current directory to the staging area for committing.



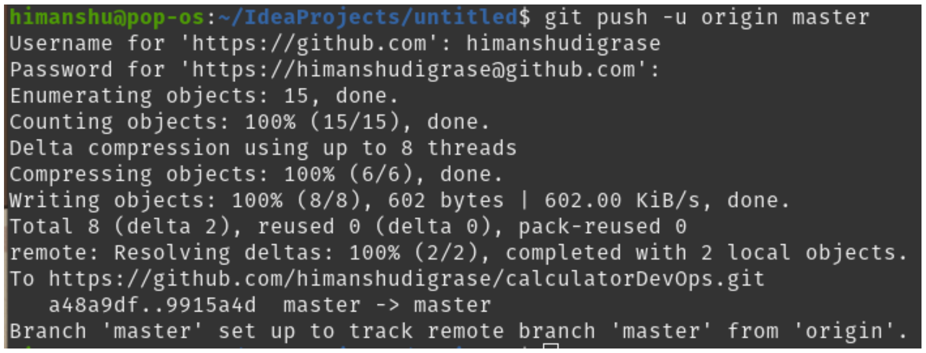
```
himanshu@pop-os:~/IdeaProjects/untitled$ git status
On branch master
Your branch is up to date with 'origin/master'.

nothing to commit, working tree clean
himanshu@pop-os:~/IdeaProjects/untitled$ git status
On branch master
Your branch is up to date with 'origin/master'.

Changes not staged for commit:
  (use "git add <file>..." to update what will be committed)
  (use "git restore <file>..." to discard changes in working directory)
        modified:   src/main/java/org/example/Calculator.java

no changes added to commit (use "git add" and/or "git commit -a")
```

git commit -m “<commit_message>” - Commit the added changes to the local Git repository also creates checkpoint for version history based on commit message one can get idea about changes happened on that steam / branch



```
himanshu@pop-os:~/IdeaProjects/untitled$ git commit -m "Done minor tweaks"
[master 9915a4d] Done minor tweaks
 1 file changed, 1 insertion(+), 1 deletion(-)
himanshu@pop-os:~/IdeaProjects/untitled$ 
```

git push -u origin master - Push the latest commits from the local Git repository master branch to the remote GitHub master branch

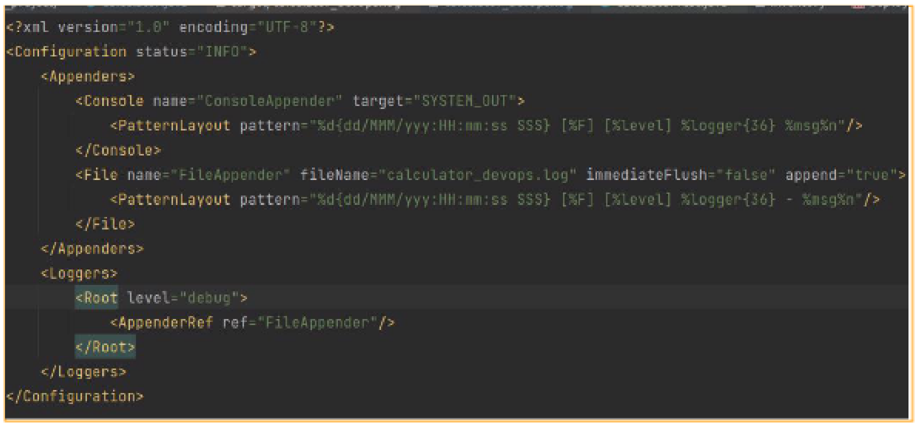


```
himanshu@pop-os:~/IdeaProjects/untitled$ git push -u origin master
Username for 'https://github.com': himanshudigrase
Password for 'https://himanshudigrase@github.com':
Enumerating objects: 15, done.
Counting objects: 100% (15/15), done.
Delta compression using up to 8 threads
Compressing objects: 100% (6/6), done.
Writing objects: 100% (8/8), 602 bytes | 602.00 KiB/s, done.
Total 8 (delta 2), reused 0 (delta 0), pack-reused 0
remote: Resolving deltas: 100% (2/2), completed with 2 local objects.
To https://github.com/himanshudigrase/calculatorDevOps.git
   a48a9df..9915a4d  master -> master
Branch 'master' set up to track remote branch 'master' from 'origin'.
```

5. Logger / Log File Generator - log4j

Logging keeps track of all the operations that were performed in the application, warnings, debugging information, errors etc. Apache log4j is a Java-based logging utility originally written by Ceki Gülcü. log4j is java logging framework - these dependency is added to maven pom.xml file so that final executable jar file gets bundled with these dependency of log4j

Its configuration is provided via the log4j2.xml file which is stored under the resources directory of the project and for this project, it is configured as follows,



```
<?xml version="1.0" encoding="UTF-8"?>
<Configuration status="INFO">
    <Appenders>
        <Console name="ConsoleAppender" target="SYSTEM_OUT">
            <PatternLayout pattern="%d{dd/MMM/yyy:HH:mm:ss SSS} [%F] [%level] %logger{36} %msg%n"/>
        </Console>
        <File name="FileAppender" fileName="calculator_devops.log" immediateFlush="false" append="true">
            <PatternLayout pattern="%d{dd/MMM/yyy:HH:mm:ss SSS} [%F] [%level] %logger{36} - %msg%n"/>
        </File>
    </Appenders>
    <Loggers>
        <Root level="debug">
            <AppenderRef ref="FileAppender"/>
        </Root>
    </Loggers>
</Configuration>
```

Now we need to add logger functions in the main application code which uses the logger which is initialized as below. And then the logger can be called to generate log messages as follows,

private static final Logger logger = LogManager.getLogger(Calculator.class);

logger.info("SquareRoot calculation");

logger.info("Factorial calculation");

logger.info("NaturalLog calculation");

logger.info("Power calculation");

logger.info("Invalid Input! Closing Application");

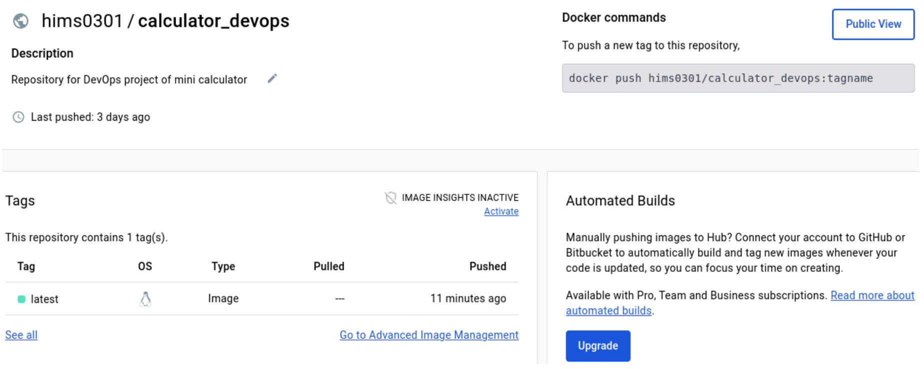
6. Containerization - Docker

Docker is an open platform for developing, shipping, and running applications. Docker helps you to seperate your applications from your infrastructure so you can deliver software quickly.

Docker containerization - it is OS level virtualization it is a modern day technique used instead of VM machines for deployment of software.

Using Docker's methodologies for shipping, testing, and deploying code quickly, you can significantly reduce the delay between writing code and running it in production.

Created docker hub repo - https://hub.docker.com/repository/docker/hims0301/calculator_devops/tags



hims0301 / **calculator_devops**

Description

Repository for DevOps project of mini calculator

Last pushed: 3 days ago

Docker commands

To push a new tag to this repository,

```
docker push hims0301/calculator_devops:tagname
```

Tags

This repository contains 1 tag(s).

Tag	OS	Type	Pulled	Pushed
latest		Image	---	11 minutes ago

Automated Builds

Manually pushing images to Hub? Connect your account to GitHub or Bitbucket to automatically build and tag new images whenever your code is updated, so you can focus your time on creating.

Available with Pro, Team and Business subscriptions. Read more about automated builds.

Docker builds images automatically by reading the instructions from a Dockerfile - a text file

that contains all commands, in order, needed to build a given image.

In this project, we need to create a container that executes the built Maven project. JAR file that is being created using the following command.

java -cp <path_to_jar_file> <class_package_name>

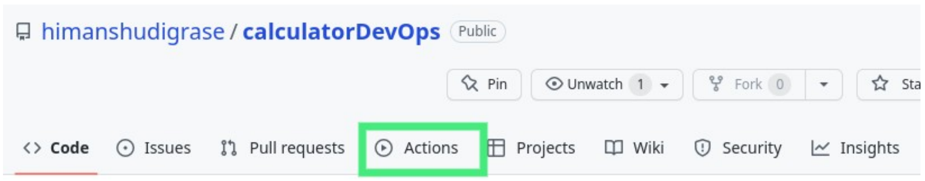
Dockerfile

```
FROM openjdk:19
COPY target/calc_mini_proj-1.0-SNAPSHOT-jar-with-dependencies.jar ./
WORKDIR ./
CMD ["java", "-cp","calc_mini_proj-1.0-SNAPSHOT-jar-with-dependencies.jar","org.example.Calculator"]
```

Once image is created by following steps in Dockerfile, next step is to push this image into DockerHub which is going to be automated by Github Actions script *(covered in next section)*

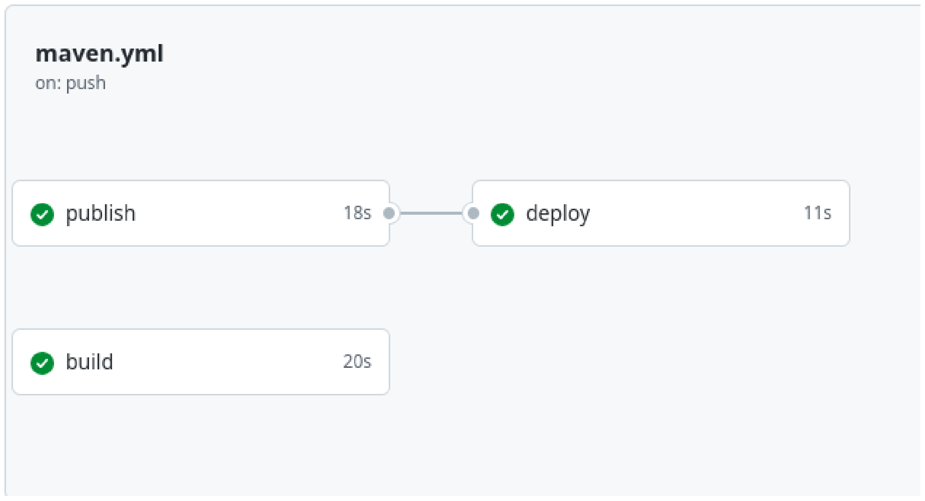
7. Continuous Integration - Github Actions

Github Actions - GitHub Actions is a continuous integration and continuous delivery (CI/CD) platform that allows you to automate your build, test, and deployment pipeline. You can create workflows that build and test every pull request to your repository, or deploy merged pull requests to production.



The components of GitHub Actions

You can configure a GitHub Actions workflow to be triggered when an event occurs in your repository, such as a pull request being opened or an issue being created. Your workflow contains one or more jobs which can run in sequential order or in parallel. Each job will run inside its own virtual machine runner, or inside a container, and has one or more steps that either run a script that you define or run an action, which is a reusable extension that can simplify your workflow.



Workflows

A workflow is a configurable automated process that will run one or more jobs. Workflows are defined by a YAML file checked in to your repository and will run when triggered by an event in your repository, or they can be triggered manually, or at a defined schedule.

Workflows are defined in the *.github/workflows* directory in a repository, and a repository can have multiple workflows, each of which can perform a different set of tasks. For example, you can have one workflow to build and test pull requests, another workflow to deploy your application every time a release is created, and still another workflow that adds a label every time someone opens a new issue.

Events

An event is a specific activity in a repository that triggers a workflow run. For example, activity can originate from GitHub when someone creates a pull request, opens an issue, or pushes a commit to a repository. You can also trigger a workflow to run on a schedule, by posting to a REST API, or manually.

Jobs

A job is a set of steps in a workflow that is executed on the same runner. Each step is either a shell script that will be executed, or an action that will be run. Steps are executed in order and are dependent on each other. Since each step is executed on the same runner, you can share data from one step to another. For example, you can have a step that builds your application followed by a step that tests the application that was built.

You can configure a job's dependencies with other jobs; by default, jobs have no dependencies and run in parallel with each other. When a job takes a dependency on another job, it will wait for the dependent job to complete before it can run. For example, you may have multiple build jobs for different architectures that have no dependencies, and a packaging job that is dependent on those jobs. The build jobs will run in parallel, and when they have all completed successfully, the packaging job will run.

Actions

An action is a custom application for the GitHub Actions platform that performs a complex but frequently repeated task. Use an action to help reduce the amount of repetitive code that you write in your workflow files. An action can pull your git repository from GitHub, set up the correct toolchain for your build environment, or set up the authentication to your cloud provider.

You can write your own actions, or you can find actions to use in your workflows in the GitHub Marketplace.

Runners

A runner is a server that runs your workflows when they're triggered. Each runner can run a single job at a time. GitHub provides Ubuntu Linux, Microsoft Windows, and macOS runners to run your workflows; each workflow run executes in a fresh, newly-provisioned virtual machine. GitHub also offers larger runners, which are available in larger configurations. If you need a different operating system or require a specific hardware configuration, you can host your own runners.

name: Java CI with Maven

```
on:
 push:
    branches: [ "master" ]
 pull_request:
    branches: [ "master" ]

jobs:
  build:
      runs-on: ubuntu-latest
      steps:
      - uses: actions/checkout@v3
      - name: Set up JDK 19
        uses: actions/setup-java@v3
        with:
          java-version: '19'
          distribution: 'temurin'
          cache: maven
      - name: Build with Maven
        run: mvn -B package --file pom.xml
  publish:
    runs-on: ubuntu-latest
    steps:
    - name: Checkout code
      uses: actions/checkout@v2
    - name: Build Docker image
      run: docker build -t hims0301/calculator_devops:latest .
    - name: Log in to Docker registry
      uses: docker/login-action@v1
      with:
        registry: docker.io
      username: ${{ secrets.DOCKER_USERNAME }}
      password: ${{ secrets.DOCKER_PASSWORD }}
    - name: Push Docker image
      run: docker push hims0301/calculator_devops:latest
  deploy:
    needs: publish
    runs-on: self-hosted
    steps:
      - name: Pull Docker image
        run: docker pull hims0301/calculator_devops:latest
```

```
- name: Stop running calculator-container
  run: docker stop calculator-container || true
- name: remove container named calculator-container
  run: docker rm calculator-container || true
- name: Start new container
  run: docker run --name calculator-container -d -t hims0301/calculator_devops:latest
  java -jar calc_mini_proj-1.0-SNAPSHOT-jar-with-dependencies.jar
```

Understanding the workflow file

To help you understand how YAML syntax is used to create a workflow file, this section explains each line of the above workflow:

```
name: Java CI with Maven
```

Optional - The name of the workflow as it will appear in the “Actions” tab of the GitHub repository.

```
on:
  push:
    branches: [ "master" ]
  pull_request:
    branches: [ "master" ]
```

Specifies the trigger for this workflow. This example uses the *push* and *pull* event, so a workflow run is triggered every time someone pushes a change to the repository or merges a pull request. This is triggered by a push to every branch;

```
jobs:
```

Groups together all the jobs that run in the *Java CI with Maven* workflow.

```
runs-on: ubuntu-latest
```

Configures the job to run on the latest version of an Ubuntu Linux runner. This means that the job will execute on a fresh virtual machine hosted by GitHub.

```
steps:
```

Groups together all the steps that run in the *Java CI with Maven* job. Each item nested under this section is a separate action or shell script.

```
uses: actions/checkout@v3
```

The uses keyword specifies that this step will run v3 of the actions/checkout action. This is an action that checks out your repository onto the runner, allowing you to run scripts or other actions against your code (such as build and test tools). You should use the checkout action any time your workflow will run against the repository’s code.

```
   uses: actions/setup-java@v3
   with:
    java-version: '19'
    distribution: 'temurin'
    cache: maven
```

```
  - name: Build with Maven
    run: mvn -B package --file pom.xml
```

Above snippet set ups our server with JAVA JDK 19 and build our pom.xml with the help of maven

```
- name: Build Docker image
  run: docker build -t hims0301/calculator_devops:latest .
```

This snippet builds docker image for out repository under user *hims0301* with repository name : *calculator_devops*

```
- name: Log in to Docker registry
  uses: docker/login-action@v1
  with:
      registry: docker.io
      username: ${{ secrets.DOCKER_USERNAME }}
      password: ${{ secrets.DOCKER_PASSWORD }}
```

Above snippet allows us to login into our dockerhub repository with provided username and password stores inside secret folder of github repository

```
- name: Push Docker image
  run: docker push hims0301/calculator_devops:latest
```

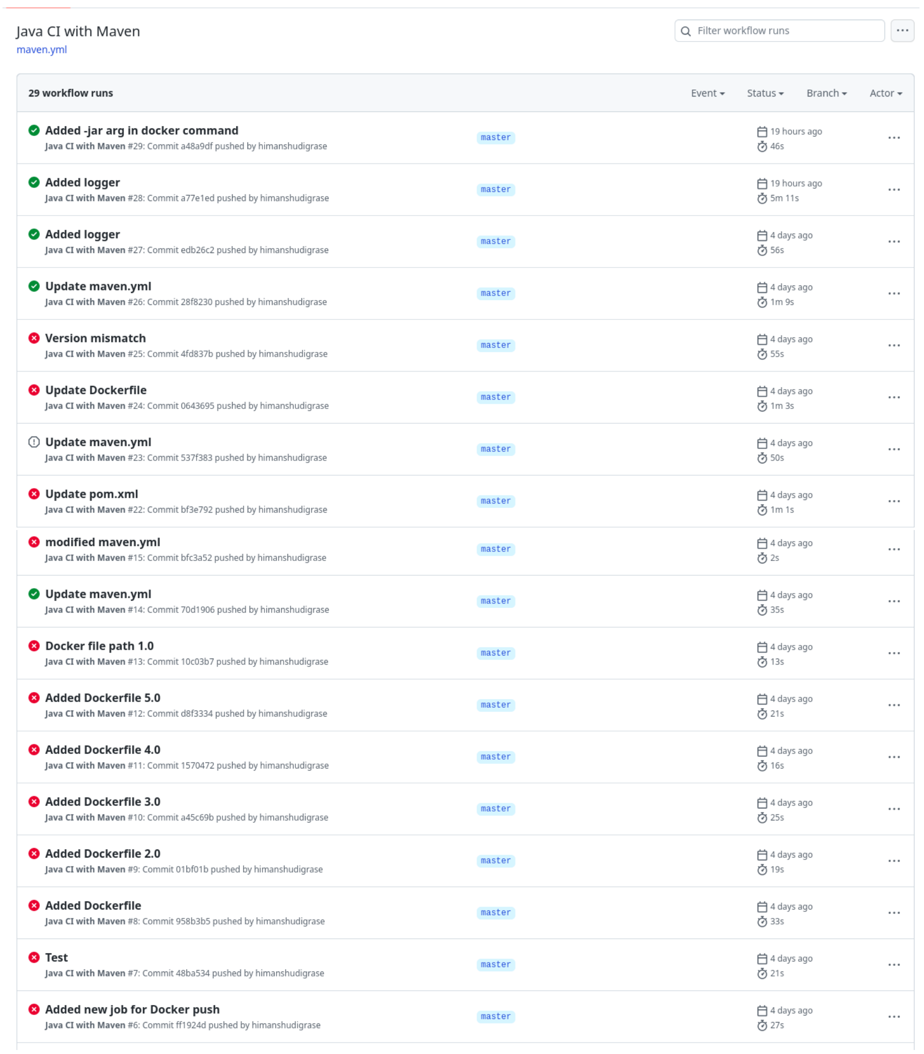
This pushes our docker image to our docker hub

```
deploy:
needs: publish
runs-on: self-hosted
```

Job named *deploy* deploys our job to our localhost and needs job named *publish* to be finished first.

```
steps:
  - name: Pull Docker image
    run: docker pull hims0301/calculator_devops:latest
  - name: Stop running calculator-container
    run: docker stop calculator-container || true
  - name: remove container named calculator-container
    run: docker rm calculator-container || true
  - name: Start new container
    run: docker run --name calculator-container -d -t hims0301/calculator_devops:latest
    java -jar calc_mini_proj-1.0-SNAPSHOT-jar-with-dependencies.jar
```

Above steps pulls docker image to our localhost and makes a new container (if it doesn't exist) and runs the .jar file



Java CI with Maven

maven.yml

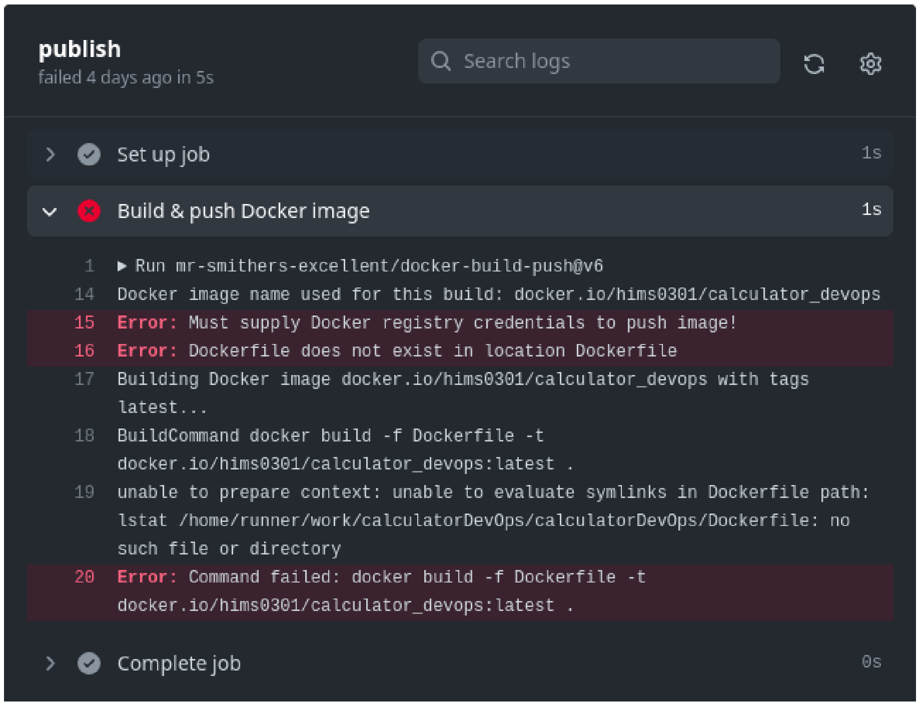
Filter workflow runs

29 workflow runs Event ▾ Status ▾ Branch ▾ Actor ▾

✓	**Added -jar arg in docker command** **Java CI with Maven** #29: Commit a48a9df pushed by himanshudigrase	`master`	19 hours ago 46s	...
✓	**Added logger** **Java CI with Maven** #28: Commit a77e1ed pushed by himanshudigrase	`master`	19 hours ago 5m 11s	...
✓	**Added logger** **Java CI with Maven** #27: Commit edb26c2 pushed by himanshudigrase	`master`	4 days ago 56s	...
✓	**Update maven.yml** **Java CI with Maven** #26: Commit 28f8230 pushed by himanshudigrase	`master`	4 days ago 1m 9s	...
✗	**Version mismatch** **Java CI with Maven** #25: Commit 4fd837b pushed by himanshudigrase	`master`	4 days ago 55s	...
✗	**Update Dockerfile** **Java CI with Maven** #24: Commit 0643695 pushed by himanshudigrase	`master`	4 days ago 1m 3s	...
!	**Update maven.yml** **Java CI with Maven** #23: Commit 537f383 pushed by himanshudigrase	`master`	4 days ago 50s	...
✗	**Update pom.xml** **Java CI with Maven** #22: Commit bf3e792 pushed by himanshudigrase	`master`	4 days ago 1m 1s	...
✗	**modified maven.yml** **Java CI with Maven** #15: Commit bfc3a52 pushed by himanshudigrase	`master`	4 days ago 2s	...
✓	**Update maven.yml** **Java CI with Maven** #14: Commit 70d1906 pushed by himanshudigrase	`master`	4 days ago 35s	...
✗	**Docker file path 1.0** **Java CI with Maven** #13: Commit 10c03b7 pushed by himanshudigrase	`master`	4 days ago 13s	...
✗	**Added Dockerfile 5.0** **Java CI with Maven** #12: Commit d8f3334 pushed by himanshudigrase	`master`	4 days ago 21s	...
✗	**Added Dockerfile 4.0** **Java CI with Maven** #11: Commit 1570472 pushed by himanshudigrase	`master`	4 days ago 16s	...
✗	**Added Dockerfile 3.0** **Java CI with Maven** #10: Commit a45c69b pushed by himanshudigrase	`master`	4 days ago 25s	...
✗	**Added Dockerfile 2.0** **Java CI with Maven** #9: Commit 01bf01b pushed by himanshudigrase	`master`	4 days ago 19s	...
✗	**Added Dockerfile** **Java CI with Maven** #8: Commit 958b3b5 pushed by himanshudigrase	`master`	4 days ago 33s	...
✗	**Test** **Java CI with Maven** #7: Commit 48ba534 pushed by himanshudigrase	`master`	4 days ago 21s	...
✗	**Added new job for Docker push** **Java CI with Maven** #6: Commit ff1924d pushed by himanshudigrase	`master`	4 days ago 27s	...

Errors/Challenges occured during CI/CD in configuring Github Actions

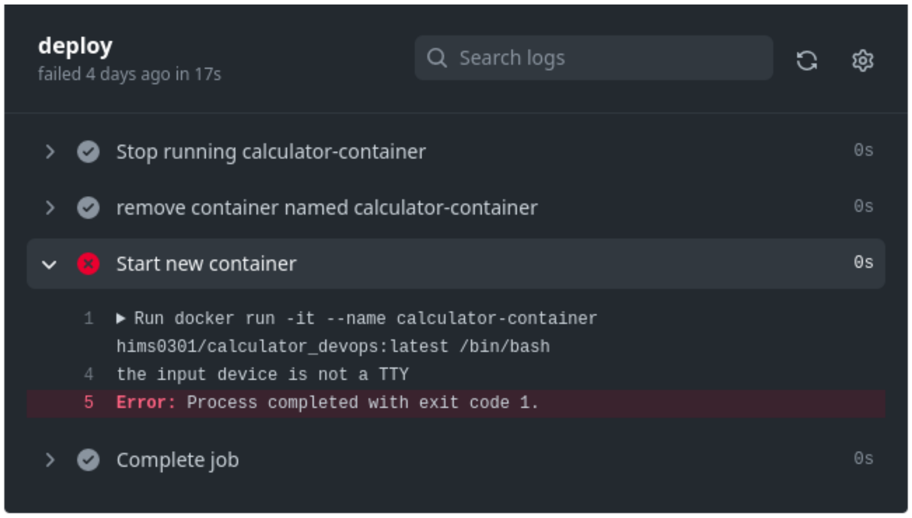
1. Unable to locate Dockerfile.



```
▶ Run mr-smithers-excellent/docker-build-push@v6
Docker image name used for this build: docker.io/hims0301/calculator_devops
Error: Must supply Docker registry credentials to push image!
Error: Dockerfile does not exist in location Dockerfile
Building Docker image docker.io/hims0301/calculator_devops with tags
latest...
BuildCommand docker build -f Dockerfile -t
docker.io/hims0301/calculator_devops:latest .
unable to prepare context: unable to evaluate symlinks in Dockerfile path:
lstat /home/runner/work/calculatorDevOps/calculatorDevOps/Dockerfile: no
such file or directory
Error: Command failed: docker build -f Dockerfile -t
docker.io/hims0301/calculator_devops:latest .
```

Solution: Relocated Dockerfile to project directory from .github/workflows folder

2. Got error of input device not a tty due to -t flag specified in *docker run* command


deploy
failed 4 days ago in 17s

Stop running calculator-container 0s
remove container named calculator-container 0s
Start new container 0s

```
▶ Run docker run -it --name calculator-container
hims0301/calculator_devops:latest /bin/bash
the input device is not a TTY
Error: Process completed with exit code 1.
```

Complete job 0s

   Solution: Removed -t flag from docker run command

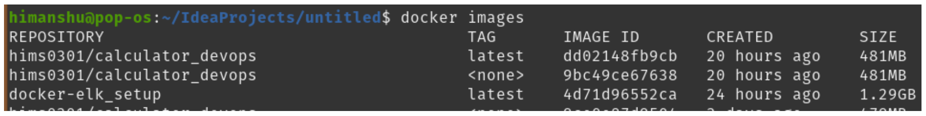
3. Got version mismatch error due to different version of JDK specified in pom.xml and Dockerfile

   Solution: Configured both platforms with JDK 19

Running Calculator Application on Container Image

To check latest images of calculator_devops -

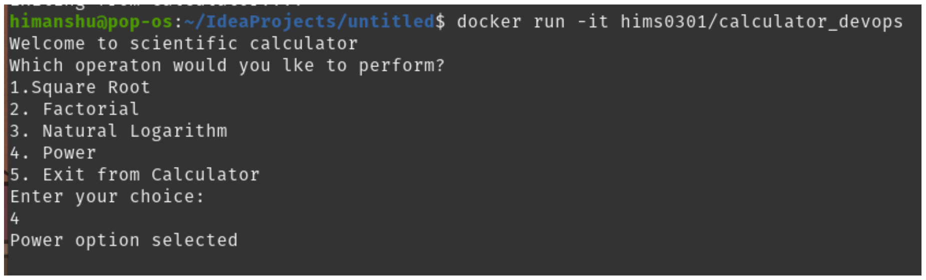
- ***docker images***
- ***docker ps -a***



```
himanshu@pop-os:~/IdeaProjects/untitled$ docker images
REPOSITORY                                      TAG       IMAGE ID       CREATED         SIZE
hims0301/calculator_devops                      latest    dd02148fb9cb   20 hours ago    481MB
hims0301/calculator_devops                      <none>    9bc49ce67638   20 hours ago    481MB
docker-elk_setup                                latest    4d71d96552ca   24 hours ago    1.29GB
```

To run application image on container

- ***docker run -it hims0301/calculator_devops***



```
himanshu@pop-os:~/IdeaProjects/untitled$ docker run -it hims0301/calculator_devops
Welcome to scientific calculator
Which operaton would you lke to perform?
1.Square Root
2. Factorial
3. Natural Logarithm
4. Power
5. Exit from Calculator
Enter your choice:
4
Power option selected
```

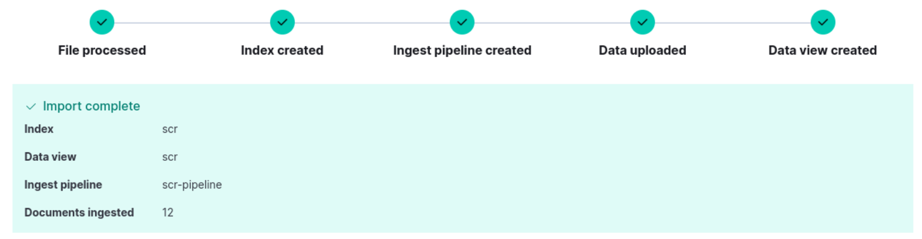
8. Monitoring Tool: ELK Stack

"**ELK**" is the acronym for three open source projects:Elasticsearch, Logstash, and Kibana.

ELK stack gives us the ability to aggregate logs from all the systems and applications, analyze these logs, and create visualizations for application and infrastructure monitoring, faster troubleshooting, security analytics, and more.

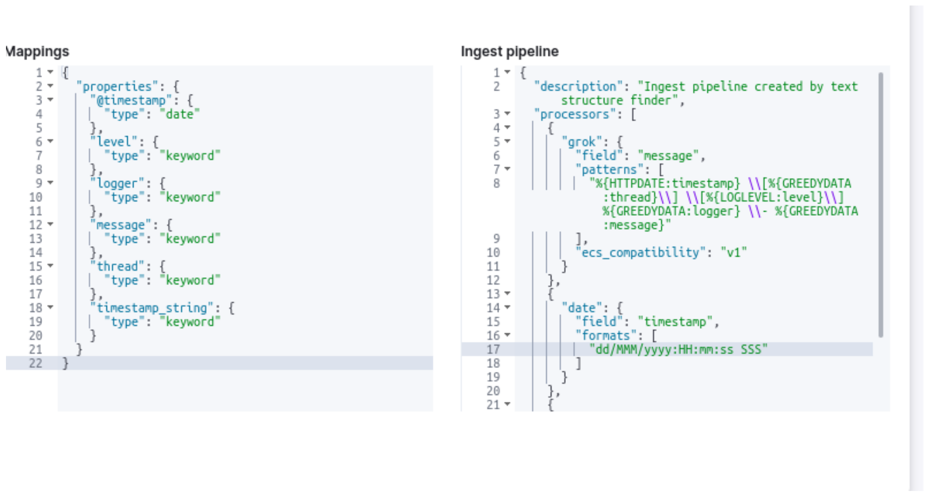
Kibana Visualization of log-file using - **GROK** pattern to decode logging messages

GROK pattern → `%{HTTPDATE:timestamp_string} \[%{GREEDYDATA:thread}\] \[%{LOGLEVEL:level}\] %{GREEDYDATA:logger} \- %{GREEDYDATA:message}`



✓ Import complete

Index	scr
Data view	scr
Ingest pipeline	scr-pipeline
Documents ingested	12



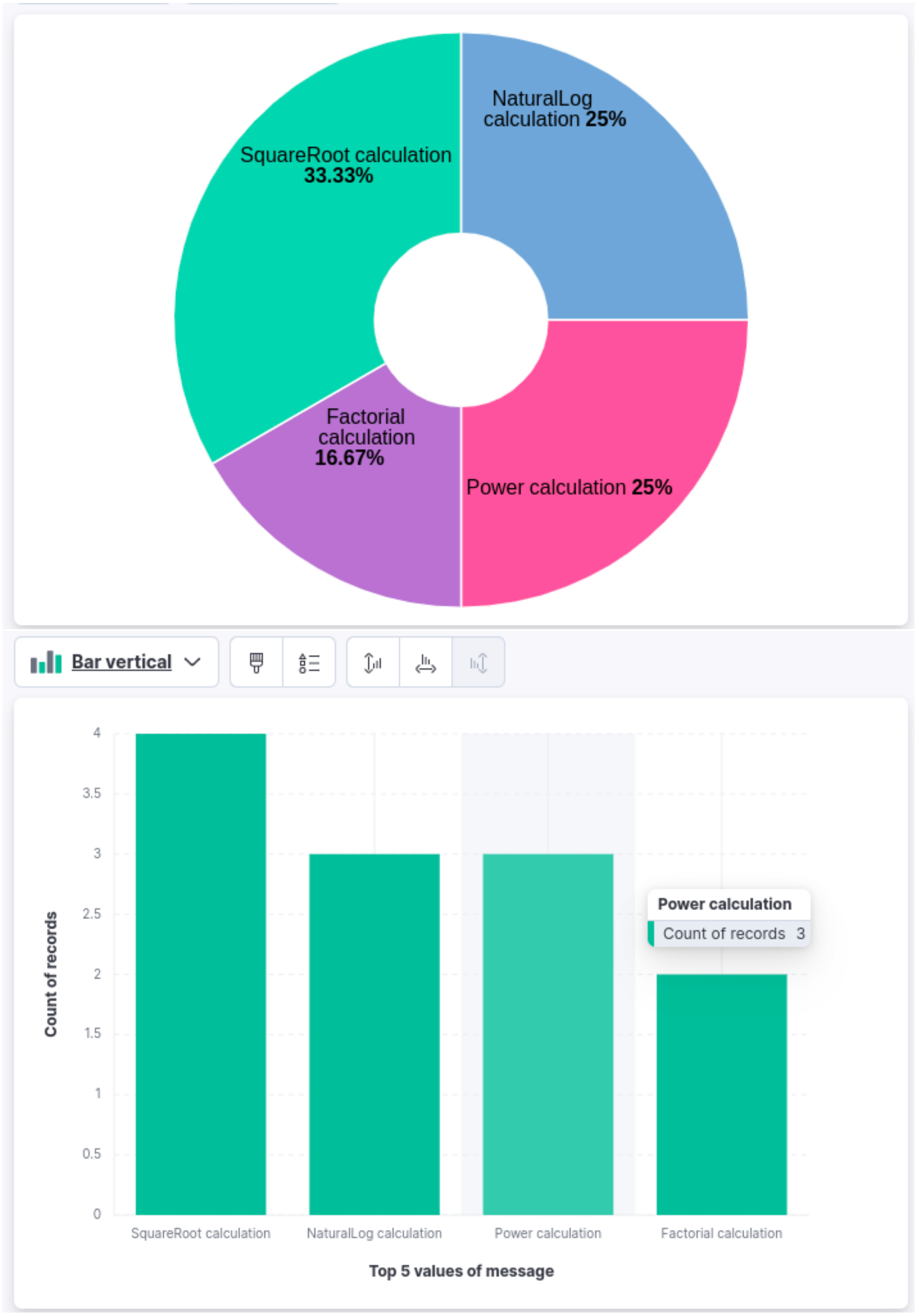
Mappings

```
{
  "properties": {
    "@timestamp": {
      "type": "date"
    },
    "level": {
      "type": "keyword"
    },
    "logger": {
      "type": "keyword"
    },
    "message": {
      "type": "keyword"
    },
    "thread": {
      "type": "keyword"
    },
    "timestamp_string": {
      "type": "keyword"
    }
  }
}
```

Ingest pipeline

```
{
  "description": "Ingest pipeline created by text
     structure finder",
  "processors": [
    {
      "grok": {
        "field": "message",
        "patterns": [
          "%{HTTPDATE:timestamp} \\[%{GREEDYDATA
            :thread}\\] \\[%{LOGLEVEL:level}\\]
           %{GREEDYDATA:logger} \\- %{GREEDYDATA
            :message}"
        ],
        "ecs_compatibility": "v1"
      }
    },
    {
      "date": {
        "field": "timestamp",
        "formats": [
          "dd/MMM/yyyy:HH:mm:ss SSS"
        ]
      }
    },
    {
```

Kibana Visualization



URLs and Script File

GitHub Repository - https://github.com/himanshudigrase/calculatorDevOps

DockerHub -

Docker Image - https://hub.docker.com/repository/docker/hims0301/calculator_devops/tags

Repository - https://hub.docker.com/repository/docker/hims0301/calculator_devops

Pipeline script -

```
name: Java CI with Maven

on:
    push:
        branches: [ "master" ]
    pull_request:
        branches: [ "master" ]

jobs:
  build:
      runs-on: ubuntu-latest
      steps:
      - uses: actions/checkout@v3
      - name: Set up JDK 19
        uses: actions/setup-java@v3
        with:
          java-version: '19'
          distribution: 'temurin'
          cache: maven
      - name: Build with Maven
          run: mvn -B package --file pom.xml
  publish:
      runs-on: ubuntu-latest
      steps:
      - name: Checkout code
        uses: actions/checkout@v2
      - name: Build Docker image
          run: docker build -t hims0301/calculator_devops:latest .
      - name: Log in to Docker registry
          uses: docker/login-action@v1
          with:
              registry: docker.io
              username: ${{ secrets.DOCKER_USERNAME }}
              password: ${{ secrets.DOCKER_PASSWORD }}
      - name: Push Docker image
          run: docker push hims0301/calculator_devops:latest
  deploy:
    needs: publish
    runs-on: self-hosted
    steps:
      - name: Pull Docker image
        run: docker pull hims0301/calculator_devops:latest
      - name: Stop running calculator-container
        run: docker stop calculator-container || true
      - name: remove container named calculator-container
        run: docker rm calculator-container || true
      - name: Start new container
        run: docker run --name calculator-container -d -t hims0301/calculator_devops:latest
        java -jar calc_mini_proj-1.0-SNAPSHOT-jar-with-dependencies.jar
```

Dockerfile -

```
FROM openjdk:19
COPY target/calc_mini_proj-1.0-SNAPSHOT-jar-with-dependencies.jar ./
WORKDIR ./
CMD ["java", "-cp","calc_mini_proj-1.0-SNAPSHOT-jar-with-dependencies.jar",
"org.example.Calculator"]
```

GROK pattern - `%{HTTPDATE:timestamp\_string} \[%{GREEDYDATA:thread}\]`
`\[%{LOGLEVEL:level}\] %{GREEDYDATA:logger} \- %{GREEDYDATA:message}`

Thank You !