1) Sort the following sequence using heap sort.

22 80 18 9 90 12 22 57 86 36 32 88 20 6 62 22

Show each heap before extracting the maximum.

2) You wish to store a set of \( n \) numbers in either a max-heap or a sorted array. For each application below, state which data structure is better, or if it does not matter. Explain your answers.
(a) Want to find the maximum element quickly.
(b) Want to be able to delete an element quickly.
(c) Want to be able to form the structure quickly.
(d) Want to find the minimum element quickly.

3) Describe an algorithm which deletes an item with index \( i \) from an \( n \)-element max-heap. Your algorithm should run in \( O(\log n) \) time.

4) Show how to implement a first-in, first-out queue with a priority queue. Show how to implement a stack with a priority queue.

5) Give an \( O(n \log k) \) time algorithm to merge \( k \) sorted lists into one sorted list, where \( n \) is the total number of elements in all the input lists.

6) You have given a max-heap with \( n \) elements. Give an algorithm to find the \( k \) largest elements. You are allowed to destroy the heap. How fast is your algorithm?

References