# CS260 Final Project Report

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In this course we learned about different data structures and their use cases. Along with the data structures we also learned search algorithms that can be used for each data structure. This is such scratching the surface of this topic, but it allowed me to better understand how and why some programs are written the way they are.

When making programs we need to consider the proper data structures and algorithms for the job. This is because we need to optimize our program for function, speed, and accuracy. A data structure is just as the name implies; it takes data and organizes how it is stored.

Vectors are like arrays because it stores data in contiguous memory, but they do not limit size. When arrays are declared/initialized they have a set size, vectors can continuously be increased in size.

Hash tables are another type of tool for storing information or data. It uses a hash function to keep track of where the data is placed in memory. The data that is stored in a hash table has a key associated with it. The hash table is useful in finding data by finding the key associated with it as opposed to going through a vector or array in a linear fashion.

Tree structures are like the name implies, it is a data structure that places data and items in a tree like form with relation to other data points. The tree structure is an abstract data type and data is organized in a hierarchal structure like that of a family tree with a parent, child, and grandchild node.

The search algorithm is any that can find specific data or node points in a data structure. When we store data, depending on the parameters we set and the data structures we use, we do not know where exactly each data point is stored in memory or storage. To find the data points we need search algorithms are written, but they are dependent on the data structure and time complexity. The two main search algorithms we covered in class are linear and binary search, but each have their advantages and disadvantages. Binary search may be quicker with certain data structures and vice versa with linear search.

When searching through data we may need to sort the data first to make it faster or easier to find what is needed. A sorting algorithm takes the data points or elements of a list and sorts it into the order we want. The sorting can be cone numerically, alphabetically, and it can also be ‘reverse sorted’.

Hash/chaining algorithms are used in hash tables to prevent collision and memory waste. This is because hash table data structures use keys, we write hash/chaining algorithms to produce one-time keys from a single key or passcode.

My favorite program that uses both an algorithm and a data structure was the Lab 5-2 assignment because I found that it was the assignment that taught me most about programming and really put all the things, I have learned so far to practice. The assignment required us to construct the data structure, a node, and then assign the node a key. The incremental steps were confusing, but through it I learned how to create a data structure and how to locate my data point using keys.

I am not sure to what extent my exact code is reusable, but I do understand the importance of concepts I learned. If I can create a data structure, organize my data and find it when I need it then this can be applied to other programs as well.

The annotations I used in my code were straight forward, the naming convention of my variables and functions are clear. The code comments inform any programmer exactly what the code is doing. With this, I believe anyone can read my code and understand what I am trying to do.

Through this course we learned about different data structures and their use cases. Along with the data structures we also learned search algorithms that can be used for each data structure. This is such scratching the surface of this topic, but it allowed me to better understand how and why some programs are written the way they are. As a beginner in programming and this being only my third programming course that I have taken I feel that it has helped to solidify my understanding of the key fundamentals. The challenges I had with this course was the use of Eclipse and setting up the environment properly. I also had trouble in writing C++ because I am a beginner and with many of the classes in this program switching languages it is difficult to become proficient at one specific language. Even with my struggles in using C++ I do understand why the language is used.