

University of Houston

COSC 3320: Algorithms and Data Structures
Spring 2016

Homework 5

Due March 31, at the start of class

1. (a) Construct a heap containing the following values, inserted one after the other:

9, 20, 8, 17, 4, 11, 2, 1, 6, 12, 5, 10, 7, 3, 18, 13.

You are to draw the final heap, both as a binary tree and as in its standard array implementation.

- (b) Give a (small) example of two distinct permutations of the same set of values such that the two heaps constructed by inserting one value after the other are different.
2. Given a heap H and a value k , we wish to return all the values in H which are at most k . Let n be the size of H , and m , with $0 \leq m \leq n$, be the number of values to be returned. (Notice that m is unknown at the beginning of the algorithm.)
- (a) Design a simple algorithm of complexity $O(1 + m \log n)$.
- (b) Design an improved algorithm with complexity $O(1 + m)$. (Hint: you should not modify the heap. Rather, you should work directly on the array implementation of H .)
3. (a) Insert the following keys into an initially empty hash table of 11 slots, numbered 0 through 10, using the hash function $h(k) = (3k+5) \bmod 11$ and assuming collisions are handled by linear probing:

13, 8, 33, 2, 20, 7, 15, 42, 9.

You are to draw the final hash table.

- (b) Same as before, but assuming collisions are handled by quadratic probing.
- (c) Same as before, but assuming collisions are handled by double hashing using the secondary hash function $h'(k) = 7 - (k \bmod 7)$.