Assignment 2

October 17, 2020

Deadline:-28/October/2020 11:59 PM IST

1 Theory

1. Show how to implement the following operations on a airport billboard in $O(1)$ time.

   - Insert an arrival of a plane at the beginning of the billboard.
   - Insert an arrival of a plane at the end of the billboard.
   - Insert an arrival at the median location of a billboard.
   - Delete second last element at the end of the billboard.

   4

2. Calculate the exact (not asymptotic) running time of the Median of Medians algorithm if we make one minor tweak. Instead of groups of size 5, we shall use groups of size 7. Assume that there exists a blackbox which sorts 7 elements using 14 comparisons. 4

3. Compute the asymptotic running time of the Median of Medians algorithm, if we use groups of size 3. 2

4. Show a simple way to compute the $\sqrt{n}$ smallest element among n elements in $O(n)$ deterministic time, without using the Median of Medians algorithm. 2

5. Given a Median finding blackbox algorithm which finds the median of n elements in $O(n)$ time, show how one can use that blackbox to sort n elements in $O(n \log n)$ time. 4