Presentation of solutions

Maghreb Coding Contest
AIAC School
March, 31, 2019

Judges

Abdelaziz Eroui : Morocco

Adam benali : France

Mehdi Cheracher : Morocco

Mortadha Touzi : Tunisia

Mouad Naciri : United Kingdom

Problem J : Aviation alphabet

Problem author : Moncef MHASNI

Solution : Just output the first character of each string

Complexity : O(N)

Problem C : Security check

Problem author : Mouad Naciri

Solution : Count the number of distinct characters in the second string, if there is less characters in first string the answer is NO.

Complexity : O(|A| + |B|)

Problem K: Combination Lock

Problem author : Adam Benali

Solution :

Iterate over digits, for each digit i compute the number of rotations needed to turn this digit to one, let this be x(i).

Compare x(i) to x(i-1), if the later is larger there is no need to rotate digit i. update x(i) after each iteration.

Complexity : O(N)

Problem H : Humpty-bump

Problem author : Mortadha Touzi

Solution : Compare the prime factors of both numbers, if the exponent of a prime factor in the denominator is greater than it's exponent in the numerator the answer is NO.

Complexity : $O(N^2 \log(N))$, can be improved if you use Legendre's formula

Problem D : Scrappy

Problem author : Mouad Naciri

Solution : Sort the airline companies by the first value, then find the longest increasing subsequence in N.log(N) (using a set for example)

Complexity : O(N.log(N))

Problem A : Dragon ball

Problem author : Moncef MHASNI

Solution :

Find the first and the last characters in two queries

Find each one of the other characters in one query

Judge solution worst case number of queries : N+2

Problem I : Runway

Problem author : Moncef MHASNI

Solution : find optimal h for each sliding window of size k using ternary search.

Complexity : O(N.K.log(h))

Problem G : Houda and flight seats

Problem author : Mehdi Cheracher

Solution :

You should notice that the numbers generating the maximum set of numbers in harmony is the sequence {1} + {primes smaller or equal than N}

So after finding the sequence, on can check all arrangements using a TSP like dynamic programming that computes the minimum required value.

The maximum size of the set cannot be greater than 15

Complexity $O(M.2^M)$

Problem B : ZigZag Numbers

Problem author : Badry Atef

Solution :

Let F(i, x) be the number of zigzag numbers of I digits ending with x.

F(i+2,d) = sum F(i,x)*min(x,d+1)

Solve the recurrence using matrix exponentiation

Problem E : Pipelines

Problem author : Moncef MHASNI

Solution :

First, note that you cannot find a set larger than the diameter of the tree, so set **k = min(k, diameter)**

Start with a centroid decomposition of the input tree, then for each subtree rooted at each children of a centroid **c** build a local **map<no of edges to c, distance to c>** then update the global map : minimum length of the path containing c, with exactly k edges.

Output the minimum of the global map

Complexity : O(N log(N) Log(N))

Problem F : Weather report

Problem author : Moncef MHASNI

Solution :

First build the convex hull containing the set of points using graham scan for example.

After that run rotating calipers : for each edge of the convex hull, find the equilateral triangle enclosing the polygon.

The minimum area enclosing triangle MUST share at least one edge with the polygon (Klee and Laskowski, 1985)

Complexity : O(N.log N))