

Spring'22 PDS Lab Test-2

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2nd June 2022

Question-1

User supplies an integer n in $[1; 20]$ and a list of n integers. Store the list in a 1D array. Find the sub-array/sub-arrays of contiguous elements in the array having the largest sum. Print the largest sum and the corresponding sub-array/sub-arrays. Write suitable functions.

Example 1:

```
Enter n: 5
Enter elements: 12 -15 9 -2 5
Largest sum = 12
Sub-arrays = 12 OR 9 -2 5
```

Example 2:

```
Enter n: 5
Enter elements: 12 -5 9 -2 5
Largest sum = 19
Sub-arrays = 12 -5 9 -2 5
```

Question-2

Consider a sequence $S = \{S_1, S_2, \dots, S_n\}$. Suppose for any index i ($1 \leq i \leq n$), if an element S_i is divisible by S_k (where k is a valid index of S , and $k < i$), then the *Alpha value* of the element S_i is the number of such indices k . Our goal is to find the *maximum Alpha value* in a given sequence.

For example, let a given sequence is $S = [8, 1, 28, 4, 2, 6, 7]$. Then the maximum Alpha value of the sequence is 3. Since $S_5 = 2$ divides 4, 28 and 8, so the Alpha value of S_5 is 3. There is no element with a higher Alpha value.

Your task is to take the sequence S as user input in an array, and write a function `int maxAlphaValue(int[] S)` which takes S as input argument, and returns the maximum Alpha value as an integer.

Example 1:

```
Enter array s[]: 1 3 12 6 16 22 2 4
Output: 4
```

Example 2:

```
Enter array s[]: 5 3 11 6 14 9 10 21 7 41 53
Output: 2
```

Question-3

IIT Kgp coding club is planning to form m number of teams for the next techno-management symposium *Kshitij*. There are n number of students who have been shortlisted to be considered in forming the teams. These students have passed an IQ exam where they have received an integer score that represents the IQ of the student. For each team, the total IQ is considered as simply the sum of the IQs of its members. Our goal is to find the minimum possible difference between the team with the maximum total IQ and the team with the minimum total IQ. The condition is that, every student will have

to be placed in a team, and each team must have at least one student.

Assume that the student IQs are supplied as an array, and the number of teams is supplied as an integer. For example, let there are 7 students whose IQs are represented in the array $n = [1, 2, 3, 4, 5, 6, 7]$, and we want to form $m = 3$ teams from them. In this case, the minimum difference possible between the team with the maximum total IQ and the team with the minimum total IQ is 1. Your program does not need to show what the members of each team are but, in this example, the minimum possible difference is created by having 2 teams with a total IQ of 9 and 1 team with 10. (min 9, max 10). There are multiple ways of doing this with these values, one of which is:

Team 1: $1 + 3 + 6 = 10$

Team 2: $2 + 7 = 9$

Team 3: $4 + 5 = 9$

You have to write a **recursive function** `int minTotalIqDiff(int m, int[] n)` that takes the number of teams to be formed as an integer m , and an array `n[]` that stores the IQ score of the students (take these as user inputs). The function should return the minimum possible difference as an integer value.

Example 1:

Enter array `n[]`: 5 1 4 10 6 9

Enter m : 2

Output: 1

Example:

Enter array `n[]`: 5 1 7 13 4 3 3

Enter m : 3

Output: 2

Question-4

Declare a structure named “Student” that contains the following components: name (string), gender (string – boy or girl), and marks (floating-point number). Create a 1D array of structure “Student” of size MAX (keep MAX as a macro using `#define` or as a constant integer) to store student records in a class. Next, take the number of students n as input and then populate the array with student data from the user. Next, print all the student records from the array. Write suitable functions to accomplish those tasks.

Now write another function to find and print the best girl student (one with highest marks) in the class. Assume that each student is unique in your input.

[No `string.h` library functions are allowed]

Example:

Enter the number of students: 6

Enter the student details:

arnab dey boy 67.00

chaiti rao girl 71.50

manas singh boy 81.00

rini sen girl 94.5

namita pandey girl 91.00

suvro pal boy 87

Printing the student records..

arnab dey boy - 67.00

chaiti rao girl - 71.50

manas singh boy - 81.00

rini sen girl 94.5

namita pandey girl - 91.00

suvro pal boy 87

Best girl student: rini sen