

## lab 16 Binary Heap and Heapsort

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**Instructions:** This lab is a practice in constructing a basic binary heap and performing heap sort. Implement insert, copy constructor, getHeight, getSize, contains, removeFirst, operator[], and sort. Note: please follow the lecture as some of this will be done in class.

```
1 #ifndef HEAP_H
2 #define HEAP_H
3
4 #include <string>
5
6 template<class T>
7 class Heap {
8     private:
9         /* Lets fill out in class. */
10    public:
11
12        /* Creates an empty heap. */
13        Heap();
14
15        /* Does a deep copy of the array into the heap. */
16        Heap(const T *array, const int size);
17
18        /* Add a given value to the heap.
19         * Must maintain ordering!
20         */
21        void insert(const T &val);
22
23        /* Returns the height of the heap. */
24        int getHeight();
25
26        /* Returns the size of the heap. */
27        int getSize();
28
29        /* Returns the index if an item if exists in the heap.
30         * Otherwise return -1.
31         */
32        int contains(const T &val) const;
33
34        /* Retrieves the element at position pos */
35        T& operator[](const int pos);
36
37        /* Removes and returns the first element */
38        T& removeFirst();
39
40        /* Performs a Heap Sort and returns an array of the sorted
```

```

41     * elements.
42     * Note: the heap is empty after the sort!
43     */
44     T* heapSort();
45
46     ~Heap();
47 };
48
49 /* Since heap templated, we include the .cpp.
50  * Templated classes are not implemented until utilized (or explicitly
51  * declared.)
52  */
53 #include "heap.cpp"
54
55 #endif

```

### Write some test cases:

Create some test cases, using cxxtestgen, that you believe would cover all aspects of your code.

### Memory Management:

Now that are using new, we must ensure that there is a corresponding delete to free the memory. Ensure there are no memory leaks in your code! Please run Valgrind on your tests to ensure no memory leaks!

### How to turn in:

Turn in via GitHub. Ensure the file(s) are in your directory and then:

- \$ git add <files>
- \$ git commit
- \$ git push

**Due Date:** March 20, 2019 2359

**Teamwork:** No teamwork, your work must be your own.