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Southern New Hampshire University

CS-499-12303 Computer Science Capstone

Professor Bermudez

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**4-2 Milestone Three: Enhancement Two-**

**Algorithms and Data Structure**

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

The artifact that I’ve decided to enhance is an interactive MongoDB dashboard originally made for a previous course project (CS-340 Client Server Development) focused on database interaction and visualization. The application was built using Dash by Plotly, Python, and MongoDB. Its main purpose was to help users filter and analyze shelter dog data from the Austin Animal Center. The final submission of this project was back in February of this years, since then it has been enhanced to incorporate stronger algorithmic and data structure implementations as part of this capstone course.

1. *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? How was the artifact improved?*

I chose this artifact because it shows my ability to work with real-world data while applying principles of efficient data handling, searching, and sorting. Before the enhancement, the dashboard had basic functionality and “light” MongoDB filtering. However, for this enhancement, I made several improvements that better align with best practices in algorithms and data structures.

I’ve made the following enhancements:

1. Made client-side sorting and searching using custom Python logic
2. Created an in-memory breed index using a Python dictionary to streamline filtering logic and reduce redundancy in repeated queries.
3. Refactored the sorting and filtering logic into modular functions to promote code reuse and separation.
4. Made a binary search tree (BST) to organize dog entries by intake age, enabling efficient age range filtering and supporting future scalability for larger databases.

1. *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?*

Yes, I met the course outcomes that I originally made in the beginning. For outcome three, I applied algorithmic thinking and principles to redesign the dashboard’s data handling logic. With the BST and a breed index dictionary in place, both are strong examples of how I approached problems with data structure tradeoffs in mind. In outcome four, I leveraged Python and Dash effectively, using these tools in a professional and scalable way. I also modularized the application logic, which not only improves maintainability but also shows my ability to apply innovative computing techniques.

1. *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?*

Working on this artifact helped me see just how much of an impact efficient data structure can make on user experience, especially when dealing with interactive applications. One challenge that I faced was making sure that the client-side enhancements did not interfere with the original MongoDB filtering or break the user interface. Another challenge was figuring out how to integrate the BST structure meaningfully within a web-based dashboard while keeping the logic clear and traceable.

In the end, these challenges helped me become a better problem solver. I learned how to break the logic into smaller, testable components and gained a deeper understanding for the way memory and performance optimization matter, even in user-facing applications.