Anna Padgett

Southern New Hampshire University

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Prof. Akhil Gudivada

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Algorithms and Data Structure Enhancement Narrative

The artifact selected for this enhancement is the Weight Tracker Android application, a mobile application developed in Java using Android Studio and SQLite. The application allows users to log daily weight entries, view historical records, and update or delete existing data The original version of the app primarily focused on basic CRUD operations and user interface interactions. This enhancement was completed during Module Four of the capstone course to address the Algorithms and Data Structures category.

For this enhancement, I extended the application beyond simple data storage by introducing structured data handling and algorithmic analysis. Weight entries are now stored as structured objects and processed using algorithmic logic to generate insights such as rolling averages and trend indicators, allowing the application to present meaningful information rather than raw values alone.

I selected this artifact for my ePortfolio because it clearly demonstrates a progression from basic data management to intentional algorithm-driven problem solving. This enhancement directly supports Course Outcome 3: Design and evaluate computing solutions that solve a given problem using algorithmic principles and computer science practices. The Weight Tracker provided a practical context in which to apply algorithms to real user data in a way that improves accuracy, usability, and performance.

Specific components of the enhancement that showcase my skills in algorithms and data structures include:

- Refactoring database queries to return structured collections (List<WeightEntry>) instead of loosely coupled primitives.
- Applying sorting logic to ensure consistent chronological ordering prior to analysis.
- Designing a rolling average algorithm to smooth short-term fluctuations.
- Implementing trend detection logic based on changes in rolling averages rather than single-entry comparisons.
- Separating analytical logic into a dedicated utility class (WeightAnalysisUtil) to improve modularity, readability, and reuse.

Compared to the original implementation, the application now performs meaningful computation on user data rather than simply displaying stored values. This represents a clear functional and conceptual improvement over the initial design.

In Module One, my enhancement plan identified the need to strengthen the artifact's use of structured data and algorithmic logic. This enhancement fully meets those planned objectives. In particular, it demonstrates key aspects of Course Outcome 3, including:

- Algorithmic principles: rolling average and trend detection algorithms were implemented with clear justification.
- Efficiency and optimization: the rolling average algorithm uses a bounded window size, ensuring linear time complexity O(n).
- Evaluation of solutions: shifting from single-point comparisons to rolling averages produced more stable and reliable trend analysis.

No changes were required to my original outcome-coverage plan, as the enhancement met and exceeded the intended scope.

Through this process, I learned the importance of selecting appropriate data structures before implementing algorithms. Earlier versions of the application relied heavily on cursors and ad hoc data access, which made analysis difficult to manage. Refactoring the data flow to use structured objects enabled clearer logic and more maintainable code.

One of the main challenges was ensuring that data was processed in the correct order before analysis. This required careful attention to sorting and consistency, particularly when calculating rolling averages and trends. Another challenge was balancing accuracy with responsiveness in a mobile environment, which reinforced the importance of efficient algorithms even for relatively small datasets.

This enhancement strengthened my understanding of how algorithmic logic can transform raw data into meaningful insights. It also reinforced the value of modular design, clear documentation, and deliberate consideration of efficiency and time complexity when developing real-world applications.