**Reflection Document  
Course Project: User Management System  
Student Name:** [Your Name]  
**Course Instructor:** Professor Keith Williams  
**Date:** [Current Date]

### **1. Project Overview**

The User Management System project was a valuable learning experience that allowed me to simulate real-world software development practices. This project required me to address **quality assurance (QA)**, **improve test coverage**, and **implement a new feature**. My chosen feature was **"Profile Picture Upload with Minio"**, which I successfully integrated into the project following best coding practices.

### **2. Issues Identified and Fixed (QA)**

I identified and resolved **5 bugs** as part of the Quality Assurance process. Each issue was tracked and closed via GitHub, demonstrating my debugging and problem-solving skills:

1. **Duplicate email and nickname error while bulk user creation process**
   * Closed Issue Link: #14 https://github.com/killuazoldyck7/user\_management/issues/14
2. **Role downgrade during email verification for users who are not anonymous**
   * Closed Issue Link: #10
   * https://github.com/killuazoldyck7/user\_management/issues/10
3. **list\_users - Pagination Validation**
   * Closed Issue Link: #8
   * https://github.com/killuazoldyck7/user\_management/issues/8
4. **Missing user-id in email verification**
   * Closed Issue Link: #6
   * https://github.com/killuazoldyck7/user\_management/issues/6
5. **Dependency conflicts in Python setup**
   * Closed Issue Link: #3
   * https://github.com/killuazoldyck7/user\_management/issues/3

Each issue was documented with detailed steps to reproduce, fixed, and verified through unit tests.

### **3. Test Coverage Improvement**

I reviewed the existing test suite and added **10 new test cases** to improve test coverage, focusing on edge cases, error scenarios, and critical functionalities:

* Added test cases for validating user creation with duplicate emails.
* Implemented tests for file upload size and type validations.
* Wrote tests to ensure correct behavior for role-based access control.
* Enhanced tests for user account updates, ensuring accurate error handling.

These tests significantly improved the reliability and robustness of the system.

### **4. New Feature Implementation: Profile Picture Upload with Minio**

For the new feature, I implemented **Profile Picture Upload** using Minio, a distributed object storage system.

**Feature Highlights:**

* Added a new API endpoint (/upload/{user\_id}) to allow users to upload their profile pictures.
* Integrated Minio to store images securely and return a unique URL for each upload.
* Resized and validated uploaded images to ensure consistent size and format.
* Updated user profile API to include the profile picture URL.

**Technologies Used:**

* FastAPI for the backend API.
* Minio for storage and management of images.
* PIL (Python Imaging Library) for image resizing.

### **5. Challenges Faced and Key Learnings**

1. **Bug Fixing:** Resolving the duplicate email and nickname issue during bulk user creation taught me the importance of database constraints and validation.
2. **Minio Integration:** Learning how to integrate Minio with FastAPI was challenging but rewarding. It expanded my knowledge of object storage systems and file handling in web applications.
3. **Testing:** Writing comprehensive tests helped me understand the importance of covering edge cases and ensuring the robustness of the system.

This project significantly improved my understanding of:

* RESTful API design with FastAPI.
* Asynchronous database operations using SQLAlchemy.
* Real-world debugging and testing practices.

### **6. Deployment and Submission**

* The project has been deployed to DockerHub.
* Docker Repository Link: DockerHub Link
* GitHub Repository: GitHub Link

### **Conclusion**

The User Management System project was a comprehensive learning experience that allowed me to implement industry-standard practices. By fixing bugs, writing robust tests, and introducing a new feature, I gained confidence in my ability to contribute to a professional software project.

This project has prepared me for real-world development scenarios and has equipped me with the skills to work in a team-oriented software engineering environment.