Heaps Worksheet

1. What are the minimum and maximum number of elements in a heap of height h? Note: the height of a heap is the number of edges on the longest root-to-leaf path.
2. Where in a min-heap might the largest element reside, assuming that all elements are distinct?
3. Is an array that is in sorted order a min-heap?
4. Illustrate the operation of HEAP-INSERT (A, 7) on the heap (note: this is a min-heap):   
   A = {2, 5, 10, 6, 8, 100, 11, 9, 15, 9, 10, 200, 101}
5. Illustrate the operation of HEAPIFY(A, 1) on   
   A = {20, 5, 10, 6, 8, 100, 11, 9, 15, 9, 10, 200, 101, 12}
6. What is the running time of Heapsort on an array of length n that is already sorted in increasing order?
7. What about decreasing order?
8. How would you implement a function that searches for a given element in a heap, and how long would it take in the worst case?
9. Develop an algorithm that computes the kth smallest element in a set of n distinct integers in O(n + k lg n) time.

(From: <https://www.bowdoin.edu/~ltoma/teaching/cs231/fall16/Lectures/03-heaps/ex-heaps.pdf>)