

CS207-ALGORITHMS LAB

Lab 4

NOTE:

- This lab is to be completed individually. Do not share your work or code with anyone else.
 - You can use any programming language that you like; we suggest Python, C++, or C.
 - For all of our labs, please avoid using Google to find suggestions or solutions. The goal is to use your own brain to work these problems out, which will help you develop the skills to do well in the exams and, more importantly, become a substantially better computer programmer.
 - Save your work in your N-drive.
 - You have to make lab report in hard copy.
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Problem 4.1: Sort a given set of elements using Merge sort method and determine the time required to sort the elements. Repeat the experiment for different values of n , the number of elements in the list to be sorted and plot a graph of the time taken versus n .

Problem 4.2: Given an array S of unsorted elements. Design an algorithm and implement that to find a pair x, y such that $x \neq y$ from S that minimizes $|x-y|$. The worst case running time of the algorithm should be $O(n \lg n)$.

Instruction: - Solve the above problem with the help of following example

Given Array is: $S = \{4, 15, 8, 1, 19, 0, 12\}$, the output should be 0 and 1.

Problem 4.3: Given two arrays A_1, A_2 of size n and a number x , design an algorithm to find whether there exists a pair of elements one from A_1 and other from A_2 whose sum is equal to x . Also find the indices of those elements

Instruction: - Solve the above problem with the help of following example

Given Arrays are $A_1 = \{4, 5, 8, 1, 3, 9, 0, 2\}$ and $A_2 = \{2, 3, 35, 32, 12, 9, 2\}$ and $x = 41$

The output should be yes with $i_1=5$ and $i_2=3$.

For $x=25$, the output should be no.

Problem 4.4: Develop an algorithm to solve the maximum segment sum problem.

Instruction: - Solve the above problem with the help of following example

Let $A[0, \dots, n-1]$ be a given array of real numbers (positive and negative). For given $0 \leq i \leq n-1$ and $0 \leq j \leq n-1$, segment sum is defined as follows:

Segment sum $(i, j) = A[i] + A[i+1] + \dots + A[j]$, if $i \leq j$.

The problem is to find the maximum value of segment sum over all i and j . Also find the value of i and j for which segment sum is maximum

Given Array is $A = \{4, -5, 8, -1, 3, -4.2, 0, 2\}$;

The maximum segment sum for this array is 10.

The corresponding value for i and j are 2 and 4 respectively.