

Design and Analysis of Algorithms

Question #1:

You are given an array A of n positive integer numbers. All the numbers in A are in the range $[10, 10n]$ except for 10 numbers. Can you design an algorithm to sort the array A in $O(n)$ time?

Question #2:

Let I_1, \dots, I_n be n intervals, where interval I_i is defined by set $[a_i, b_i]$, i.e., starting from a_i and ending at b_i . The interval scheduling problem asks to find a maximum number of disjoint intervals that do not overlap with each other (for example, if four intervals are given as $I_1 = [1, 2]$, $I_2 = [2, 3]$, $I_3 = [1, 4]$, $I_4 = [4, 5]$, then the solution is $\{I_1, I_2, I_4\}$). Can you design a linear time greedy algorithm to solve the interval scheduling problem? You can ignore the running time of your algorithm in the pre-processing phase.

Question #3:

The input consists of a directed graph, encoded in the usual adjacency list representation, along with two distinguished vertices s and t . Design and analyze a linear time algorithm to decide whether or not there is a path from s to t that contains a cycle.