CSI 2110 Computer Science Fall 2016 University of Ottawa

Assignment #3 Solution

1. See hand-drawing page.

2.

a. Original heap, then results of downheap for positions 3, 2, 1, 0:

0	1	2	3	4	5	6	7	8
5	3	17	10	84	19	6	22	9
5	3	17	22	84	19	6	10	9
5	3	19	22	84	17	6	10	9
5	84	19	22	3	17	6	10	9
84	22	19	10	3	17	6	5	9

b. Steps of heapsort:

0	1	2	3	4	5	6	7	8
84	22	19	10	3	17	6	5	9
22	10	19	9	3	17	6	5	84
19	10	17	9	3	5	6	22	84
17	10	6	9	3	5	19	22	84
10	9	6	5	3	17	19	22	84
9	5	6	3	10	17	19	22	84
6	5	3	9	10	17	19	22	84
5	3	6	9	10	17	19	22	84
3	5	6	9	10	17	19	22	84

c.

0	1	2	3	4	5	6	7	8
5								
5	3							
17	3	5						
17	10	5	3					
84	17	5	3	10				
84	17	19	3	10	5			
84	17	19	3	10	5	6		
84	22	19	17	10	5	6	3	
84	22	19	17	10	5	6	3	9

3. See hand-drawing page.

4. See hand-drawing page.

5. See hand-drawing page.

```
int calculateHeight(Node p) {
        if (p== null) return -1;
        hmax=   calculateHeight(p.leftChild());
        h2 = calculateHeight(p.rightChild());
        if  (h2>hmax) hmax=h2;
        return hmax+1;
}
```

6.

(a) 3^i

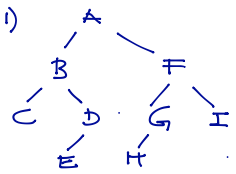
(b) 13

(c) 1+3+…+3^i+…+3^h= (3^(h+1)-1)/2

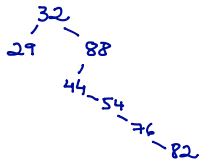
(d) For minimum number of node there are several possible solutions, we have: at level 0 there will be 1 node; at level 1 there will be 3 nodes, at level 2 there will be 3 nodes (all these 3 nodes will be kids of one same node in level 1). For the maximum number of nodes there will be 1 node at level 0, there will be 3 nodes and at level 1, there will be 9 nodes at level 2 (each 3 connected to one parent on level 1).

(e) Minimum: n=1+3*h; Maximum: same answer as c, that is n=(3^(h+1)-1)/2.

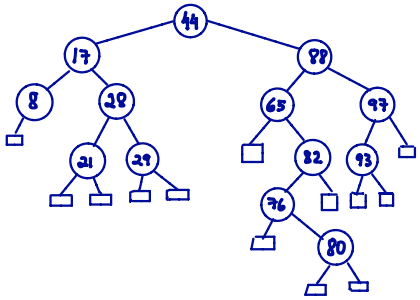
1)


A
B
F
C
D
G
I
E
H

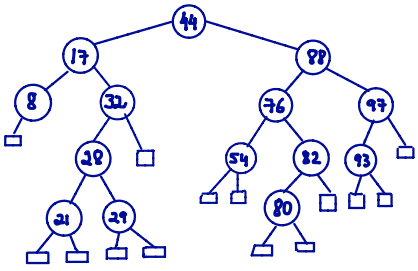
3)


32
29
88
44
54
76
82

4a)


44
17
88
8
28
65
97
21
29
82
93
76
80

4b)


44
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