CS 499 Enhancement Two Algorithms and Data Structure

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

   This artifact is a continuation to the work I completed in enhancement one which originated as an application I created in my CS 320 course as a way to practice writing Junit tests. This application creates a list of contacts that can be interacted with in multiple ways, like adding more, updating, and removing the contacts. Through enhancement one I transferred the application to C++ using Google Test. In enhancement two I have implemented more functionality as well as a way for users to directly interact with the application. In doing this, I implemented a main menu that lets users interact with the existing functionality as well as the new functionality I added in the enhancement. The new functionality I implemented allows users to sort the contacts vector in multiple different ways including ascending or descending alphabetically and ascending or descending numerically as well as allowing users to search for a specific contact based on its ID.

2. **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 to include this artifact in my ePortfolio as it demonstrates my abilities in working with algorithms and data structures. This is because through my enhancement I utilized these skills to bring more functionality to the application. This is demonstrated in the methods I implemented working with the vector data structure to sort the contacts within the vector in various ways as well as find specific elements within it. The artifact was improved in many ways, including new functionality, as well as creating a way for users to directly interact with the application through menus.

3. **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?**

   I did meet the course outcomes I planned through my work on this enhancement. I was able to demonstrate my abilities to develop with a security mindset through my work validating user input and safely handling errors. I was also able to demonstrate how I can implement techniques, tools, and algorithmic principles to achieve a solution. An example of this would be

in my methods where I used different techniques to sort or search the contacts vector including utilizing sort and find if and more. Lastly, through my work implementing proper in-code comments, I also demonstrated my abilities to create and work in a collaborative environment. At this time, I do not have any updates that I want to make to my outcome-coverage plans.

4. **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?**

While working on this enhancement, I learned a lot about working with vectors as well as some of the newer features and tools implemented in C++ 11 like the changes made to sort and erase. When implementing these tools, I had to decide which ones to utilize in my application for example I chose to use the find_if function. I chose this method as it was easier to implement over manually searching through the vector. The more refined and simple nature of this function makes the code more readable, promoting a more collaborative environment and made it easier for me to develop. I learned how to implement these things to match the functionality I was aiming to achieve and in doing so I did run into some challenges. While working on my methods, I found myself unable to output the elements of my vector. I eventually found that the problem was my Contact classed need to include the overload operator << to achieve what I was trying to do. I was able to implement this with the help of a geek for geeks tutorial. This is something I had not done before and taught me about overload operators and how to implement them. One challenge that I faced when developing this application was that I was experiencing a clunky user interface. When using the application, I saw that instructions were being printed multiple times and user input would not always to what was expected, and seemingly valid input was being interpreted as invalid. When approaching this, I ran through the program multiple times, identifying where all of these issues occurred. I noticed that when the program would print multiple instructions, it was right after I had already inputted a command for a previous menu option. To implement input validation, I made the instructions print every time invalid input was detected. When analyzing this I realized the input from the previous menu option was being read again for the next menu option causing invalid input and the instructions to be printed again, to solve this I simply

cleared the input when entering a secondary menu option and this solved the issue. While running the application I also noticed that input would be read incorrectly only in the secondary menu option “display contacts” where you can choose how you want the contacts to be displayed. In this menu option, the first input worked perfectly fine but when brought back to the main menu options seemingly correct input would be read as invalid. Looking into this secondary menu option and through implementing testing error codes to indicate where in the code this error took place I realized my issue was that I had implemented else cases into this menu option. These else cases were meant to catch invalid input however I had already implemented other measures to do this so these cases were being met when exiting one of the display contact options causing the invalid input message to display and the application collected input for the display contact options. To fix this I removed the else branches as they were not needed to maintain functionality or security and caused issues in the program that could be exploited, upon removal the application functioned properly.

5. Concluding Paragraph

This enhancement is a good representation of my growth through the computer science program as it showcases many key skills I have developed. Through working on this enhancement, I demonstrated my abilities to develop using industry standards tools and techniques, weigh the pros and cons of specific tools and approaches, creating a collaborative development environment, designing and developing user friendly interface, and lastly effectively debugging utilizing proper procedure like implemented error outputs. These are key skills that I have developed through the computer science program and can be applied in many areas in the field.