Problems for the Today [23-08-2024]

1. You are given an array of n numbers. You have to find the indices i and j such that sum of the numbers from A[i] to A[j] has the maximum value. Assume that some values are negative in the array. Solve the problem by Brute-force and analyze the time complexity of the algorithm. Design a Divide and conquer algorithm to solve the problem. Analyze the time complexity of the algorithm. Time complexities can be mentioned as a comment in your program. Implement both the algorithms and measure the running time of your programs.

   Example:

   For the array of values [−2, 1, −3, 4, −1, 2, 1, −5, 4], the contiguous subarray with the largest sum is [4, −1, 2, 1], with sum 6.

2. Given a binary string S of type $\{1^m0^n\}$, devise an algorithm that finds the number of zeroes in O(log k) time. Let m + n = k. Implement the algorithm.

3. Given a series of line segment, $l_i = (x_i , y_i)$ where x_i is the start point and y_i is the end point and i ranges from 1, 2, 3, · · · , n, find the number of pairs i, j such that i > j and l_j completely contains l_i. For example, j = 1, i = 3, l_1 = (2, 10) and l_3 = (3, 5). Here, i > j and l_j completely contains l_i . Devise an efficient algorithm for this problem, better than $O(n^2)$ and implement it.

INSTRUCTIONS:

- All the programs should be stored in a folder by the name " YOUR ROLL NUMBER_DATE" (All letters in the roll number should be in caps). The Folder should be zipped before uploading.
- It should be uploaded through Moodle.
- The test cases (if any) are provided along with the problems.