DevOps Homework 3 - Winter 2026

Student: César Núñez
Date: 01/26/2026

Question 1

Compare and contrast at least three CI tools/platforms (e.g., Jenkins, GitHub Actions, GitLab CI, Azure DevOps, CircleCI). Create a comparison table that includes:

- Pricing model
- Ease of setup
- Integration capabilities
- Key features
- Best use cases

CI Tool/Platform	Pricing model	Ease of setup	Integration capabilities	Key features	Best case uses
Jenkins	Free and Open Source, but you need to pay for the machine it runs on	Setup is harder since you have to install Jenkins, manage plug ins (ex. Docker) which can take a lot of time	It has a lot of plug-ins that allows the integration with different services (GitHub, AWS, Docker, etc.)	Customizable pipelines, full control over the pipeline	When you need full control of the pipeline/infrastructure and custom behavior
GitHub Actions	Free for public repositories. Private repositories have a monthly allowance of build minutes, then pay per minute.	Easier. Just need to create a YAML file that will runs CI automatically	Integration with GitHub features (PR, issues and releases)	Automatic checks for other GitHub features, YAML-based workflows	Small-medium projects hosted in GitHub

CI Tool/Platform	Pricing model	Ease of setup	Integration capabilities	Key features	Best case uses
Azure DevOps	Free for individuals up to 1800 minutes per month in one Microsoft-hosted jobs and unlimited minutes for 1 self-hosted job. $40 per extra Microsoft-hosted CI/CD parallel job	More complex relative to GitHub Actions/Jenkins	Integrations with Azure services and supports external repos	CI/CD pipelines, enterprise grade access control	Better for enterprises that use other Azure services

Question 2

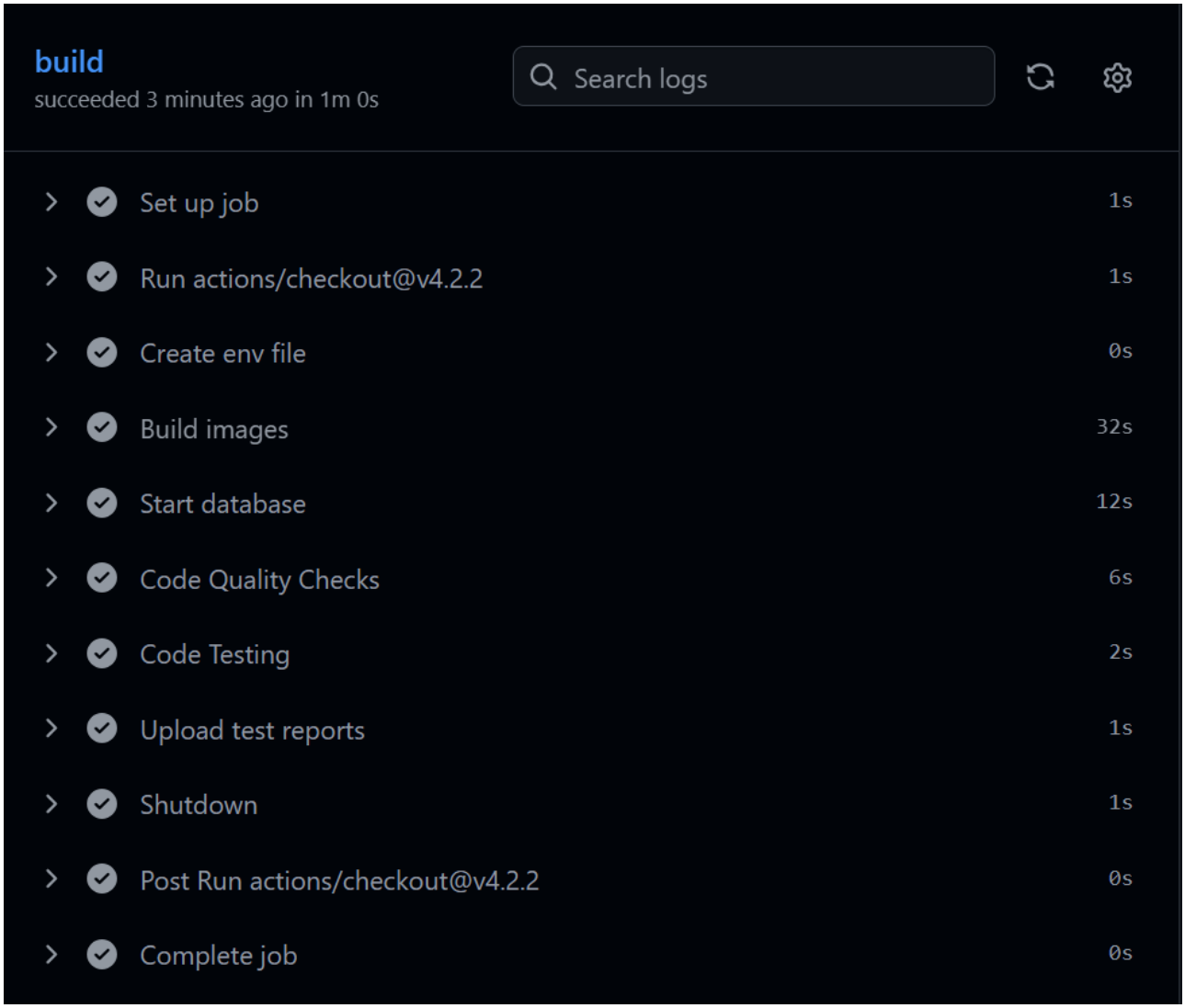
1. CI Pipeline Configuration

- Complete pipeline configuration file (Jenkinsfile, .github/workflows/ci.yml, etc.): available here and also here:

```
name: ci_ass3

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

permissions:
  contents: read

jobs:
  build:
    runs-on: ubuntu-latest

    env:
      COMPOSE_PROJECT_NAME: ${{ github.workflow }}_${{ github.run_id }}_${{
github.run_attempt }}
```

```
    COVERAGE_FAIL_UNDER: "80"

  steps:
    - uses: actions/checkout@v4.2.2

    - name: Create env file
      run: |
        echo "${{ secrets.DEVOPS_ASS3 }}" > .env

    - name: Build images
      run: |
        docker compose -p "$COMPOSE_PROJECT_NAME" build db backend test

    - name: Start database
      run: |
        docker compose -p "$COMPOSE_PROJECT_NAME" up -d db

    - name: Code Quality Checks
      run : |
        docker compose -p "$COMPOSE_PROJECT_NAME" run --rm test \
          ruff check . --fix
        docker compose -p "$COMPOSE_PROJECT_NAME" run --rm test \
          ruff format --check .

    - name: Code Testing
      run : |
          set -eu
          mkdir -p reports

          docker compose -p "$COMPOSE_PROJECT_NAME" run --rm \
            -v "$PWD/reports:/backend/reports" \
            test sh -lc "
              pytest -q \
                --junitxml=/backend/reports/junit.xml \
                --cov=. \
                --cov-report=xml:/backend/reports/coverage.xml \
                --cov-report=html:/backend/reports/htmlcov \
                --cov-fail-under=$COVERAGE_FAIL_UNDER
            "

    - name: Upload test reports
      if: always()
      uses: actions/upload-artifact@v4
      with:
        name: test-reports
        path: reports/

    - name: Shutdown
      if: always()
      run: |
        docker compose -p "$COMPOSE_PROJECT_NAME" down -v
```

- Pipeline must implement all 5 required tasks above



2. Application Source Code

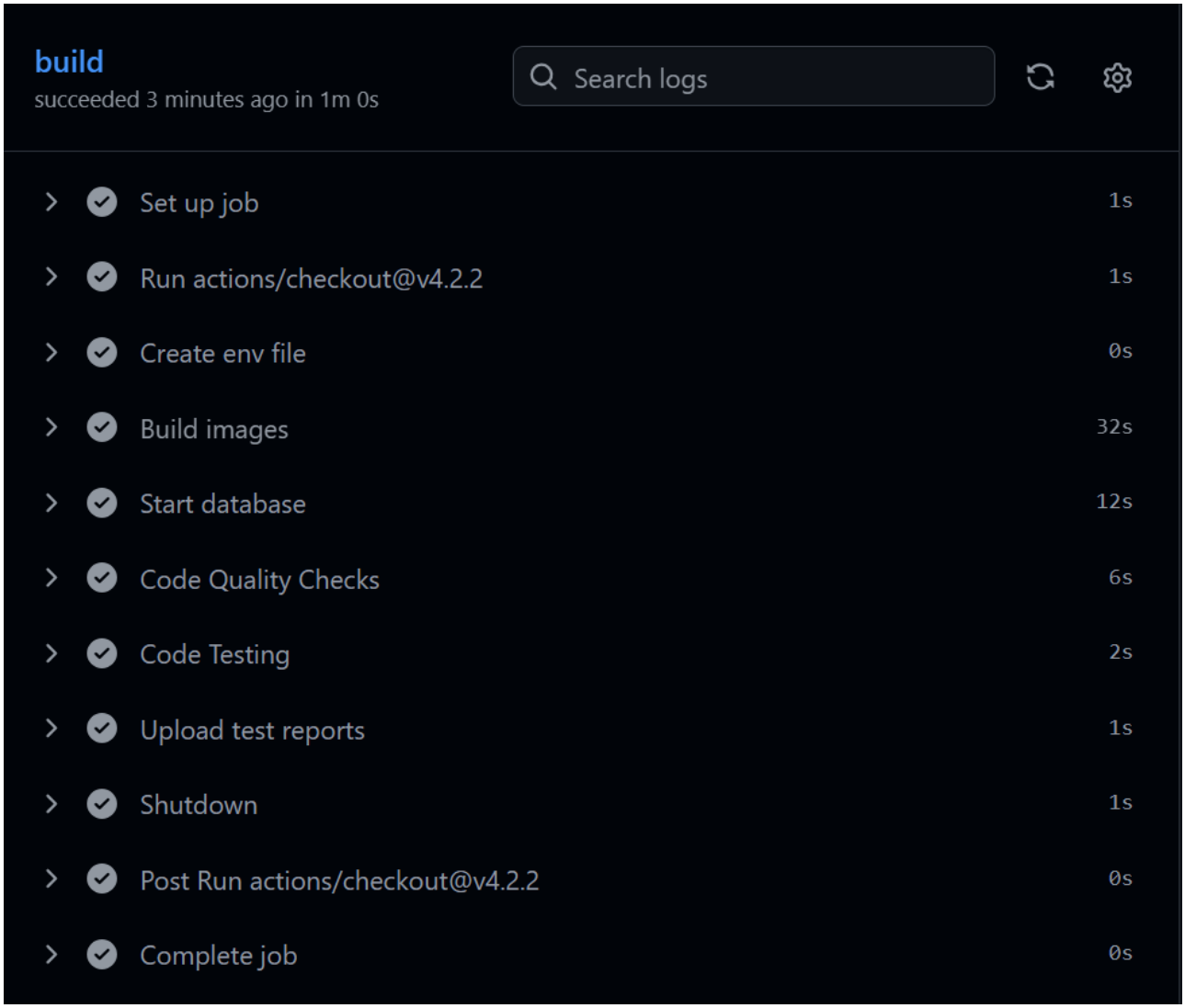
- Working application with minimum 3 endpoints/features: available here
- Unit tests with minimum 5 test cases: available here
- README file with project setup instructions: available here
- All necessary configuration files: use this .env file (also in the README.md)

```
MYSQL_ROOT_PASSWORD=secret
MYSQL_DATABASE=todos
MYSQL_USER=todo_user
MYSQL_PASSWORD=todo_pass
```

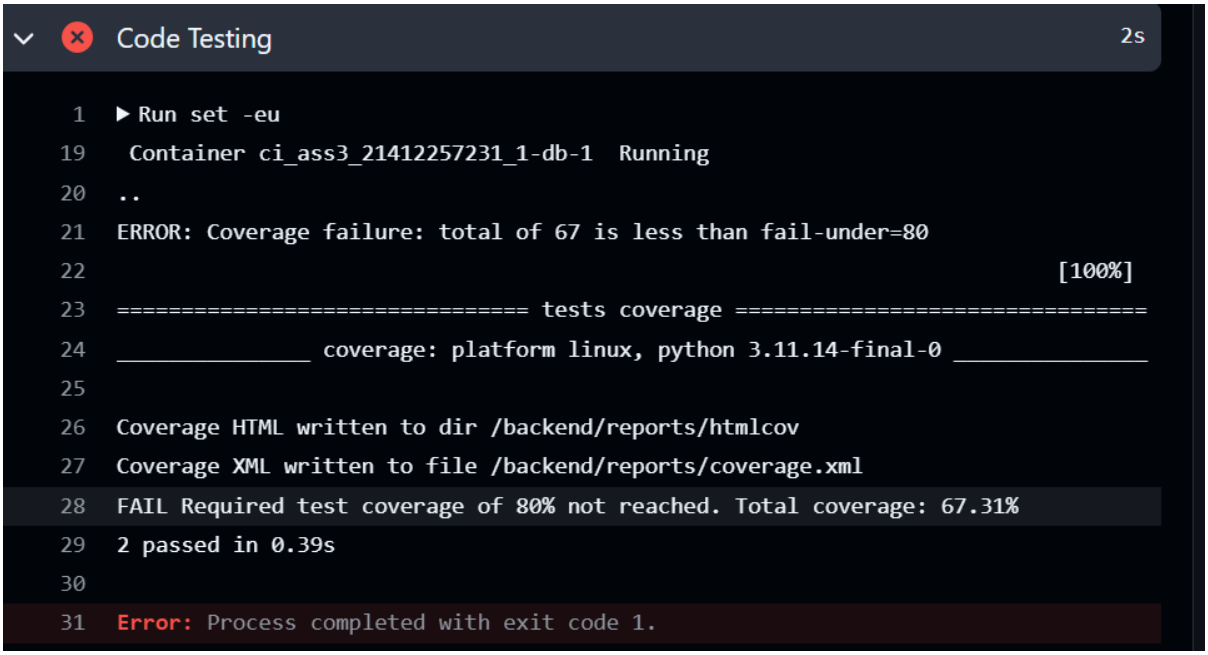
3. Pipeline Evidence

- Screenshots or links showing successful pipeline runs:
  - Example 1: click here
  - Example 2: click here

- Evidence that all 5 pipeline tasks execute successfully

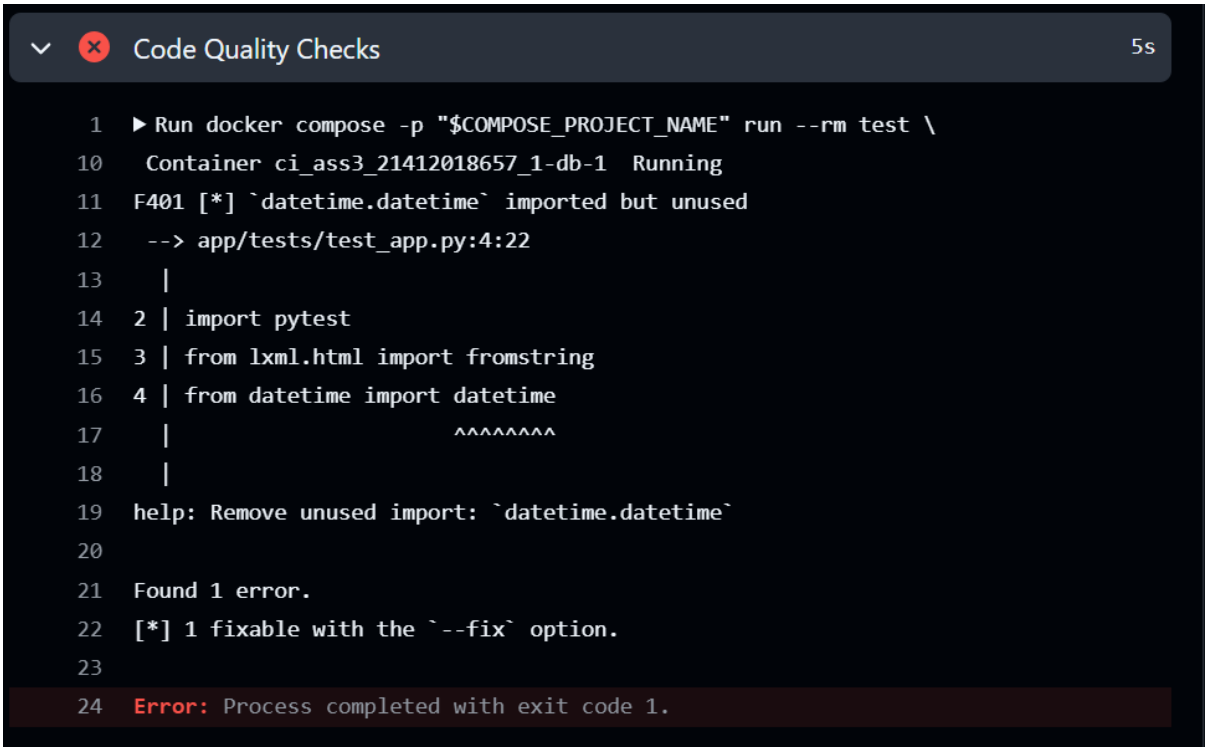


- Screenshots showing pipeline failures (e.g., failed tests, code quality issues)
  - Coverage fail: click here



- Test fail: click here

- Code Quality fails: click here



Question 3

Implementing a CI pipeline came with several challenges, especially during the initial setup phase. At the beginning of this homework, I chose Jenkins and was able to run it locally alongside my containerized application. While this helped me understande how CI tools work under the hood, I quickly ran into friction. The Jenkins documentation felt outdated and fragmented, and when I tried to configure GitHub triggers, the lack of clear and modern examples made debugging unnecessarily difficult. Much of my time was spent troubleshooting configuration issues rather than improving the pipeline itself, which made the process frustrating and inefficient.

Because of these challenges, I decided to switch to GitHub Actions. This change significantly improved my experience. The documentation was clear, well-maintained, and filled with practical examples, especially for Python and Docker-based applications (https://github.com/actions/starter-workflows/blob/main/ci/docker-image.yml). The availability of starter workflows made it easy to bootstrap a working CI pipeline with minimal configuration. Compared to Jenkins, GitHub Actions felt more intuitive and better integrated with the GitHub ecosystem, allowing me to focus on defining meaningful checks rather than fighting the tool.

Using CI has already changed how I think about software development. Going forward, I plan to include CI pipelines in all my projects from the start. Automatically running code quality checks and unit tests on every commit and push gives me faster feedback and more confidence in my changes. Instead of manually testing or worrying about breaking existing functionality, I can rely on CI to catch issues early. This encourages smaller, more frequent commits and reinforces better development habits overall.

Given more time, one improvement I would make to my pipeline is publishing Docker images to Docker Hub as part of the CI process. This would allow me to easily deploy and run my application in any environment without rebuilding images manually. Additionally, I would like to learn how to better integrate GitHub and Jenkins, as understanding how these tools can complement each other would be valuable for working in more complex or legacy CI/CD environments in the future.