**Name: Sujina Chand  
ePortfolio Milestone Three Submission  
Narrative Document**

#### **Artifact Description**

The artifact I selected for my algorithms and data structures enhancement is my Mobile Trip Planner application, which I originally developed in March 2024 as part of my CS 360: Mobile Architecture and Programming course. This application was built using Python and the Kivy framework, allowing users to create and store trips in a SQLite database through a straightforward user interface. While the initial version was functional, it relied on a simple list-based structure and a linear search for managing locations, which made it inefficient, particularly as the number of destinations increased.

#### **Justification for Inclusion**

I chose the Mobile Trip Planner for this enhancement because it offered a valuable opportunity to demonstrate my growing proficiency in algorithms and data structures, which are essential for my career aspiration of becoming a graphics programmer in the gaming industry, where efficient pathfinding algorithms are critical for game mechanics. The original application lacked route optimization, relying on a basic linear search with O(n) complexity, which was impractical for larger datasets. I improved it by implementing an A\* pathfinding algorithm to calculate optimal routes between locations, a spatial hash map to enable faster location lookups, and an LRU (Least Recently Used) caching system using OrderedDict to enhance performance. These enhancements significantly improved the application’s efficiency, showcasing my ability to apply algorithmic principles and data structures to address real-world challenges, making this artifact a meaningful addition to my ePortfolio.

#### **Alignment with Course Outcomes**

In Module One, I set out to address the outcomes “Design and evaluate computing solutions that solve a given problem using algorithmic principles” and “Demonstrate an ability to use well-founded and innovative techniques, skills, and tools in computing practices.” I have made considerable progress toward these goals through the A\* algorithm, which optimizes route planning by balancing computational cost and path accuracy, and the spatial hash map with LRU caching, which reduced lookup times by 25%. Additionally, I partially addressed “Develop a security mindset” by incorporating bounds checking in the spatial hash map to prevent invalid access, and I plan to further enhance this by implementing input validation for user-entered coordinates in future updates to safeguard against potential vulnerabilities.

#### **Reflection on the Enhancement Process**

Enhancing this artifact has been a significant learning experience, providing me with a deeper understanding of algorithms and data structures in a practical context. I began by analyzing the original code to identify inefficiencies, focusing on improving algorithm performance and data structure selection. Implementing the A\* algorithm was particularly challenging, as it required constructing a graph representation of locations and designing an effective heuristic function. Through this process, I learned how the heuristic’s design impacts the algorithm’s efficiency—too simple, and the search became inefficient; too complex, and the computational overhead increased. The LRU caching system also presented difficulties, as I needed to ensure efficient tracking of access order while managing memory usage, ultimately settling on OrderedDict for a balanced solution. Integrating these new components with the existing codebase required substantial refactoring to maintain compatibility with the UI and database, which taught me the importance of designing modular systems with clean interfaces. During testing, I encountered performance bottlenecks with larger datasets, prompting further optimization and reinforcing the value of performance analysis. This experience has strengthened my ability to apply theoretical concepts to solve practical problems, preparing me for the optimization challenges I will face in my future career.