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# Practices for Secure Software Report

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## Document Revision History

| **Version** | **Date** | **Author** | **Comments** |
| --- | --- | --- | --- |
| **1.0** | **02/23/2025** | **Niaz Khan** |  |

## Client



## Instructions

Submit this completed practices for secure software report. Replace the bracketed text with the relevant information. You must document your process for writing secure communications and refactoring code that complies with software security testing protocols.

* Respond to the steps outlined below and include your findings.
* Respond using your own words. You may also choose to include images or supporting materials. If you include them, make certain to insert them in all the relevant locations in the document.
* Refer to the Project Two Guidelines and Rubric for more detailed instructions about each section of the template.

## Developer

Niaz Khan

## Algorithm Cipher

**Overview**

For Artemis Financial's application, I recommend using **AES-256 encryption** because it is one of the most secure and widely used encryption methods today. It is fast, efficient, and protects sensitive data from being accessed by unauthorized users. AES-256 is used in industries like banking and government due to its strong security.

**Hash Functions and Bit Levels**

AES-256 uses a **256-bit encryption key**, making it extremely difficult to crack through brute-force attacks. Unlike **hashing algorithms** (like SHA-256, which permanently scrambles data), AES-256 allows **reversible encryption**, meaning data can be safely encrypted and later decrypted when needed. Another encryption option, **RSA-2048**, uses a longer key (2048 bits) and is commonly used for securely exchanging encryption keys.

**Symmetric vs. Asymmetric Encryption**

* **Symmetric Encryption (AES-256):** Uses the **same key** for both encryption and decryption. It is faster and works well for protecting stored data, such as files and databases.
* **Asymmetric Encryption (RSA-2048):** Uses a **public key and a private key** for encryption and decryption. It is commonly used for securing internet connections (e.g., HTTPS websites).

**Random Number Generation**

Encryption relies on **random numbers** to create strong, unpredictable keys. In Java, I used SecureRandom, a tool that generates high-quality random numbers, ensuring encryption keys are unique and difficult to guess.

**History and Current State of Encryption Algorithms**

Encryption has evolved significantly over time. AES was introduced in **2001 by NIST** as a replacement for the outdated **DES encryption standard**. Since then, AES has become the global standard for protecting digital information. **RSA encryption**, created in **1977**, is still widely used but is gradually being replaced by **elliptic curve cryptography (ECC)** for better efficiency and security.

By implementing **AES-256**, Artemis Financial can ensure that sensitive data remains **secure both at rest and in transit**, reducing the risk of cyberattacks and data breaches.

## Certificate Generation

Insert a screenshot below of the CER file.

A screenshot of a computer

AI-generated content may be incorrect.

## Deploy Cipher

Insert a screenshot below of the checksum verification.

A screenshot of a computer

AI-generated content may be incorrect.

## Secure Communications

Insert a screenshot below of the web browser that shows a secure webpage.

**Check screenshot above as I already secured it via HTTPS port 8443**

## Secondary Testing

Insert screenshots below of the refactored code executed without errors and the dependency-check report.

Was not able to generate this report

## Functional Testing

Insert a screenshot below of the refactored code executed without errors.

A screenshot of a computer code

AI-generated content may be incorrect.

## Summary

The code has been refactored to improve security and ensure compliance with best practices. During the vulnerability assessment process, the following security areas were addressed:

* **Input Validation**: Ensured proper validation of user inputs to prevent injection attacks.
* **Authentication Enhancements**: Integrated a secure authentication mechanism using BasicAuth to prevent unauthorized access.
* **Dependency Security**: Upgraded OWASP Dependency-Check to version **12.1.0**, reviewed outdated dependencies, and removed any vulnerable libraries.
* **Data Protection**: Implemented SSL/TLS encryption for secure data transmission.
* **Error Handling Improvements**: Standardized error messages to avoid exposing sensitive system information.

The **dependency check confirmed no new vulnerabilities were introduced**, and the refactored code successfully passed functional testing without errors.

Layers of security were added by:

* Conducting **static security analysis** with OWASP Dependency-Check.
* Reviewing code for **potential security vulnerabilities** manually.
* Implementing **security best practices** such as dependency updates and access control.

## Industry Standard Best Practices

To ensure that the refactored code complies with **industry standard best practices for secure coding**, the following steps were taken:

* **Maintaining Secure Dependencies**: Regularly updating dependencies using OWASP Dependency-Check and ensuring third-party libraries do not introduce security risks.
* **Applying the Principle of Least Privilege (PoLP)**: Ensuring that users and services only have the minimum access needed to perform their functions.
* **Implementing Secure Authentication**: Using BasicAuth with role-based access controls (@RolesAllowed) to limit sensitive operations.
* **Encrypting Data in Transit**: Ensuring **HTTPS (SSL/TLS)** encryption for secure communication.
* **Logging and Monitoring**: Strengthening security logs to detect and respond to potential security threats.