

Cs 499 milestone three

Tiba Alramadan

Reflection on Algorithms and Data Structure Enhancement

For this milestone, I chose to enhance the **Weight Tracker mobile app** as my artifact for the **Algorithms and Data Structure** category of my ePortfolio. The original app allowed users to enter their daily weight and store it in a simple SQLite database, but it lacked advanced data handling and efficient algorithms for managing and displaying user records. My goal for this enhancement was to improve the app's data organization, retrieval, and responsiveness to better showcase my skills in computer science principles.

Artifact Description and Rationale

The Weight Tracker app is an Android Studio project that tracks user weight entries and goals. Originally, the app relied primarily on sequential access of SQLite tables to store and retrieve records. I selected this artifact because it allowed me to demonstrate practical applications of **data structures, algorithms, and object-oriented design** while enhancing an existing project from prior coursework.

Enhancements Implemented

1. DashboardManager and TableHelper Integration

- a. Created a DashboardManager class to fetch and process weight records for display.
- b. Built a TableHelper class to dynamically populate a table in the main screen, showing weight, date, and remaining weight toward the user's goal.
- c. This improvement uses **lists and object-oriented principles** to efficiently handle multiple user entries.

2. GoalManager and Goal Update

- a. Implemented a GoalManager class to allow users to update their weight goals dynamically.
- b. The main screen now refreshes the table when the goal changes, demonstrating real-time data update and handling.

3. Optimized Login Retrieval with HashMap Cache

- a. Introduced a HashMap<String, String> in LoginManager to cache user credentials.

- b. Login verification now occurs in **O(1) average time**, reducing reliance on SQLite lookups for every login attempt.
- c. The cache automatically updates when new users are added, maintaining consistency between the database and in-memory cache.

4. Algorithmic User Experience Enhancements

- a. Implemented a **prefix search algorithm** (`findClosestUser()`) to suggest usernames if users mistype their login credentials, improving usability.
- b. Extended password validation and login checks to integrate with the cache and suggestion system, creating a smoother and more responsive login process.

5. Algorithmic Enhancements in Weight Tracking

- a. Weight records are retrieved and **sorted by date**, improving efficiency for display operations.
- b. Calculations for “weight remaining” toward a goal are done on-the-fly using a simple algorithm that iterates over stored records.
- c. These enhancements demonstrate **practical use of arrays/lists, HashMaps, loops, and basic calculations**, reflecting competency in algorithmic thinking.

Course Outcomes Demonstrated

Through these enhancements, I demonstrated the ability to:

- **Design and evaluate computing solutions using algorithmic principles**, such as sorting, caching, and search algorithms.
- **Use well-founded techniques and data structures** (lists, HashMaps, singletons, and objects) to implement a functional mobile app.
- **Deliver professional-quality software** by improving code structure, readability, maintainability, and responsiveness.

Learning and Challenges

During this process, I strengthened my understanding of **algorithm optimization and data structures** applied to real-world software. One challenge was ensuring the cache stayed synchronized with the database while avoiding duplicate entries. Another challenge was implementing the prefix search efficiently for user suggestions. By carefully designing `LoginManager` and the `UserDB` interface, I was able to overcome these issues. I also improved my knowledge of **object-oriented design, singleton patterns, and algorithmic logic** applied in mobile applications.

Conclusion

This enhancement allowed me to showcase practical skills in algorithms and data structures while improving an existing artifact for my ePortfolio. The project now demonstrates **efficient data handling, dynamic display, goal tracking, and optimized login mechanisms**, all of which reflect my growing expertise as a computer science professional. The artifact not only illustrates my ability to improve software functionality but also highlights my understanding of key programming principles that align with the course outcomes.