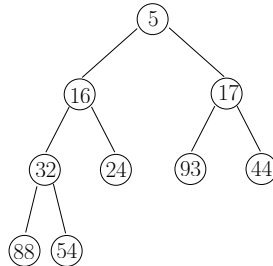


## CSCI2100: Special Exercise Set 8

Prepared by Yufei Tao

**Problem 1.** Show the priority queue after inserting the number 3 into the binary heap below:



**Problem 2.** Show the priority queue after performing a delete-min on the binary heap shown in the above figure.

**Problem 3.** Show the binary heap after inserting the following integers (in this order): 10, 9, 8, 7, 6, 5, 4, 3, 2, and 1 (you should use the regular insertion algorithm).

**Problem 4.** Let  $S$  be a dynamic set of integers. At the beginning,  $S$  is empty. Then, new integers are added to it one by one, but never deleted. Let  $k$  be a fixed integer. Describe an algorithm to maintain the  $k$  largest integers in  $S$ . Your algorithm must use  $O(k)$  space at all times, no matter how large  $|S|$  is (note that  $|S|$  increases continuously, but your space cannot). Furthermore, it must process every integer insertion in  $O(\log k)$  time.

For example, suppose that  $k = 3$ , and that the sequence of integers inserted is 83, 21, 66, 5, 24, 76, 92, 32, 43... Your algorithm must be keeping  $\{83, 66, 24\}$  after the insertion of 24,  $\{83, 66, 76\}$  after the insertion of 76, and  $\{83, 76, 92\}$  after the insertion of 43.