Milestone Three Narrative: Algorithms and Data Structures Enhancement

Artifact Description

The artifact I selected for this milestone is a CSV Parser and Sorting Program created in February 2024 during my CS-300 course. This project involved reading a CSV file containing bid data, parsing the content into structured objects, and sorting the data using different algorithms. The original artifact implemented two sorting algorithms—Selection Sort and Quick Sort—to sort the bids based on the title. The project also included fundamental operations like loading the CSV data and displaying the results.

Justification for Inclusion in the ePortfolio

I selected this artifact for inclusion in my ePortfolio because it showcases my proficiency in algorithms and data structures, two foundational pillars of computer science. The artifact is an excellent representation of my ability to work with real-world data, organize it efficiently, and apply sorting algorithms to optimize performance. The two implemented algorithms, Selection Sort and Quick Sort, clearly demonstrate my understanding of:

* Time complexity: I can evaluate the performance of algorithms in terms of best, average, and worst-case scenarios.
* Data handling: I was able to parse structured data from a CSV file and manipulate it using efficient data structures (such as vectors).
* Algorithmic improvement: As part of this milestone, I improved the existing code by enhancing memory management and performance using smart pointers and optimized file parsing techniques.

I chose this artifact because it highlights both theoretical knowledge (understanding algorithm complexity) and practical application (optimizing file input/output and handling large datasets). These components showcase my capability to design and improve algorithms, while also emphasizing my software development skills with a focus on efficiency and reliability.

Course Outcomes Achieved

With the enhancements made to this artifact, I have successfully met several course outcomes:

* Outcome 3 (Algorithm Design and Evaluation): This outcome focuses on designing and evaluating computing solutions using algorithmic principles. By enhancing the sorting algorithms and improving their performance, I demonstrated my ability to make informed design choices to solve a specific problem efficiently.
* Outcome 4 (Implementing Well-founded Techniques): In this milestone, I demonstrated my ability to use well-founded and innovative techniques. The improvements made to memory management, file handling, and the sorting algorithm highlight my technical proficiency in solving industry-relevant problems.

I do not have any significant updates to my outcome-coverage plans since I am progressing as expected.

Process of Enhancing and Modifying the Artifact

The process of enhancing this artifact involved several learning experiences and challenges. One of the key areas I focused on was memory management. In the original artifact, raw pointers were used, which can lead to memory leaks if not handled carefully. I replaced these raw pointers with smart pointers (std::unique\_ptr) to ensure automatic memory management, which eliminated the need for manual deletion and improved the robustness of the program.

Another area of improvement was file handling. I optimized the way CSV files were read and processed by using more efficient looping constructs and error-checking mechanisms. This improved both the readability of the code and its performance when handling large datasets.

The main challenge I faced was ensuring that the enhanced sorting algorithms still adhered to their theoretical time complexities while also maintaining correctness in edge cases (such as handling empty or malformed CSV files). Additionally, integrating smart pointers into the code required me to refactor some parts of the original program to ensure that the logic remained clear and efficient.

Through this process, I learned how crucial it is to focus on both algorithmic performance and code maintainability. By refactoring the original code, I also improved its readability and ensured that future modifications or enhancements could be made more easily. The experience deepened my understanding of the trade-offs between performance optimization and complexity in software design.

This narrative outlines the artifact's relevance to algorithms and data structures and reflects on the process of enhancing it for inclusion in my ePortfolio. The improvements I made showcase my growth in designing efficient algorithms and implementing solutions that meet real-world performance standards. I am confident that this artifact demonstrates my competency in core computer science concepts and my readiness for professional development in this field.