**4-2 Milestone Three: Enhancement Two: Algorithms and Data Structure**

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**Artifact Description**

The artifact I selected is the enhanced version of the item-tracking program for the Corner Grocer, originally created in my CS 210 course in December 2023 . This program was designed to help the Corner Grocer manage the inventory of items sold in the store. The enhancements to the original artifact include adding user accounts for login and saving items to a database (using an efficient data structure or algorithm), ensuring each user's items are tracked separately.

**Justification for Inclusion**

I selected this artifact for my ePortfolio because with the enhancements I can demonstrate critical skills and competencies I developed, particularly in algorithms and data structures. The original list management application focused on basic item tracking, but the enhancements significantly improve its efficiency and functionality. By integrating a database and using std::unordered\_map for in-memory item management, I optimized the data structure for storing list items. This ensures that each user's items are tracked separately and efficiently managed. The program has solid functionality for creating and authenticating user accounts, showcasing my ability to implement secure user management systems. Additionally, the database integration and the use of a hash table highlight my skills in using data structures to efficiently store and retrieve information. I also improved error handling and input validation to maintain system security.

**Meeting Course Objectives**

The planned enhancements for this artifact aligned with the course objectives set in Module One, focusing on software design and engineering, algorithms and data structures, and databases. By implementing user authentication and session management, I met the objective of designing and developing a secure and efficient user management system. The integration of a database for storing user accounts and item data, along with the use of std::unordered\_map for efficient in-memory item management, demonstrated my ability to use modern computing techniques to implement practical solutions. This approach addressed the course objectives and reinforced my understanding and application of essential computer science principles. The use of a hash table optimized in-memory data handling, and the database provided a effective and flexible foundation for managing and retrieving user data. This artifact shows my growth in effectively using algorithms and data structures to develop practical, real-world software solutions.

**Reflection on the Enhancement Process**

The process of enhancing and modifying the artifact provided me with valuable learning experiences, especially in algorithms and data structures. Initially, I planned to use an unordered map for item management, and I successfully integrated this hash table into the system. This allowed me to manage in-memory data efficiently while the database handled persistent storage and retrieval. I would also like to mention that I added comprehensive error handling and input validation, improving the program's reliability and mitigating potential vulnerabilities.

**Challenges Faced**

One of the main challenges I faced was ensuring data integrity when adding items from a text file to the user's account. Other challenges were the integration of hash table for in-memory item management and the database for persistent storage to efficiently handle item data. By optimizing both in-memory and database operations, I ensured the system operated correctly and efficiently. Doing this enhancement helped me understand the importance of design choices and trade-offs in computing solutions, aligning with the course outcome of designing and evaluating computing solutions using algorithmic principles and computer science practices.