Assignment 2

October 8, 2020

Deadline:-19/October/2020 11:59 PM IST

1 Theory

1. Suppose an array A consists of n elements, each of which is red, white, or blue. We seek to sort the elements so that all the reds come before all the whites, which come before all the blues The only operation permitted on the keys are

   • Examine(A, i) – report the color of the i^{th} element of A.

   • Swap(A, i, j) – swap the ith element of A with the j^{th} element. Find a correct and efficient algorithm for red-white-blue sorting. Hint:- There is a linear time solution. 4

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 arbitrary element quickly.

   (c) Want to be able to form the structure quickly.

   (d) Want to find the minimum element quickly. 4

3. Mr. B. C. Dull claims to have developed a new data structure for priority queues that supports the operations Insert, Maximum, and Extract-Max—all in $O(1)$ worst- case time. Prove that he is mistaken. 2

4. Show how to construct the min-heap in $O(n)$ time. In other words, show how an arbitrary array can be transformed to make sure that it satisfies the min-heap property in $O(n)$ time. 4

5. Show how to sort n integers in the range 0 to $n^3 - 1$ in $O(n)$ time. 2