Workshop 7 – Week 8 – Worksheet 8

Question 8.1 Construct a max binary heap from the following keys. Insert the items one-at-a-time, ~~where Z is the maximum, and A is the minimum~~:

[Old Problem: H G P J E M E K O L A Q]

8 7 16 10 5 13 5 11 15 12 1 17

1. Construct a max binary heap using the top-down approach.

8

8											

To Insert: 7 16 10 5 13 5 11 15 12 1 17

--

8
7

8	7										

To Insert: 16 10 5 13 5 11 15 12 1 17

--

16
7 8

16	7	8									

To Insert: 10 5 13 5 11 15 12 1 17

--

16
10 8
7

16	10	8	7								

To Insert: 5 13 5 11 15 12 1 17

--

16
10 8
7 5

16	10	8	7	5							

To Insert: 13 5 11 15 12 1 17

--

16

10 13

7 5 8

16	10	13	7	5	8						

To Insert: 5 11 15 12 1 17

--

16

10 13

7 5 8 5

16	10	13	7	5	8	5					

To Insert: 11 15 12 1 17

--

16

11 13

10 5 8 5

7

16	11	13	10	5	8	5	7				

To Insert: 15 12 1 17

--

16

15 13

11 5 8 5

7 10

16	15	13	11	5	8	5	7	10			

To Insert: 12 1 17

--

16

15 13

11 12 8 5

7 10 5

16	15	13	11	12	8	5	7	10	5		

To Insert: 1 17

--

16

15 13

11 12 8 5

7 10 5 1

16	15	13	11	12	8	5	7	10	5	1	

To Insert: 17

--

17

15 16

11 12 13 5

7 10 5 1 8

17	15	16	11	12	13	5	7	10	5	1	8

Done.

2. Now construct a max binary heap from the same keys, using the bottom-up “heapify” method.

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8 7 16 10 5 13 5 11 15 12 1 17

8

7 16

10 5 13 5

11 15 12 1 17

8	7	16	10	5	13	5	11	15	12	1	17

First we start from the bottom level, both 11 and its children and 15 and its children are proper heaps.

8

7 16

10 5 13 5

11 15 12 1 17

10 < 11, 11 < 15 so

8

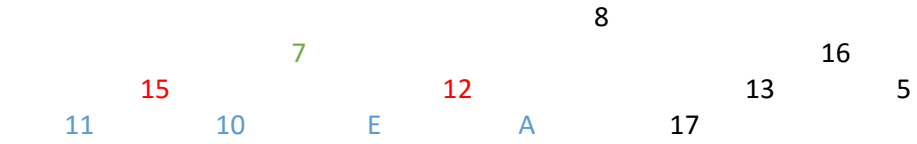
7 16

15 5 13 5

11 10 12 1 17

15 and its children is a proper heap. Repeating the same process for E and its children;

For G,



So,

For P,

So finally for H,

And finally after the last downheap

17	15	16	11	12	13	5	7	10	5	1	8

3. What is the complexity of each method? Did the time it took you to do the exercise on paper correlate (roughly) with the theoretical complexity?

Method 1: $O(n \log n)$

Method 2: $O(n)$