EECS 233 HW7

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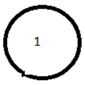
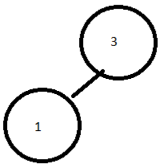
GitHub: https://github.com/bp0017/CWRUEECS233/tree/master/HW7

1 Question 1

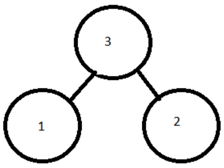
a)



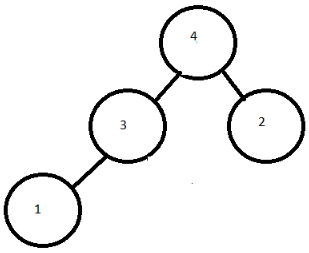
b)



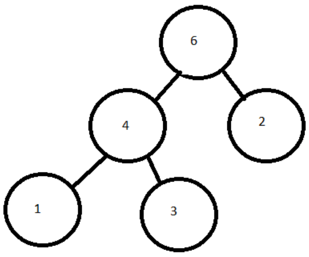
c)



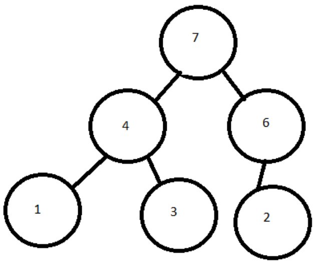
d)



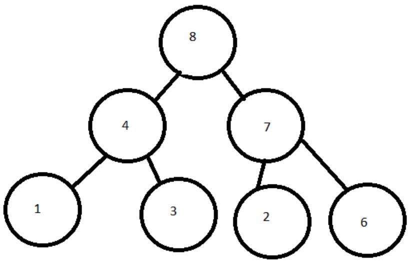
e)



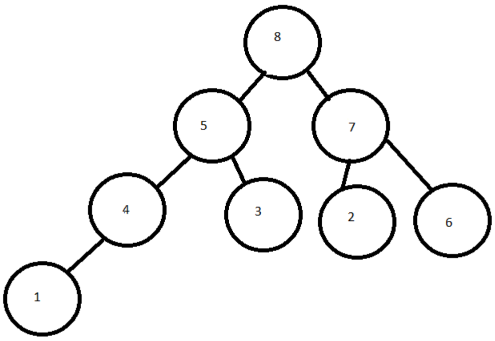
f)



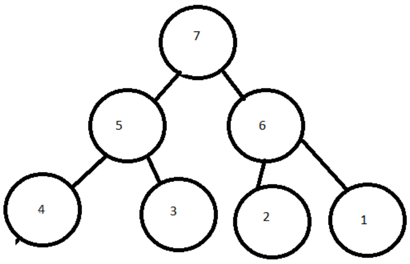
g)



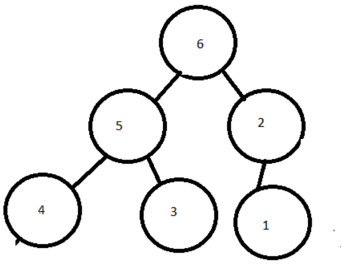
h)



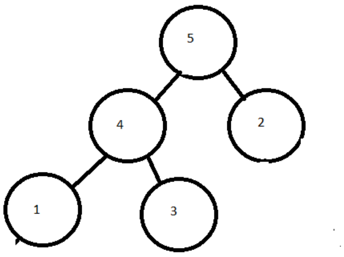
i)



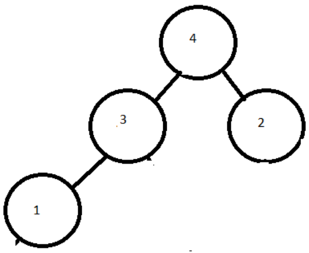
j)



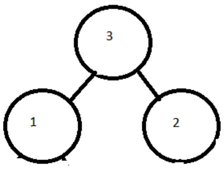
k)



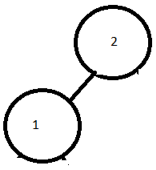
l)



m)



n)

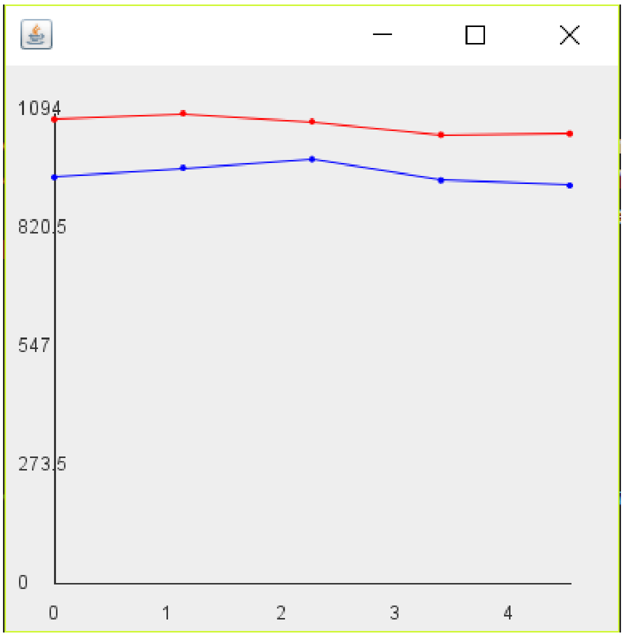


2 Question 2

```
C:\Users\bp001\Documents\EECS223\HW7>java Heap
Adding values...
[0] 8
[1] 5
[2] 7
[3] 4
[4] 3
[5] 2
[6] 6
[7] 1
Removing... 8
[0] 7
[1] 5
[2] 2
[3] 4
[4] 3
[5] 1
[6] 6
Removing... 7
[0] 6
```

```
[1]  5
[2]  2
[3]  4
[4]  3
[5]  1
Removing ...  6
[0]  5
[1]  4
[2]  2
[3]  1
[4]  3
Removing ...  5
[0]  4
[1]  3
[2]  2
[3]  1
Removing ...  4
[0]  3
[1]  1
[2]  2
Removing ...  3
[0]  2
[1]  1
```

3 Question 3



blue= IntArrayBag, red = Heap
y-axis in ms

4 Question 4

a) The add operation for the IntArrayBag class is $O(1)$ because it adds a single element to the end of an array with one assignment.
b) The remove operation for the IntArrayBag where the element is the last item of the array is $O(N)$ because the remove method has to search through the entire array of length N.
c) The sum of the add and remove operations for the IntArrayBag class is $O(N)$, because as N gets larger, the $O(1)$ time of the add operation becomes less important.
d) The add method for the Heap class where the element added is larger then the root is $O(logN)$ because the element needs to shift the entire height of the tree, which is $logN$ where N is the height of the tree.
e) The removeMax() method for the Heap class is worst-case $O(logN)$ because at the worst case, the element swapped to the root of the tree has to sift downwards through the whole tree of height $logN$.
f) The sum of the add and removeMax methods for the Heap class is $O(logN)$ because two methods with time complexity $logN$ are summed together, causing the resulting time complexity to be $2 * logN$, which simplifies to $O(logN)$.

5 Question 5

The experimental results do not really agree with the expected results; for large N the heap times would be expected to plateau, whereas the IntArrayBag times would be expected to increase in a linear fashion. The experimental results have both at constant time. This is probably due to experimental (programming) error.