**Summer 2021**

**CSC 1310**

**Lab 8: Heaps**

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| **Reference:** | Chapter 10 – Heaps |

**Objective:** To gain a better understanding of how Heaps work.

**Source File (s)**: Heap.h, Driver.cpp, Student.h

**INTRODUCTION:**

Heaps are used for some applications which require fast access to and removal of the maximum item in a changing set of items. For example, a computer may execute jobs one at a time; upon finishing a job, the computer executes the pending job having maximum priority. The heap structure uses an array to represent a tree. The insert, and remove functions run in O(lg n) time. The building of a heap has a run time of O(n), and this is where it differs from previous structures such as an AVL tree.

***Properties of binary trees:***

A heap is a complete binary tree, where all the descendants of the root have less of a priority than the root. For a Min (Max) Heap, the root will always be the smallest (largest) element. A Heap is not like a BST; an in-order traversal does not necessarily yield an ordered list.

Inserting into the heap:

• append the new element to the end of the array storing the heap.

• “bubble up” the new element until it is in the right position.

Removing an element from a heap:

• pop out the root and replace it with the element at the end of the array.

• “bubble down” from the root to preserve the heap property.

**In the following heap below, what will be the 10’s right and left child if 10 is inserted?**

20

25

Left child = Right Child =

**What is the array representation of the tree after 10 is inserted?**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| \* | **7** | **15** | **10** | **24** | **17** | **25** | **20** |

**What is the array representation of the tree if 7 is removed**?

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| \* |  |  |  |  |  |  |  |

**Then, rebuild the heap tree (as above) after 7 is removed.**

**WHAT SHOULD THIS PROGRAM DO?**

You are provided with a **Student.h** and a **Driver.cpp files**. Whereas, **a Heap.h** is partially provided for you. **You will be completing Heap.h file where you see the following comment section:**

// Write your code here!

**(Note: Hints and directions are given as comments in the program file. Please read them carefully)**

**How confident are you that your implementation is *correct*? And why?**

**Pretty confident because I had help with a tutor.**

**You have finished!**

**In order to receive credit, you must submit this lab exercise (handout) with answers filled in along with the following files:**

* **Heap.h**
* **Driver.cpp**
* **Student.h**

**[*possible full credit*]**