CS 2028C- Data Structures

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Lab 11: Heaps

Lab Report

In this lab, we explored min and max heaps- how to insert and delete items from them, and how to perform a heap sort. In addition to these concepts, we also dealt with friend functions and class/ function templates.

A heap is a specialised tree-based data structure which is essentially an almost complete tree that satisfies the heap property. The heap is one maximally efficient implementation of an ADT called the priority queue and is considered partially ordered. A heap is a useful data structure when it is necessary to remove the object with highest or lowest priority. Heaps are used in many famous algorithms such as Dijkstra’s algorithm for finding the shortest path, heapsort, etc.

A friend function of a class is defined outside that classes scope but has the right to access all private and protected members of the class. They are thought to be loopholes in OOP. In this lab, the LPT has been made available to two classes thus acting as a gateway between the two, allowing easier data manipulation.

Function templates operate with generic types, which allows us to create a function template whose functionality can be adapted to more than one type or class without repeating the entire code for each type.

All of these skills mentioned above, are extremely important not only for the course, but also for a career in Computer Science, which is all about using algorithms and allowing our code to be flexible in time and memory resources.

Screenshots for outputs of task 2 and task 3 have been added below.

**Please Note:** There were some slight deviations made from the original structure mentioned as follows:

1. In task 1, instead of implementing a Min AND Max Heap, we implemented a min heap and used separate functions for the HeapSort () function thus fulfilling the requirements of Max Heap. Permission was obtained from our TA.
2. A random number generator using the seed and #Include <ctime> was used, so that the user does not have to input any timings and everything is automatically entered for them, if they with to do so.
3. LPT was implemented as a regular friend function and not a template friend function, since it could not recognize the private values as valid. This too was mentioned to the TA.

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