CODE ALPHA

Department of Computer Science & Engineering

Task Completion Report

A PROJECT REPORT

ON

“Secure Coding Review”

SUBMITTED BY

RUSHALI CHETAN RATHOD

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Under the guidance of

Code Alpha

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Name: Rushali Chetan Rathod

INTRODUCTION

Task Overview This report summarizes the work completed on checking for SQL injection vulnerabilities in the Flask application app.py.py and the results of static code analysis. The primary goal was to ensure the application is secure and free from common vulnerabilities.

Setup Instructions

1. Create a Virtual Environment
   python -m venv .venv
2. Activate the Virtual
   Environment .venv\Scripts\activate
3. Install Required Packages:
   Ensure you have Flask and testing libraries installed: pip install Flask unittest mock
4. Code Snippets SQL Injection Testing with Mocks

   Here is the unit test code for checking SQL injection vulnerabilities:

```
import importlib.util
import sys
import unittest from unittest.mock
   import patch, MagicMock
# Load the app module
spec=importlib.util.spec_from_file_location("app",
"C:/Users/Malu/PycharmProjects/CodeAlpha_cybersecurity/.venv/app,py.py")
 app_module=importlib.util.module_from_spec(spec)
sys.modules["app"]=app_module
spec.loader.exec_module(app_module)
app = app_module.app
classSQLInjectionTest(unittest.TestCase):
```

```
@patch('sqlite3.connect')
deftest_sql_injection(self, mock_connect):
mock_cursor=MagicMock()
mock_connect.return_value.cursor.return_value = mock_cursor

# Simulate a login attempt with SQL injection
response = app.test_client().post('/login', data={'username': "' OR '1'='1", 'password': "' OR '1'='1"})
# Check that the expected response is returned
session = response.environ['werkzeug.session']
 self.assertIn('Invalid credentials!', session['_flashes'][0][1])
# Check the first flash message
if __name__ == '__main__':
unittest.main()
```

Limitations

1. Human limitations

- Reviewers may **miss subtle or complex vulnerabilities**, especially logic flaws.
- Effectiveness depends heavily on the **reviewer's experience and security knowledge**.
- Fatigue and time pressure can reduce accuracy.

2. Scope and coverage limits

- Reviews often focus only on **source code**, missing issues in:
    - Configuration files

    - Deployment environments
    - Third-party services or infrastructure
- Large codebases make **complete coverage difficult**.

3. Time and cost constraints

- Thorough secure code reviews are **time-consuming**.
- Project deadlines may force **shallow or partial reviews**.
- Security reviews can be expensive if skilled experts are required.

4. Tool limitations (when using automated reviews)

- Static analysis tools can produce **false positives** (noise) and **false negatives** (miss real issues).
- Tools may not understand **business logic or application context**.
- New or custom vulnerabilities may not be detected.

5. Dependency and third-party code issues

- Secure coding reviews often **exclude external libraries**, even though they may contain vulnerabilities.
- Open-source or vendor code may be treated as a "black box."

6. Evolving threats

- Reviews are **point-in-time**; new attack techniques can emerge after the review.
- Code that was secure before may become vulnerable due to **changes in threat models**.

7. Not a substitute for other security practices

Secure code review alone cannot replace:

- Dynamic testing (DAST)
- Penetration testing

- Runtime monitoring
- Secure design and threat modeling

8. Context and environment mismatch

- Code may behave securely in review but become vulnerable due to:
    - Misconfiguration
    - Different runtime environments
    - Unexpected user behavior

In short: Secure coding reviews are essential, but they work best when combined with automated tools, testing, secure design, and continuous monitoring.

Objectives

Objectives of Secure Coding Review

1. Identify security vulnerabilities
    - Detect weaknesses such as input validation flaws, authentication issues, and insecure data handling.
2. Ensure compliance with security standards
    - Verify adherence to secure coding standards and guidelines (e.g., OWASP, CERT).
3. Reduce risk early in development
    - Find and fix security issues before deployment, when they are cheaper and easier to resolve.
4. Improve overall code quality
    - Encourage better structure, error handling, and safer programming practices.
5. Protect sensitive data

- Ensure proper use of encryption, access controls, and secure storage of confidential information.

6. Prevent common attack vectors
    - Mitigate risks from attacks like SQL injection, XSS, CSRF, and buffer overflows.
7. Validate secure design implementation
    - Confirm that security requirements and threat models are correctly implemented in code.
8. Increase developer security awareness
    - Help developers learn secure coding practices through feedback and review findings.
9. Support regulatory and audit requirements
    - Provide evidence of security controls for audits and compliance needs.
10. Enhance application reliability and trust
    - Reduce security incidents, improving user trust and system stability.

5. Commands Used
Run the Application:

python app,py.py

Static Code Analysis

bandit -r app.py.py
pylint app.py.py
pyflakes app.py.py

6. Run Unit Tests

Run the Application in a Test Environment

python -m unittest test_app.py
Check for SQL Injection Vulnerability Without a Database
python -m unittest test_sql_injection.py

Results

• The SQL injection test passed, indicating that the application properly handles potentially harmful input.

• Static analysis tools did not report any critical issues, ensuring the code quality is maintained.

Task Overview

In this project, we utilized several tools and methods to ensure the security and quality of our Flask application, app.py.py. Each tool and approach played a critical role:

1. **Bandit:**
   o Purpose: Bandit is a security linter specifically designed to find common security issues in Python code.
   o Use: By running Bandit, we were able to identify potential vulnerabilities such as hardcoded passwords, insecure use of APIs, and SQL injection risks. This proactive approach helps in mitigating security threats before they can be exploited.

2. **Pylint:**
   o Purpose: Pylint is a comprehensive linting tool that checks for coding standards, errors, and code smells in Python programs.
   o Use: Using Pylint allowed us to enforce best practices in our code, ensuring it is clean, readable, and maintainable.

It provides feedback on variable naming, code structure, and unused imports, which contributes to overall code quality.

3. **Pyflakes:**
   - Purpose: Pyflakes is a lightweight tool that detects errors in Python source files.
   - Use: Pyflakes helped us catch potential errors such as unused variables and syntax issues without imposing coding style rules. It complements the functionality of Pylint by focusing purely on error detection.

4. **Unit Testing with test_app.py:**
   - Purpose: Unit testing is essential for verifying that individual components of the application function correctly.
   - Use: The test_app.py file specifically tests for SQL injection vulnerabilities using mock objects. This ensures that our application is resilient against attacks, and the tests provide a safety net for future code changes. Automated testing helps in maintaining application integrity over time.

By incorporating these tools and testing methodologies, we not only improved the security posture of our application but also enhanced its overall quality and reliability. This comprehensive approach is essential in modern software development, where security and maintainability are paramount.

Conclusion:

The task of checking for SQL injection vulnerabilities was successfully completed using unit tests with mocks. The static code analysis confirmed the overall security and quality of the application. Further improvements could include regular code reviews and additional security testing to ensure ongoing safety.