CSC212

Tutorial: Heaps

Problem 1:

a) Construct a new binary min-heap from the following elements: 12, 5, 17, 22, 20, 9, 1, 32, 50, 16, 25, 8, 44 and 33

b) Perform three root/min/head deletions from the heap you built in (a.

Solution: a)

Insert 12

	12													

Insert 5

	5	12												

Insert 17

	5	12	17											

Insert 22

	5	12	17	22										

Insert 20

	5	12	17	22	20									

Insert 9

	5	12	9	22	20	17								

Insert 1

	1	12	5	22	20	17	9							

Insert 32

	1	12	5	22	20	17	9	32						

Insert 50

	1	12	5	22	20	17	9	32	50					

Insert 16

	1	12	5	22	16	17	9	32	50	20				

Insert 25

	1	12	5	22	16	17	9	32	50	20	25			

Insert 8

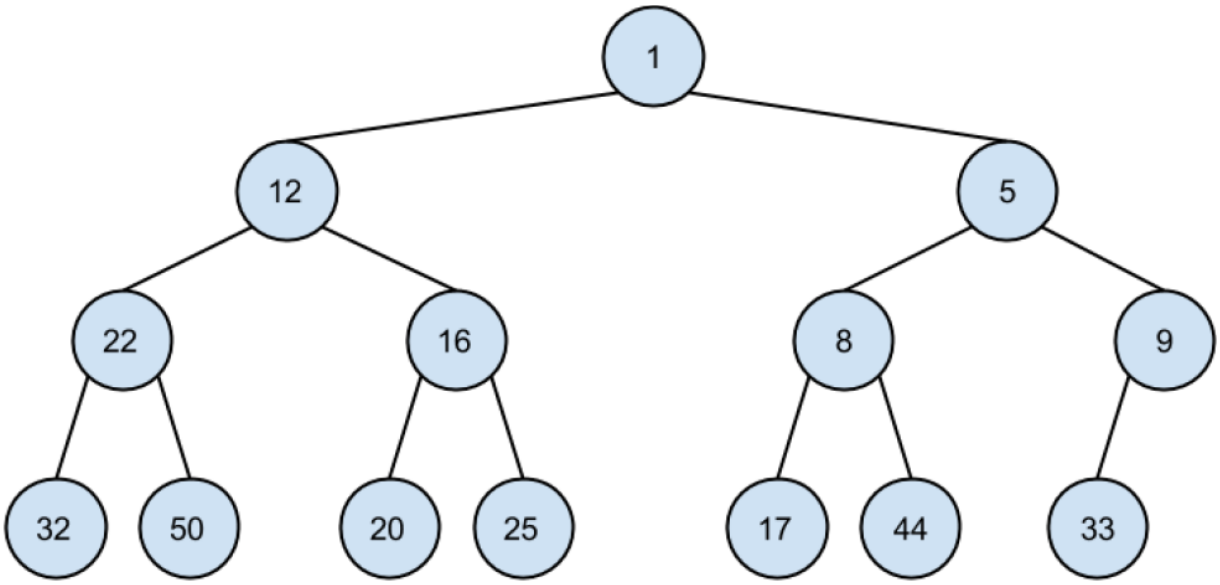
	1	12	5	22	16	8	9	32	50	20	25	17		

Insert 44

	1	12	5	22	16	8	9	32	50	20	25	17	44	

Insert 33

	1	12	5	22	16	8	9	32	50	20	25	17	44	33



b)

First Root delete

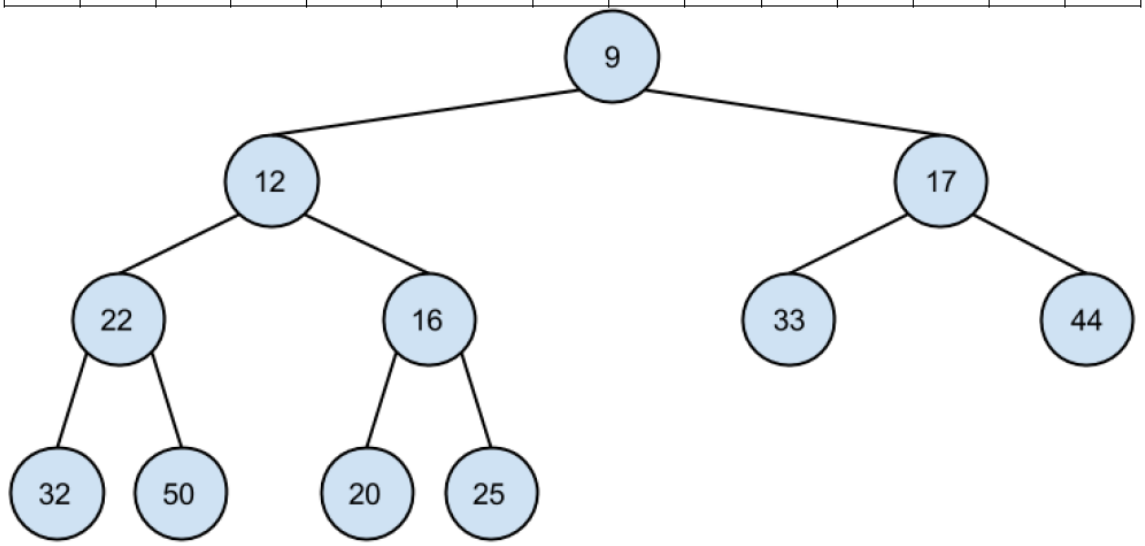
	5	12	8	22	16	17	9	32	50	20	25	33	44	

Second Root delete

	8	12	9	22	16	17	44	32	50	20	25	33		

Third Root delete

	9	12	17	22	16	33	44	32	50	20	25			



Problem 2:

The time complexity of building a binary heap from a sequence of elements when all elements are:

a. Sorted according to the heap property **O(n)**

b. Sorted in the inverse of the heap property **O(nlogn)**

Problem 3:

Give the implementation of the method isBinaryHeap(int[] a, int size) that returns true iff array a satisfies max-binary heap condition.

Solution:

```
public static boolean isBinaryHeap(int[] a, int size){
        for(int i = 1; i < size; i++) {
                if(i*2 <= size) {
                        if(a[i*2] > a[i]) {
                                return false;
                        }
                }
                if(i*2+1 <= size) {
                        if(a[i*2+1] > a[i]) {
                                return false;
                        }
                }
        }
        return true;
}
```

Problem 4:

Can a BST satisfy heap conditions? Give an example if yes.

Yes, if the BST is empty or if it has only two nodes.