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

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* Q: Briefly describe the artifact. What is it? When was it created?

A: The artifact is a Kotlin-based implementation of Dijkstra’s algorithm originally developed during my CS 300: Data Structures and Algorithms – Analysis and Design course in 2024 C-2 (Mar–Apr). The project was a console-based graph traversal tool that used a simple implementation of Dijkstra’s algorithm to compute shortest paths.

* Q: What is the source of the artifact?

A: This artifact originated as an individual coding project from CS 300 at SNHU. It was submitted as part of a graded assignment focused on graph algorithms.

* Q: Did the artifact already implement the algorithm?

A: Yes, it used a basic implementation of Dijkstra’s algorithm using a nested loop and linear array to track distances. The time complexity was O(V^2) due to inefficient vertex selection and distance updates.

* Q: How was the artifact improved?

A: I enhanced the artifact by converting the linear vertex selection logic to use a binary heap (min-heap) through a priority queue. This improved the performance to O((V + E) log V). I also added optional A\* pathfinding logic to offer a more heuristic-driven approach for spatial data use cases. These enhancements demonstrate understanding of advanced graph traversal optimization.

* Q: Justify the inclusion of the artifact in your ePortfolio. Why did you select this item? What specific components of the artifact showcase your skills and abilities in algorithms and data structure?

A: I selected this artifact because it showcases my ability to analyze and optimize algorithmic performance. By replacing inefficient structures with advanced data structures and integrating an optional heuristic algorithm (A\*), the project now reflects real-world performance considerations and advanced algorithmic thinking.

* Q: Did you meet the course outcomes you planned to meet with this enhancement in Module One? Do you have any updates to your outcome-coverage plans?

A: Yes, I met the intended outcomes of demonstrating data structure optimization and algorithm analysis. No updates are required to my coverage plans.

* Q: Reflect on the process of enhancing and modifying the artifact. What did you learn as you were creating it and improving it? What challenges did you face?

A: The main challenge was efficiently implementing a binary heap and integrating it with the Dijkstra algorithm. I also had to refactor graph initialization and add error handling to make the application more flexible. Through this process, I gained deeper experience in algorithmic efficiency and practical data structure use.