JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2024

B.Tech-II Semester (CSE)

COURSE CODE (CREDITS): 18B11CI412 (3) MAX. MARKS: 25

COURSE NAME: Design & Analysis of Algorithms

COURSE INSTRUCTORS: YGL. AKJ, ARV, DHA MAX. TIME: 1.5 Hour

Note: (a) All questions are compulsory.
(b)Marks are indicated against each question in square brackets.
(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

Q.1 [CO3] Suppose, an array of items is given as

2 -6 -1 3 -1 2 2 (6)

Your task is to design the brute force algorithm for finding the maximum possible contiguous subarrays. Also explain the each step of the algorithm using the aforementioned array.

Q.2 [CO4] Inversion Count for an array indicates – how far (or close) the array is from being sorted. If the array is already sorted, then the inversion count is 0, but if the array is sorted in reverse order, the inversion count is the maximum. Given an array of integers, an inversion occurs if there are two elements at indices i and j such that i < j but arr[i] > arr[j]. Design an algorithm to Count the total number of inversions in the array using a divide-and-conquer approach. (Hint: Use MergeSort) (6)

Examples:

Input: arr[] = {8, 4, 2, 1} ; Output: 6
Explanation: Given array has six inversions: (8, 4), (4, 2), (8, 2), (8, 1), (4, 1), (2, 1).

Input: arr[] = {1, 20, 6, 4, 5} ; Output: 5
Explanation: Given array has five inversions: (20, 6), (20, 4), (20, 5), (6, 4), (6, 5).

Q.3 [CO3] Suppose that you have given a chain of four matrics M1, M2, M3 and M4 with p0=5, p1=4, p2=6, p3=2 and p4=7. Find out how many minimum multiplication you need to multiply these matrices with dynamic programming. (6)

Q.4 [CO3] Consider prices & taxes of items (divisible) that are given as Items (1, 2, 3, 4), Price (10, 7, 4, 2) and Tax (60, 28, 20, 24). Note that there is only one unit of each item. The task is to pick a subset of these items such that the sum of their prices becomes 19. The objective of the problem is to minimize the total tax (Sum of tax of all the chosen items). Items can be split into fractions. The total tax of items picked by the most optimal greedy algorithm is denoted by Tax_{greedy}. Trace the steps for the greedy approach giving the optimal solution and find out the value of Tax_{greedy}. Give the pseudo code of the greedy algorithm used to solve the above problem. Perform the time complexity analysis of the greedy algorithm used to solve the above fractional problem. (7)