Marks: 30

Time: 2.5 Hrs.

[Answer any three of the following four questions. Fastest algorithm will get more points]

Problem-1:

Count the number of unique prime factors of a positive integer $N \leq 10^2$.

Any integer N can be decomposed as products of prime factors and their powers:

$$N = p_1^{i_1} p_2^{i_2} \dots p_n^{i_n}$$

Where p_j are prime numbers and i_k are their powers, for $j, k = 1 \dots n$

Input Format: Your program should get one positive integer N.

Output Format: Print the number of unique factors of N

Sample Input: 20

Sample Output: 2

Explanation: The number 20 can be factorized as the following:

$$20 = 2 \times 5 \times 5$$

As its clear that the factorization has only two unique factors.

Problem-2:

Suppose that you are working at an event management company and you have been sent to a school to arrange a class party. In that class you have n students. The class teacher asked you to group all those n students in such a way that no two students in a group has age difference more that D years. The class teacher also asked you to minimize the number of such groups, as more groups would require more teachers to monitor.

Input Format: Your program should first get two integers n, D i.e. the number of students in the class and maximum allowable age difference. After that your

program should get n real numbers(floating points) denoting the ages of the students.

Output Format: Print the minimum number of groups require on a single line followed by the age of the students, arranged in those groups.

Sample Input:

8

5

20 34 31 28 26 18 15 30

Sample Output:

2

Group 1: 15 18 20

Group 2: 26 28 30 31

Group 3: 34

Constraint: Your algorithm must run in $O(n \lg n)$.

Problem-3:

You are given m array of size n. Compute the maximum subarray sum of each of those m arrays and print the array whose maximum subarray's length is smallest. In case of tie, chose the one with largest maximum subarray sum.

Input Format: The first line of integer contains the number m and n. The following m line will have n space separated integers.

Output Format: On a single line, print the desired array that matches the constraints described in the problem's statement.

Sample Input:

3

4

-1 4 5 -6

5 1 2 1

-4 5 -1 7

Sample Output:

-1 4 5 -6

Constraint: Your algorithm should run in $O(mn \lg n)$

Problem-4:

You are designing a scheduler for an operating system. The job of a scheduler is to schedule programs that wants to run on the CPU. The scheduler has n process, and each process i has a start time s_i and a finish time f_i, for $i = 1 \ldots n$. But the CPU has a limited amount of free time $T < \infty$ in seconds. Design and implement an algorithm that will chose a subset of processes and print their index, such that no chosen processes overlaps. Your algorithms must try to choose as many such non overlapping processes as possible.

Input Format: The first line will have two integers n (number of processes). The following n lines would have two number s_i, f_i.

Output Format: Print the indexes of process that your algorithms chose, making sure that they did not overlap.

Sample Input:

[GENERATE YOUR OWN INPUT]

Sample Output:

[GENERATE YOUR OWN OUTPUT]