Software Quality Management & Assurance

Jenkins CI Assignment - Automated Testing with Dockerized Pipelines

Student: Zeek Liviu-Ioan
Repository: SQMA_Zeek_Liviu-Ioan
GitHub URL: https://github.com/zeekliviu/SQMA_Zeek_Liviu-Ioan

---

1. Introduction

This assignment focuses on the configuration and use of Jenkins as a Continuous Integration (CI) tool for automated testing.
The objective is to demonstrate the use of **Pipeline as Code**, **parameterized builds**, and **multi-job pipelines**, using a fully **containerized Jenkins environment**.

All components, including the Jenkins server and the pipelines, are configured in a reproducible manner, following Infrastructure as Code principles.

---

2. Jenkins Environment Setup (Dockerized)

2.1 Rationale for Using Docker

Jenkins was deployed using Docker in order to:

- avoid installing Jenkins directly on the host system,
- ensure environment reproducibility,
- keep the CI infrastructure isolated and self-contained.

This approach aligns with modern CI/CD best practices and facilitates portability.

2.2 Docker Compose Configuration

The Jenkins infrastructure is stored in the `jenkins/` directory of the repository.

File: `jenkins/docker-compose.yml`

```
services:
  jenkins:
    image: jenkins/jenkins:lts-jdk17
    container_name: jenkins
    user: root
    ports:
      - "8080:8080"
      - "50000:50000"
    volumes:
      - jenkins_home:/var/jenkins_home
      - /var/run/docker.sock:/var/run/docker.sock
    restart: unless-stopped

volumes:
  jenkins_home:
```

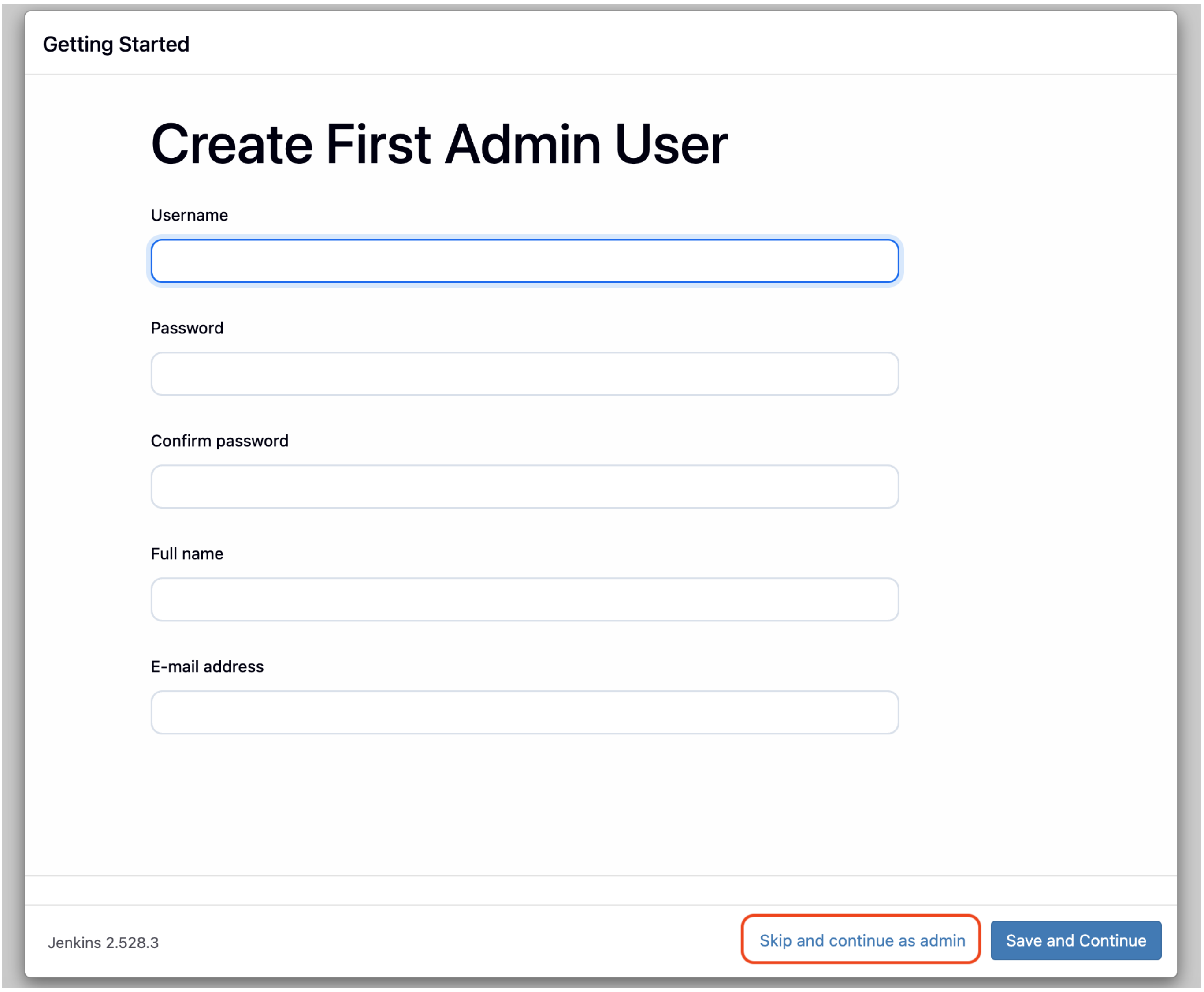
2.3 Jenkins Initialization

Jenkins was started using the following command:

```
docker compose up -d
```

The initial administrator password was retrieved using:

```
docker exec -it jenkins cat /var/jenkins_home/secrets/initialAdminPassword
```



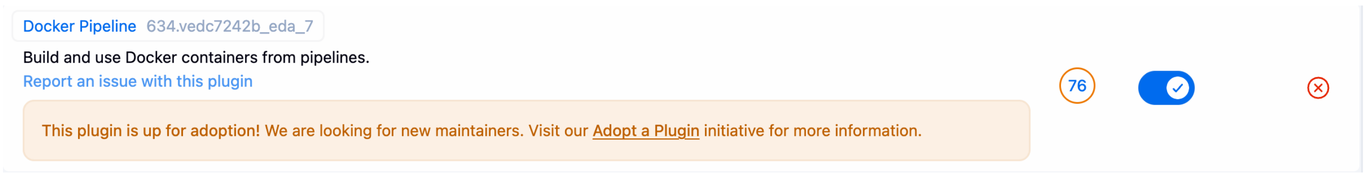
The default administrator account was used, as the environment is local and isolated.

2.4 Plugin Installation

The following plugins were installed:

- Pipeline
- Git
- GitHub

I had to manually install the "Docker Pipeline" plugin to enable Docker agent support in pipelines.



Docker Pipeline 634.vedc7242b_eda_7

Build and use Docker containers from pipelines.

Report an issue with this plugin

This plugin is up for adoption! We are looking for new maintainers. Visit our Adopt a Plugin initiative for more information.

3. Repository Structure

```
SQMA_Zeek_Liviu-Ioan/
├── tests/
│   ├── test_math.py
│   ├── test_strings.py
│   └── requirements.txt
├── Jenkinsfile.task1
├── Jenkinsfile.math
├── Jenkinsfile.strings
├── Jenkinsfile.task2
├── jenkins-sqma/
│   └── docker-compose.yml
├── SQMA_Jenkins_Report.pdf
└── SQMA_Jenkins_Report.md
```

4. Task 1 – Parameterized Jenkins Job

4.1 Objective

Create a Jenkins job that connects to the GitHub repository and allows the user to select which test suite to run via a parameter.

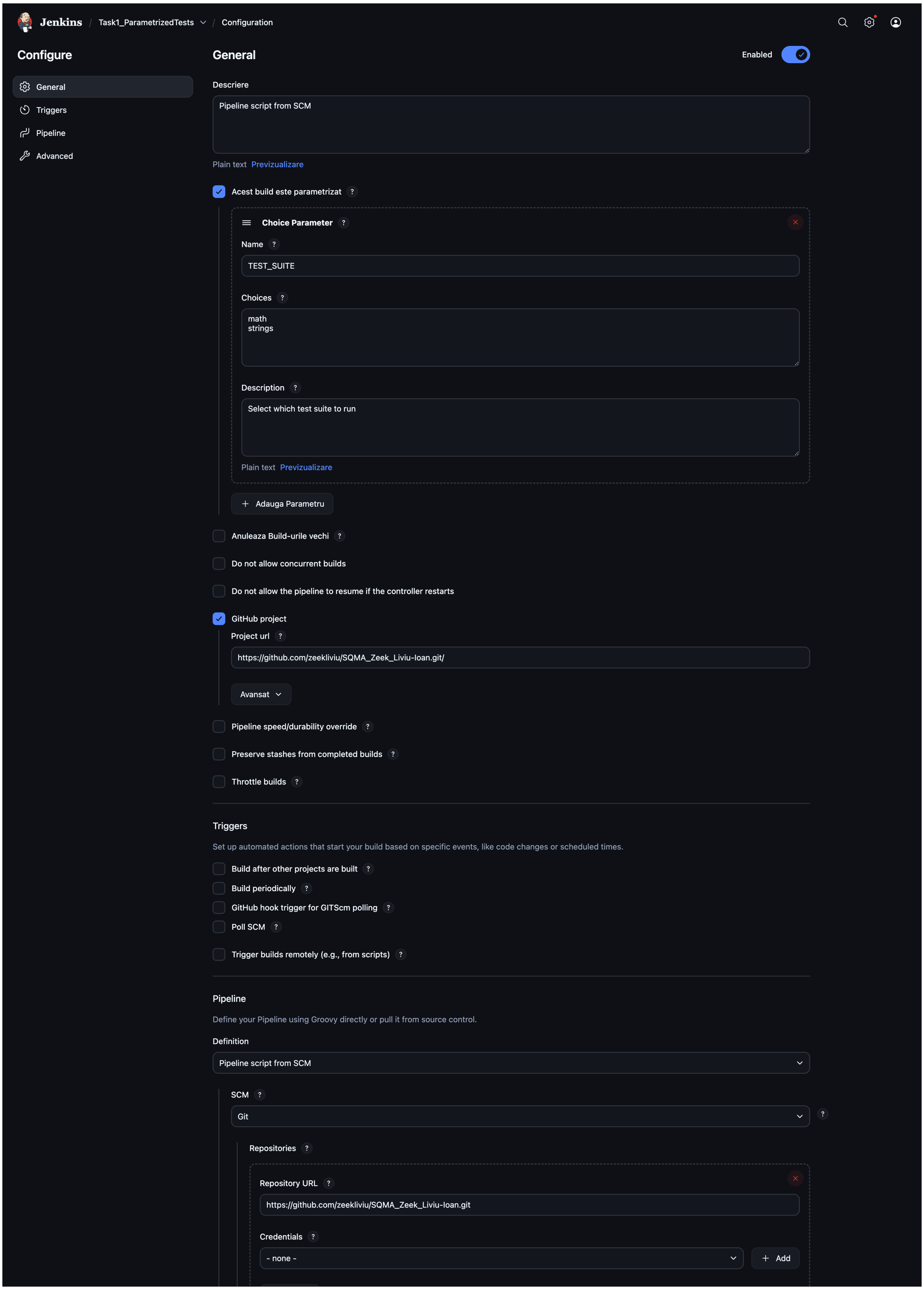
4.2 Jenkinsfile.task1

The pipeline defines a `TEST_SUITE` parameter and executes tests inside a Docker container.

The task can be found here.

4.3 Job Configuration

- Type: Pipeline
- Definition: Pipeline script from SCM
- Script Path: `Jenkinsfile.task1`



Jenkins / Task1_ParametrizedTests / Configuration

Configure

- General
- Triggers
- Pipeline
- Advanced

General

Enabled ✓

Descriere

Pipeline script from SCM

Plain text Previzualizare

✓ Acest build este parametrizat ?

Choice Parameter ?

Name ?

TEST_SUITE

Choices ?

math
strings

Description ?

Select which test suite to run

Plain text Previzualizare

+ Adauga Parametru

☐ Anuleaza Build-urile vechi ?

☐ Do not allow concurrent builds

☐ Do not allow the pipeline to resume if the controller restarts

✓ GitHub project

Project url ?

https://github.com/zeekliviu/SQMA_Zeek_Liviu-loan.git/

Avansat

☐ Pipeline speed/durability override ?

☐ Preserve stashes from completed builds ?

☐ Throttle builds ?

Triggers

Set up automated actions that start your build based on specific events, like code changes or scheduled times.

☐ Build after other projects are built ?

☐ Build periodically ?

☐ GitHub hook trigger for GITScm polling ?

☐ Poll SCM ?

☐ Trigger builds remotely (e.g., from scripts) ?

Pipeline

Define your Pipeline using Groovy directly or pull it from source control.

Definition

Pipeline script from SCM

SCM ?

Git

Repositories ?

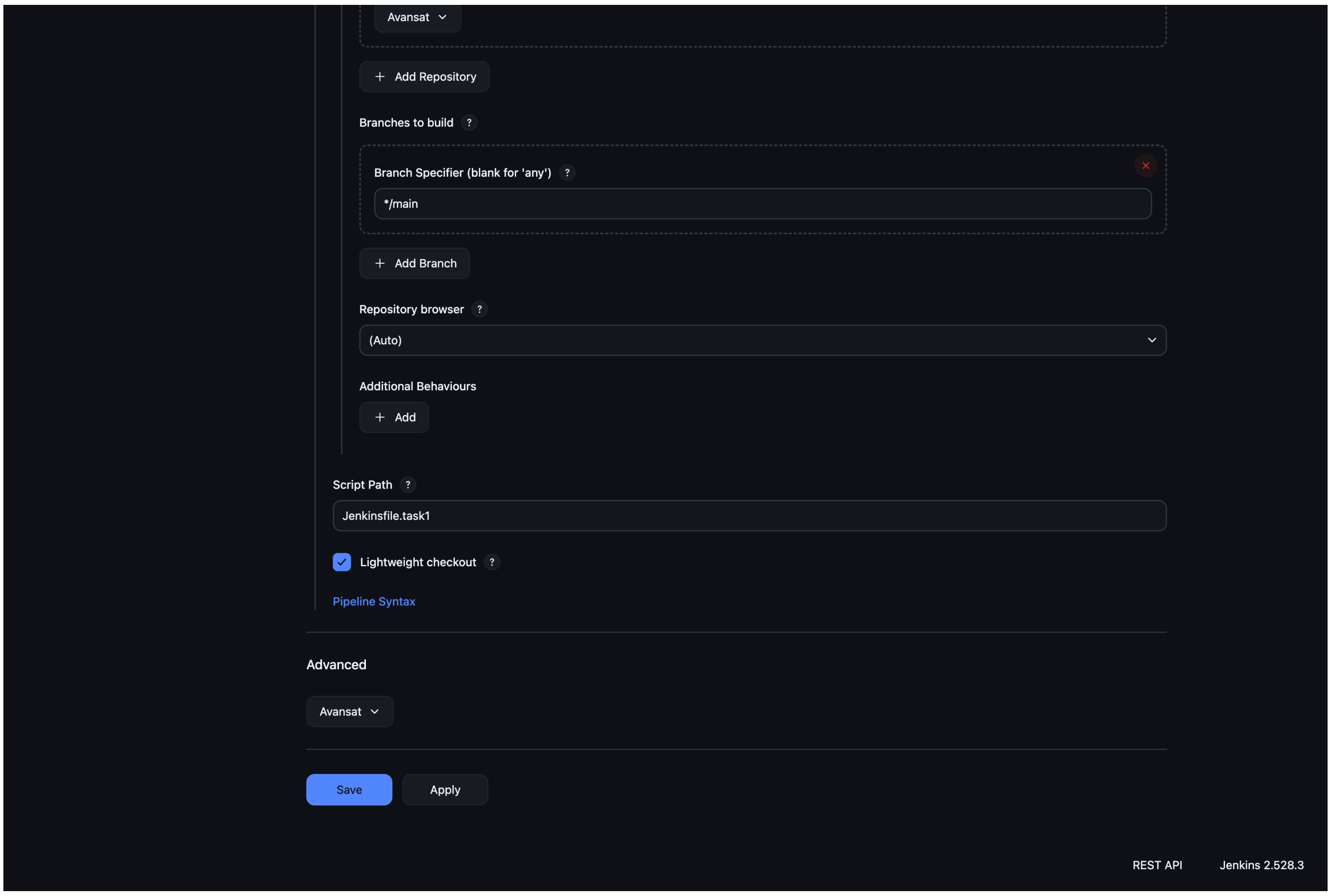
Repository URL ?

https://github.com/zeekliviu/SQMA_Zeek_Liviu-loan.git

Credentials ?

- none -

+ Add


Avansat

Add Repository

Branches to build

Branch Specifier (blank for 'any'): */main

Add Branch

Repository browser: (Auto)

Additional Behaviours

Add

Script Path: Jenkinsfile.task1

✓ Lightweight checkout

Pipeline Syntax

Advanced

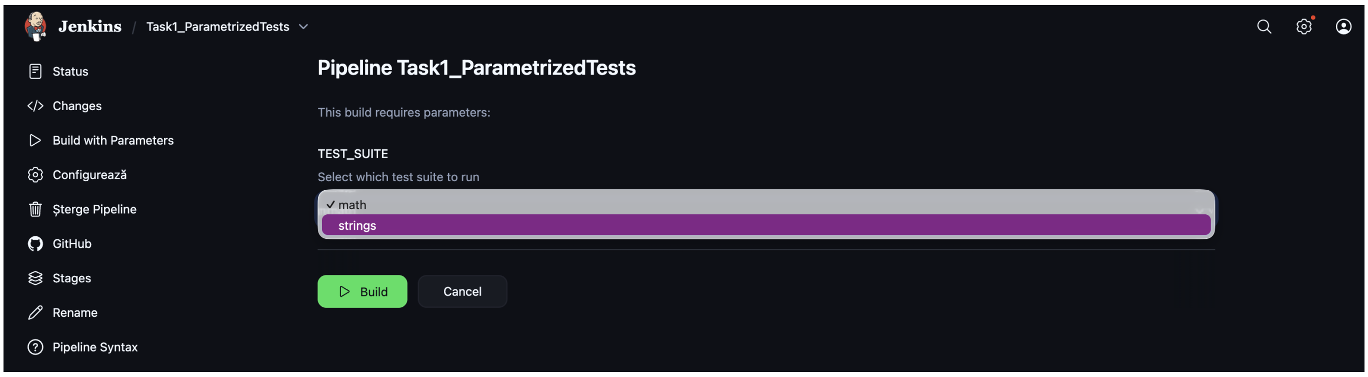
Avansat

The `This build is parameterized` option was automatically enabled due to the presence of parameters in the Jenkinsfile.

4.4 Execution Results

Two executions were performed:

- `TEST_SUITE = math`
- `TEST_SUITE = strings`



Pipeline Task1_ParametrizedTests

This build requires parameters:

TEST_SUITE

Select which test suite to run

✓ math

strings

Console Output for `math` tests:

```
Started by user admin

Obtained Jenkinsfile.task1 from git
https://github.com/zeekliviu/SQMA_Zeek_Liviu-Ioan.git
```

```
[Pipeline] Start of Pipeline
[Pipeline] node
Running on Jenkins
 in /var/jenkins_home/workspace/Task1_ParametrizedTests
[Pipeline] {
[Pipeline] stage
[Pipeline] { (Declarative: Checkout SCM)
[Pipeline] checkout
Selected Git installation does not exist. Using Default
The recommended git tool is: NONE
No credentials specified
 > git rev-parse --resolve-git-dir
/var/jenkins_home/workspace/Task1_ParametrizedTests/.git # timeout=10
Fetching changes from the remote Git repository
 > git config remote.origin.url
https://github.com/zeekliviu/SQMA_Zeek_Liviu-Ioan.git # timeout=10
Fetching upstream changes from
https://github.com/zeekliviu/SQMA_Zeek_Liviu-Ioan.git
 > git --version # timeout=10
 > git --version # 'git version 2.47.3'
 > git fetch --tags --force --progress --
https://github.com/zeekliviu/SQMA_Zeek_Liviu-Ioan.git
+refs/heads/*:refs/remotes/origin/* # timeout=10
 > git rev-parse refs/remotes/origin/main^{commit} # timeout=10
Checking out Revision f45152a8a44e92372246a807458feb3c8b8c4102
(refs/remotes/origin/main)
 > git config core.sparsecheckout # timeout=10
 > git checkout -f f45152a8a44e92372246a807458feb3c8b8c4102 # timeout=10
Commit message: "chore: added compose for containerized jenkins"
 > git rev-list --no-walk f45152a8a44e92372246a807458feb3c8b8c4102 #
timeout=10
[Pipeline] }
[Pipeline] // stage
[Pipeline] withEnv
[Pipeline] {
[Pipeline] stage
[Pipeline] { (Checkout)
[Pipeline] checkout
Selected Git installation does not exist. Using Default
The recommended git tool is: NONE
No credentials specified
 > git rev-parse --resolve-git-dir
/var/jenkins_home/workspace/Task1_ParametrizedTests/.git # timeout=10
Fetching changes from the remote Git repository
 > git config remote.origin.url
https://github.com/zeekliviu/SQMA_Zeek_Liviu-Ioan.git # timeout=10
Fetching upstream changes from
https://github.com/zeekliviu/SQMA_Zeek_Liviu-Ioan.git
 > git --version # timeout=10
 > git --version # 'git version 2.47.3'
 > git fetch --tags --force --progress --
https://github.com/zeekliviu/SQMA_Zeek_Liviu-Ioan.git
+refs/heads/*:refs/remotes/origin/* # timeout=10
 > git rev-parse refs/remotes/origin/main^{commit} # timeout=10
```

```
Checking out Revision f45152a8a44e92372246a807458feb3c8b8c4102
(refs/remotes/origin/main)
 > git config core.sparsecheckout # timeout=10
 > git checkout -f f45152a8a44e92372246a807458feb3c8b8c4102 # timeout=10
Commit message: "chore: added compose for containerized jenkins"
[Pipeline] }
[Pipeline] // stage
[Pipeline] stage
[Pipeline] { (Run selected tests)
[Pipeline] node
Running on Jenkins
 in /var/jenkins_home/workspace/Task1_ParametrizedTests@2
[Pipeline] {
[Pipeline] checkout
Selected Git installation does not exist. Using Default
The recommended git tool is: NONE
No credentials specified
 > git rev-parse --resolve-git-dir
/var/jenkins_home/workspace/Task1_ParametrizedTests@2/.git # timeout=10
Fetching changes from the remote Git repository
 > git config remote.origin.url
https://github.com/zeekliviu/SQMA_Zeek_Liviu-Ioan.git # timeout=10
Fetching upstream changes from
https://github.com/zeekliviu/SQMA_Zeek_Liviu-Ioan.git
 > git --version # timeout=10
 > git --version # 'git version 2.47.3'
 > git fetch --tags --force --progress --
https://github.com/zeekliviu/SQMA_Zeek_Liviu-Ioan.git
+refs/heads/*:refs/remotes/origin/* # timeout=10
 > git rev-parse refs/remotes/origin/main^{commit} # timeout=10
Checking out Revision f45152a8a44e92372246a807458feb3c8b8c4102
(refs/remotes/origin/main)
 > git config core.sparsecheckout # timeout=10
 > git checkout -f f45152a8a44e92372246a807458feb3c8b8c4102 # timeout=10
Commit message: "chore: added compose for containerized jenkins"
[Pipeline] withEnv
[Pipeline] {
[Pipeline] isUnix
[Pipeline] withEnv
[Pipeline] {
[Pipeline] sh
+ docker inspect -f . python:3.12-slim
.
[Pipeline] }
[Pipeline] // withEnv
[Pipeline] withDockerContainer
Jenkins seems to be running inside container
a70d8f72071db2cdf33a2cc757177d3d7d103b674a4715d58a677f01b407bb2b
$ docker run -t -d -u 0:0 -u root:root -w
/var/jenkins_home/workspace/Task1_ParametrizedTests@2 --volumes-from
a70d8f72071db2cdf33a2cc757177d3d7d103b674a4715d58a677f01b407bb2b -e
******** -e ******** -e ******** -e ******** -e ******** -e ******** -e
******** -e ******** -e ******** -e ******** -e ******** -e ******** -e
******** -e ******** -e ******** -e ******** -e ******** -e ******** -e
```

```
******** -e ******** -e ******** -e ******** -e ******** -e ******** -e
******** -e ******** -e ******** -e ******** -e ******** -e ******** -e
******** -e ******** python:3.12-slim cat
$ docker top
c85b58d3c9bb25330e1faa4947c00f0a4813faf89bc9dae99ccd82882ebe4217 -eo
pid,comm
[Pipeline] {
[Pipeline] sh
+ python --version
Python 3.12.12
+ pip install -r tests/requirements.txt
Collecting pytest (from -r tests/requirements.txt (line 1))
  Downloading pytest-9.0.2-py3-none-any.whl.metadata (7.6 kB)
Collecting iniconfig>=1.0.1 (from pytest->-r tests/requirements.txt (line
1))
  Downloading iniconfig-2.3.0-py3-none-any.whl.metadata (2.5 kB)
Collecting packaging>=22 (from pytest->-r tests/requirements.txt (line 1))
  Downloading packaging-25.0-py3-none-any.whl.metadata (3.3 kB)
Collecting pluggy<2,>=1.5 (from pytest->-r tests/requirements.txt (line
1))
  Downloading pluggy-1.6.0-py3-none-any.whl.metadata (4.8 kB)
Collecting pygments>=2.7.2 (from pytest->-r tests/requirements.txt (line
1))
  Downloading pygments-2.19.2-py3-none-any.whl.metadata (2.5 kB)
Downloading pytest-9.0.2-py3-none-any.whl (374 kB)
Downloading iniconfig-2.3.0-py3-none-any.whl (7.5 kB)
Downloading packaging-25.0-py3-none-any.whl (66 kB)
Downloading pluggy-1.6.0-py3-none-any.whl (20 kB)
Downloading pygments-2.19.2-py3-none-any.whl (1.2 MB)
   ---------------------------------------- 1.2/1.2 MB 3.9 MB/s eta
0:00:00
Installing collected packages: pygments, pluggy, packaging, iniconfig,
pytest
Successfully installed iniconfig-2.3.0 packaging-25.0 pluggy-1.6.0
pygments-2.19.2 pytest-9.0.2
WARNING: Running pip as the 'root' user can result in broken permissions
and conflicting behaviour with the system package manager, possibly
rendering your system unusable. It is recommended to use a virtual
environment instead: https://pip.pypa.io/warnings/venv. Use the --root-
user-action option if you know what you are doing and want to suppress
this warning.

[notice] A new release of pip is available: 25.0.1 -> 25.3
[notice] To update, run: pip install --upgrade pip
+ [ math = math ]
+ pytest -q tests/test_math.py
..
[100%]
2 passed in 0.00s
[Pipeline] }
$ docker stop --time=1
c85b58d3c9bb25330e1faa4947c00f0a4813faf89bc9dae99ccd82882ebe4217
$ docker rm -f --volumes
c85b58d3c9bb25330e1faa4947c00f0a4813faf89bc9dae99ccd82882ebe4217
```

```
[Pipeline] // withDockerContainer
[Pipeline] }
[Pipeline] // withEnv
[Pipeline] }
[Pipeline] // node
[Pipeline] }
[Pipeline] // stage
[Pipeline] stage
[Pipeline] { (Declarative: Post Actions)
[Pipeline] echo
Finished Task 1 job with TEST_SUITE=math
[Pipeline] }
[Pipeline] // stage
[Pipeline] }
[Pipeline] // withEnv
[Pipeline] }
[Pipeline] // node
[Pipeline] End of Pipeline
Finished: SUCCESS
```

---

5. Task 2 – Multi-Job Pipeline

5.1 Objective

Create multiple Jenkins jobs and orchestrate them using a master pipeline that runs all tests in parallel.

5.2 Individual Test Jobs

- `Task2_TestMath` → `Jenkinsfile.math`
- `Task2_TestStrings` → `Jenkinsfile.strings`

Each job runs its corresponding test suite inside a Docker container.

The configurations are similar to Task 1, but without parameters.

5.3 Master Pipeline

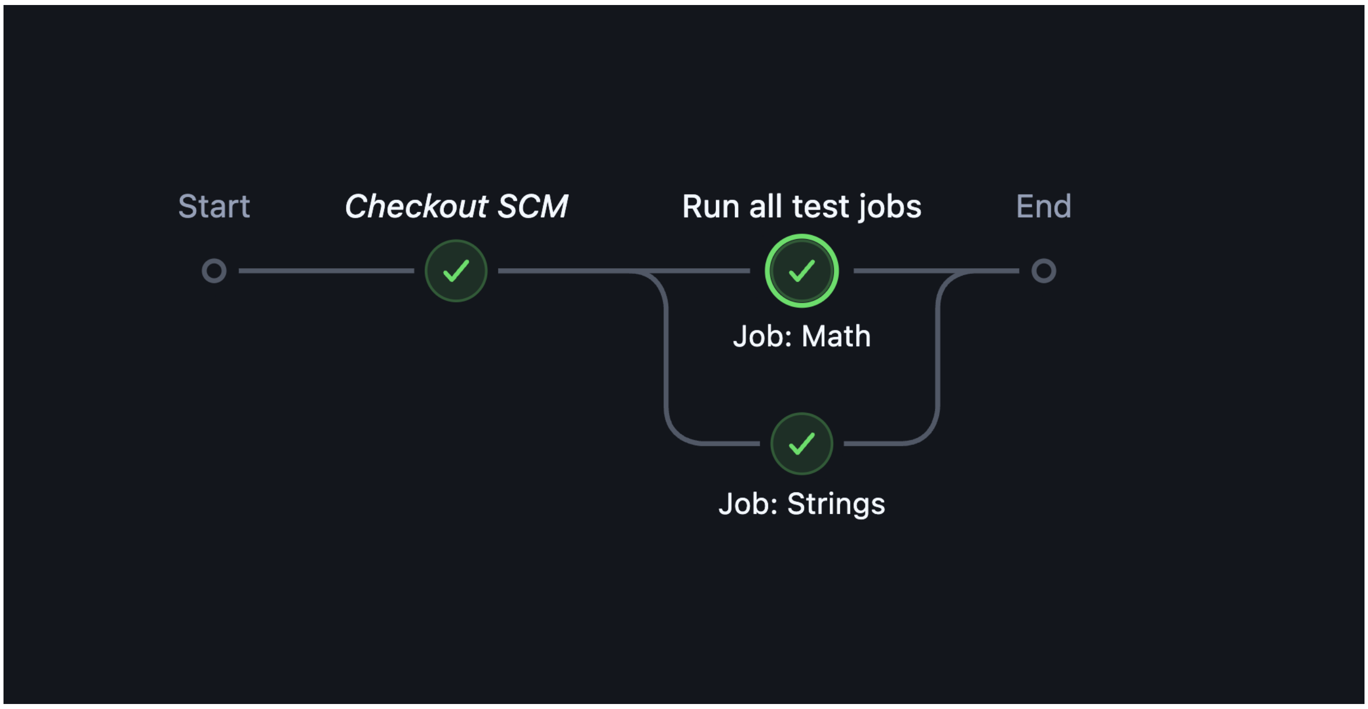
File: `Jenkinsfile.task2`

This pipeline triggers both test jobs in parallel.

The task can be found here.

5.4 Execution Results

The master pipeline was executed successfully, running both test jobs in parallel.



Console Output for the master pipeline:

```
Started by user admin

Obtained Jenkinsfile.task2 from git
https://github.com/zeekliviu/SQMA_Zeek_Liviu-Ioan.git
[Pipeline] Start of Pipeline
[Pipeline] node
Running on Jenkins
 in /var/jenkins_home/workspace/Task2_AllTestsPipeline
[Pipeline] {
[Pipeline] stage
[Pipeline] { (Declarative: Checkout SCM)
[Pipeline] checkout
Selected Git installation does not exist. Using Default
The recommended git tool is: NONE
No credentials specified
Cloning the remote Git repository
Cloning repository https://github.com/zeekliviu/SQMA_Zeek_Liviu-Ioan.git
 > git init /var/jenkins_home/workspace/Task2_AllTestsPipeline #
timeout=10
Fetching upstream changes from
https://github.com/zeekliviu/SQMA_Zeek_Liviu-Ioan.git
 > git --version # timeout=10
 > git --version # 'git version 2.47.3'
 > git fetch --tags --force --progress --
https://github.com/zeekliviu/SQMA_Zeek_Liviu-Ioan.git
+refs/heads/*:refs/remotes/origin/* # timeout=10
 > git config remote.origin.url
https://github.com/zeekliviu/SQMA_Zeek_Liviu-Ioan.git # timeout=10
 > git config --add remote.origin.fetch
+refs/heads/*:refs/remotes/origin/* # timeout=10
Avoid second fetch
```

```
 > git rev-parse refs/remotes/origin/main^{commit} # timeout=10
Checking out Revision 310c440d7880ed527ca96ef9ab7b70e464743bd7
(refs/remotes/origin/main)
 > git config core.sparsecheckout # timeout=10
 > git checkout -f 310c440d7880ed527ca96ef9ab7b70e464743bd7 # timeout=10
Commit message: "chore: fixed paths... again"
First time build. Skipping changelog.
[Pipeline] }
[Pipeline] // stage
[Pipeline] withEnv
[Pipeline] {
[Pipeline] stage
[Pipeline] { (Run all test jobs)
[Pipeline] parallel
[Pipeline] { (Branch: Job: Math)
[Pipeline] { (Branch: Job: Strings)
[Pipeline] stage
[Pipeline] { (Job: Math)
[Pipeline] stage
[Pipeline] { (Job: Strings)
[Pipeline] build (Building Task2_TestMath)
Scheduling project: Task2_TestMath

[Pipeline] build (Building Task2_TestStrings)
Scheduling project: Task2_TestStrings

Starting building: Task2_TestMath #3

Starting building: Task2_TestStrings #2

Build Task2_TestStrings #2
 completed: SUCCESS
[Pipeline] }
[Pipeline] // stage
[Pipeline] }
Build Task2_TestMath #3
 completed: SUCCESS
[Pipeline] }
[Pipeline] // stage
[Pipeline] }
[Pipeline] // parallel
[Pipeline] }
[Pipeline] // stage
[Pipeline] }
[Pipeline] // withEnv
[Pipeline] }
[Pipeline] // node
[Pipeline] End of Pipeline
Finished: SUCCESS
```

6. Conclusions

This assignment demonstrates:

- the use of Jenkins pipelines defined as code,
- parameterized builds for controlled test execution,
- Docker-based agents for isolated and reproducible environments,
- orchestration of multiple jobs using a master pipeline.

The implemented solution follows modern CI principles and ensures clarity, reproducibility, and maintainability.