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Problem Analysis

Take-Off Programming Contest Fall-23 [Preliminary - A Slot]

Problem Setters

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Reviewers

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Judges

Ahsanul Haque Nahid
Kh Sadman Sakib

Contest Links

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Problem A: ICPC

Category: Giveaway
Setter: Eiamin Hassan
Special Thanks: Sourav Halder

Observation:
Have a close look at a sentence that is bold.

Solution Idea:
Just print the ICPC full form without any quotation sign and a new line after the output.

Problem B: SOMETHING ODD!

Category: Basic Math
Setter: Sourav Halder
Special Thanks: Mahir Hasan Sifat, Anamika Hossain Lily
Alternate: Anamika Hossain

Solution Idea:
This problem is a basic geometry problem. All you need to do is find the height of the triangle. Here, the base and area are given as **A** and **B**. We know the formula of the area of a triangle is $\frac{1}{2}$ * base * height.

So, formulate this as A = $\frac{1}{2}$ * B * H **(Here H is denoting the height of the triangle)**

The height of the triangle will be, H = $\frac{2 * A}{B}$

Problem C: Before Mathforces

Category: Conditional Statement / If-else
Setter: Kh Sadman Sakib
Special Thanks: Ahsanul Huque Nahid

Solution Idea:

To get the remainder of a number when divided by 3, we can simply use the modulo (%) operator. If the remainder is R when divided by 3, we can say, R = N%3. Then we have to check if the result R is 0, 1 or 2 and print the corresponding problem category mentioned in the statement. One thing to be cautious about is the range of N is 1 to 1e18. Which means we cannot use the integer datatype “int” (which can only store till 2^32), we must have to use “long long” or “long long int” in order to pass all the test cases.

Problem D: Selected?

Category: Nested If-else
Setter: Anamika Hossain
Alternate: Sourav Halder

Solution Idea:
In this problem, we have to find out if Drake's team can attend the ICPC regional contest. So, to find that out we can follow the below steps:

- Count the number of teams solving at least 1 problem
- If the count is greater than 2 and N is greater than 1, then print Yes.
- Or else if N is equal to 3, then print Yes.
- Otherwise, print No.

Problem E: The Time Trial Challenge

Category: Loop + Conditional Statement
Setter: Farhin Khaled
Alternate: Samia Haque

Solution Idea:
If there are no obstacles in the way then the time taken for players to reach the end of each path is N seconds, as there are N points and each point takes 1 sec. Now, if a player faces an obstacle at point X, such that X is odd then it will take them back 2 steps, costing 2 more seconds, meaning reaching the end now will take N+2 seconds. And if X is even, then it will take N+1 seconds. So we need the sum of all the extra time that was caused by the points in which

an obstacle was found, then if we add the sum to N, we get the total time taken by a player to reach the end. Finally we need to check who took less time and declare the winner, otherwise say it's a draw.

Problem F: Consonant Chronicles

Category: Implementation + Array + String
Setter: Samia Haque
Special Thanks: Sabbir Ahmed Mridha

Solution Idea:
The idea is to first retrieve the string (secret message) by navigating through the 2D array that is provided. To implement this one needs the knowledge of 2D arrays and iterating through it, also make sure that we ignore the characters that are vowels while doing this. Once we get the "secret message" string then we need to print it and then find out if any of its subsequence matches with the string that is given in the query.

Note that, a subsequence of a string is a new string that is formed from the original string by deleting some (can be none) of the characters without disturbing the relative positions of the remaining characters. (i.e. "ace" is a subsequence of "abcde", while "aec" is not).

Problem G: MAGIC PRIME

Category: Number Theory
Setter: Masum Billah
Special Thanks: Saiful Islam Ramim

Solution Idea:

First Part: Finding the Number Modulo MOD

To obtain the number modulo MOD, we can employ binary exponentiation and apply the formula:

$$(a \times b) \bmod m = ((a \bmod m) \times (b \bmod m)) \bmod m$$

This enables us to efficiently compute the result in the modulo operation.

Second Part: Determining the Parity of the Number of Divisors

To ascertain the parity of the number of divisors, we can exploit the fact that a number with an odd number of divisors is a perfect square. We achieve this by examining the prime factorization of the number. If the exponent of each prime factor is even, the number is a perfect square.

Third Part: Finding count of digits in the number of divisors.

We can find the number using the following formula:

The **number of factors** of a number n is

$$\tau(n) = \prod_{i=1}^{k} (\alpha_i + 1),$$

Where, $n = p_1^{\alpha_1} p_2^{\alpha_2} \cdots p_k^{\alpha_k}$,

And we know that a number has *log10(n) + 1* digits. And using the logarithmic property *log(a x b) = log(a) + log(b)* we can find the number of digits of the number.

For any kind of queries/complaints/feedback regarding the event, contest or problem set, please contact,

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