

## Lab 08 – Heaps and Priority Queues

### Task 1:

1. Discuss the advantages and disadvantages of this structure over a standard queue.

#### Advantages

- Can be inserted in any way (front or back since there are no end in a priority queue)
- Nodes can be weighted (higher priority = higher precedence)

#### Disadvantages

- Data needs to be ordered to delete values (since highest priority needs to be removed first)
- Takes longer to sort (not optimal at all times)
- Uses lots of space

### Task 2:

1. Discuss the advantages and disadvantages of this structure over a standard binary search tree

#### Advantages

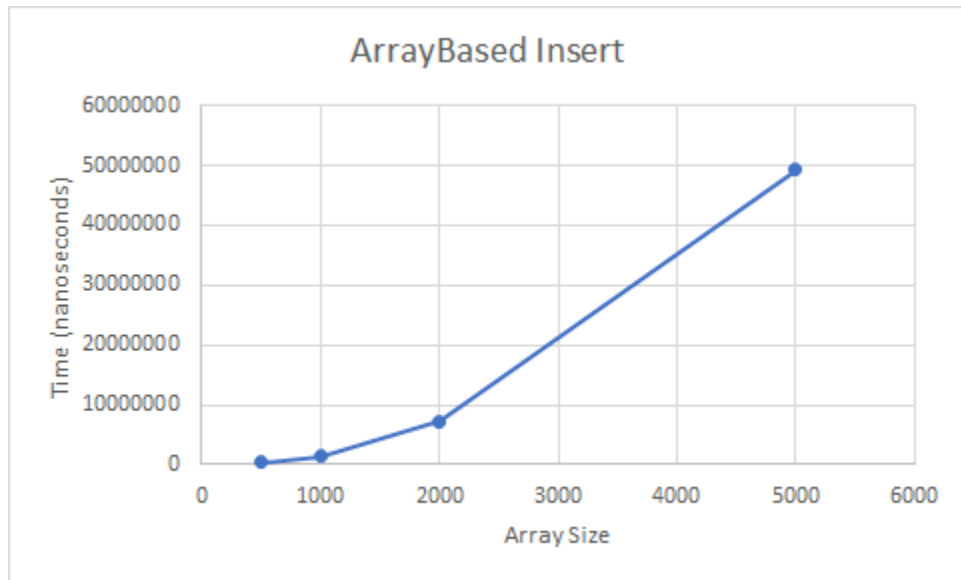
- Can be sorted from max or min heap with the highest or lowest value as the root
  - BST only guarantees order from left or right
- Highest priority is at the root (easiest to access)
- Faster to sort (time complexity is better than BST)

#### Disadvantages

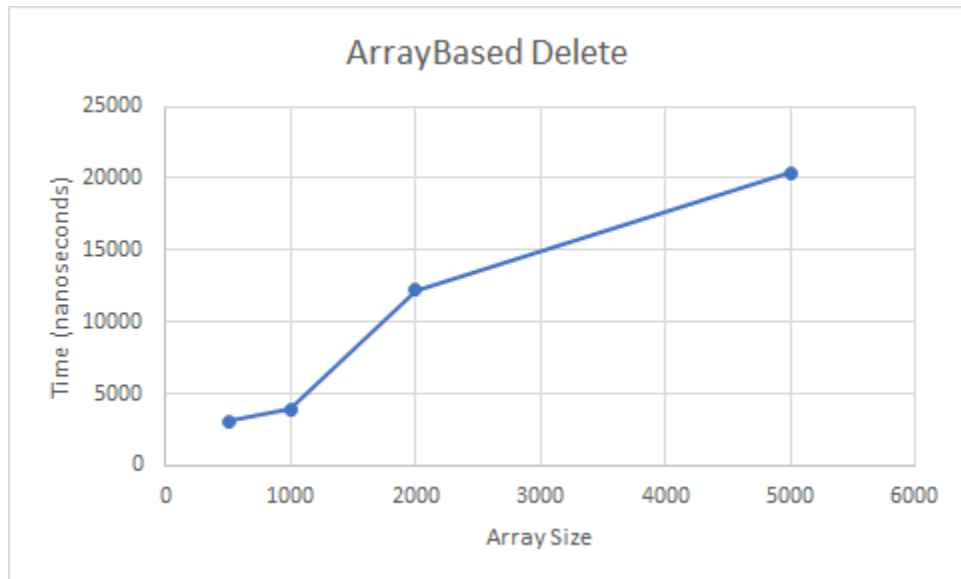
- Allows duplicates (BST doesn't)
- Takes long to search for arbitrary values
  - BST would be faster

### Task 3:

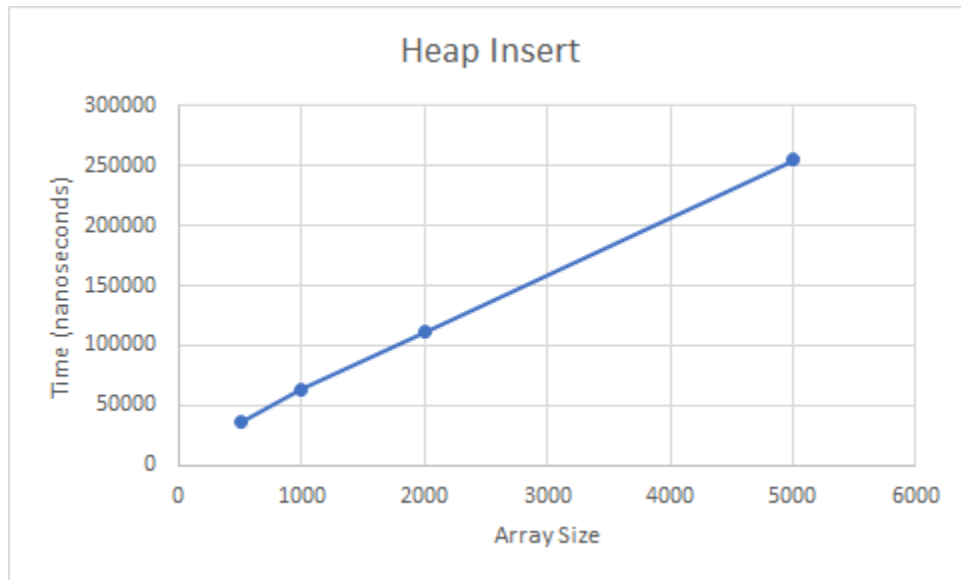
Array Based Insert:



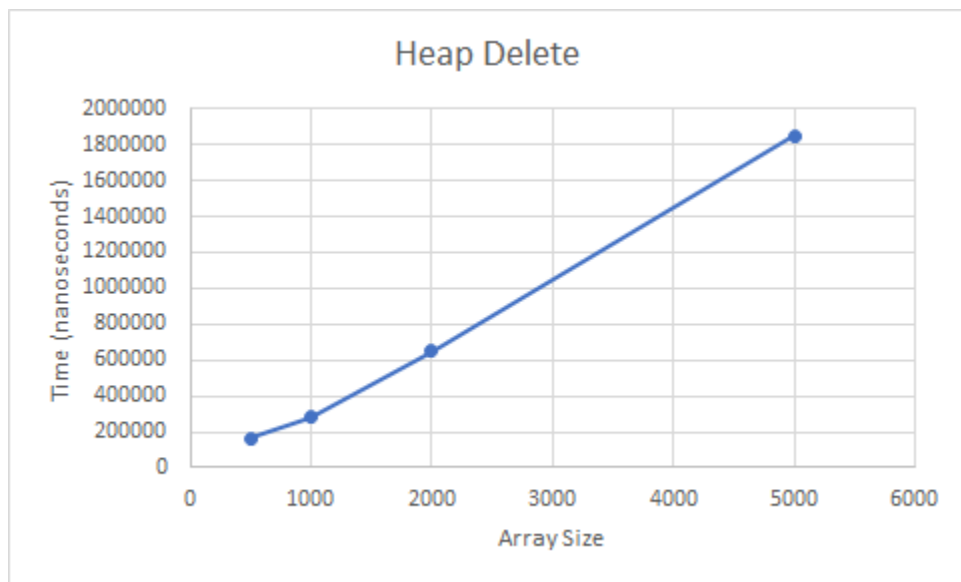
Array Based Delete:



Heap Insert:



Heap Delete:



The array-based insert is much slower than the heap insert. The max time for heap insert is about 250,000 nanoseconds at 5,000 elements while the max time for array-based insert is 50,000,000 nanoseconds at 5,000 elements. Array based delete is much faster than the heap delete with array based having a max time of 20,000 nanoseconds at 5,000 elements and the heap delete having a max time of 1,800,000 nanoseconds at 5,000 elements.