COSC-211: DATA STRUCTURES
HW8: HEAPS

Due Friday, December 9, 11:59pm

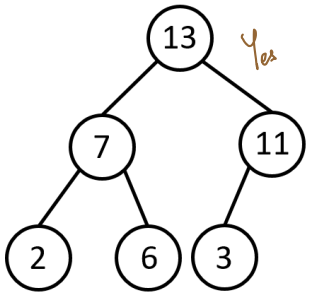
Reminder regarding intellectual responsibility: This is an individual assignment, and the work you submit should be your own. Do not look at anyone else's work, and do not show anyone your work (except for me and the course TAs).

1 The Assignment

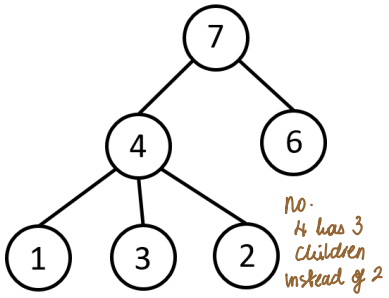
This is a short written assignment to give you some practice working with heaps.
1. For each of the following trees:

- Is it a heap?
- If it's not a heap, why not? That is, state the structural and/or organizational properties that are violated (you may list more than one violated property).

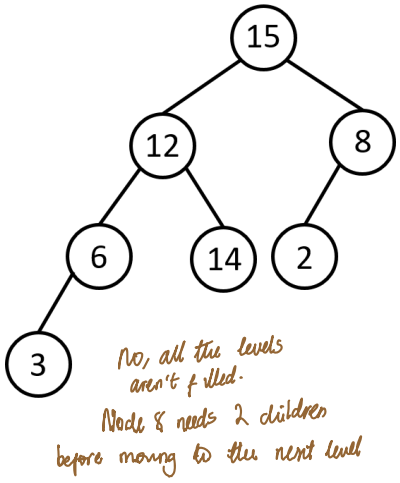
(a)



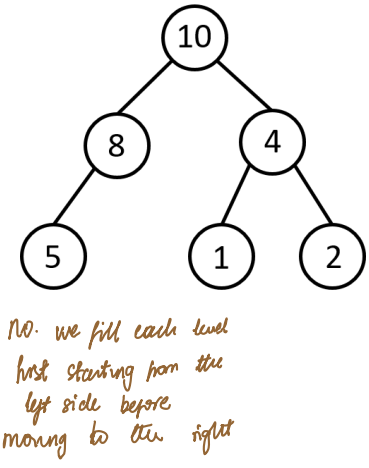
(b)



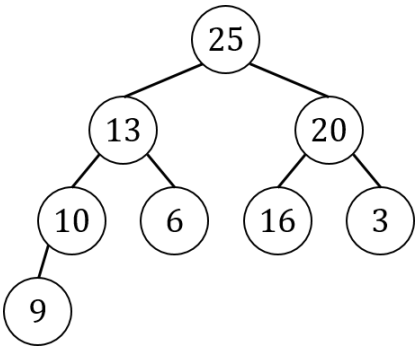
(c)

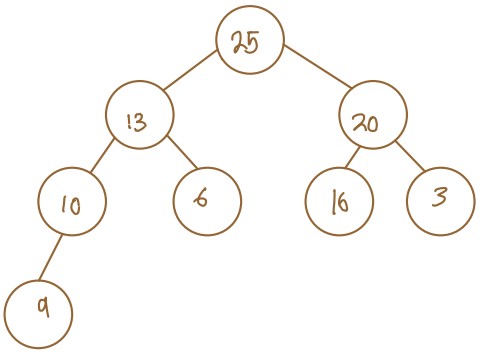


(d)



2. Here is a heap:





Show what happens after each of the following operations is called in sequence. (For each operation, draw some pictures of what the heap looks like after every step of the add or remove process.)

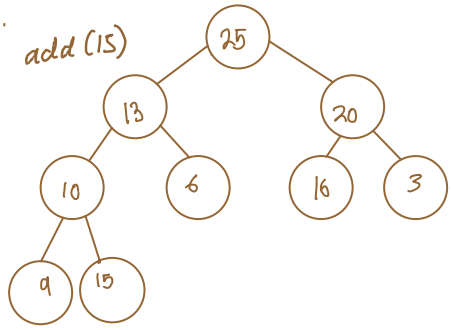
(a) `add(15)`

(b) `remove()`

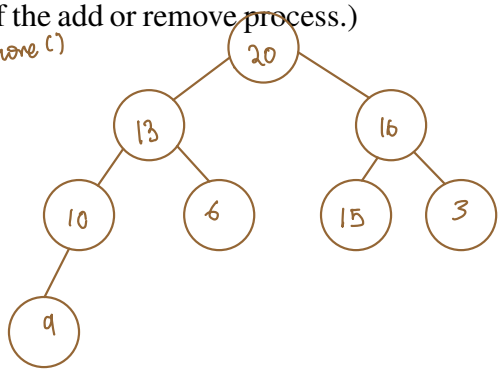
(c) `remove()`

(d) `add(22)`

a).



b) remove()



3. In class we wrote code for the `add` and `siftUp` methods for the array-based heap implementation. Write code (in Java) for the corresponding `remove` and `siftDown` methods.

2 Submit your work

Submit your work via Gradescope.

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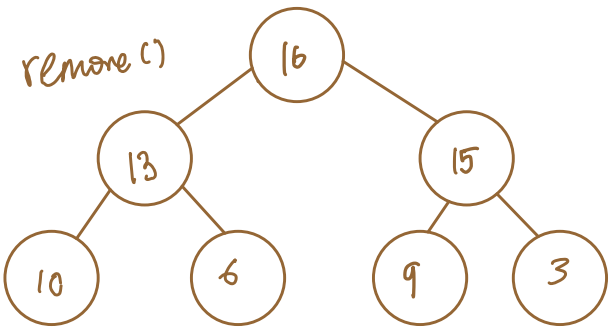
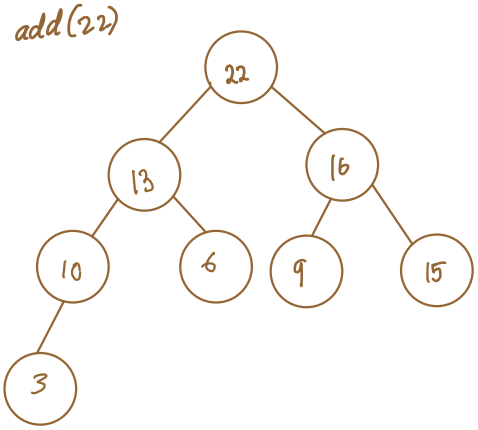
c)



d) add(22)



```
Public void remove (int x) {
    numElts --;
    int x = data [0];
    data [0] = data [numElts];
    siftDown (0);
}

Public void siftDown (int pos) {
    int x = data [pos];
    int index;
    while (pos < length/2) {
        int left = 2 * pos + 1;
        int right = 2 * pos + 2;
        if (right < numElts && data [left] < data [right]) {
            index = right;
        }
        else {
            index = left;
        }
        if (data [pos] < data [index]) {
            return;
        }
        int temp = data [index];
        data [index] = data [pos];
        data [pos] = temp;
        siftDown (index);
    }
}
```