

# DIU Take Off Programming Contest, Summer 2018

## Problem Analysis

### Problem A: You shall not pass!

**Category:** Give-away

**Problem Setter:** Mehedi Imam Shafi

**Analysis:** Just copy and paste the given code in your program and then submit or just print “I still believe in heroes” and submit.

### Problem B: Census Taker Problem

**Category:** Simple math

**Problem Setter:** Muhaiminul Islam Jim

**Analysis:** Each snap of Thanos makes the population decreased by half. So he snaps twice, at first it will get decreased by half. Then after the second snap half of that population will again get decreased by half. That means only 1/4th of the population will remain alive. So, just divide the given number by 4 and this problem is solved.

### Problem C: Stupid Reality!

**Category:** Simple if/else if

**Problem Setter:** Mehedi Imam Shafi

**Alternate Writer:** Muhaiminul Islam Jim

**Analysis:** The thing you need to know is 60 seconds makes up a minute. So 2 and half minute is 150 seconds. Therefore anything more than 150 is real experience. And anything less than or equals to that is made up. Therefore the one line solution is to be

```
if (time > 150) printf("Yes\n");  
else printf("No\n");
```

## Problem D: Welcome to the dark side!

**Category:** Simple math

**Problem Setter:** Pranto Das

**Alternate Writer:** Muhaiminul Islam Jim

**Special Thanks:** Saiful Islam, Lecturer, CSE-DIU

**Analysis:** Here the value of A and B doesn't matter. Just check if  $C == D$  or not.

```
if (c == d)
    printf("YES\n");
else
    printf("NO\n");
```

## Problem E: Time Stone & Kolijar tukra

**Category:** Simple loop

**Problem Setter:** Mahmud Sajjad Abeer

**Alternate Writer:** Muhaiminul Islam Jim

**Analysis:** Let  $sum=0$ , run a loop  $i$  from  $x$  to  $y$  and add  $i$  to the sum as  $sum=sum+i$  and finally print sum.

## Problem F: Super Soccer

**Category:** String, Loop

**Problem Setter:** Debashish Saha Pranta

**Alternate Writer:** Mehedi Hasan

**Special Thanks:** Muhaiminul Islam Jim

**Analysis:** The only thing you need to remember is that you need to calculate the number of passes. Not number of players. A successful pass happens when the next player is also from same team. That is consecutive two characters are same.

That means **AA** is a **successful pass** for Team A and **BB** for Team B. Thus **AB** is a **wrong pass** so is **BA**.

If we run a loop from first to last of the given string (character array) we can check all the characters. Now to compare two consecutive ones we can go with two points at each iteration. Something like this would solve the problem.

```
for (i = 0; i < length-1; i++){ //since we will go two character at once we need
to stop the first one before the string ends else the later one will go outside
the length
    if (str[i] == 'A' && str[i+1] == 'A'){
        score_A ++;
    }
    else if (str[i] == 'B' && str[i+1] == 'B'){
        score_B ++;
    }
}
```

## Problem G: Nemesis

**Category:** Math

**Problem Setter:** Nesar Ahammed Jony

**Alternate Writer:** Pranto Das

**Special Thanks:** Muhaiminul Islam Jim

**Analysis:** Hope you already noticed that the constraint of this problem is strict. if you attempt the naive solution (Loop iteration from **A** to **B**) for this problem you will get TLE. Because we have **100** test cases and max value of **N** and **M** could be  $10^4$  and most importantly the maximum absolute difference of **A** and **B** could be  $(10^7 - 1)$ . Using simple maths if we calculate the time complexity for naive solution:  $100 * 10^4 * 10^7 = 10^{13}$ . But a CPU can execute at most  $10^8$  (approximately) instructions per second. So it is obvious that naive solution won't pass. Now I hope you already know that the sum of Arithmetic sequence like  $1+2+3+4+5+6+... + n$ th term can be calculated using this formula :  $n*(n+1)/2$

So what will be the sum of all numbers start from **A** and Ends with **B** ?

That is, the sum of all numbers from **1** to **B** ( $1+2+3+... +B$ ) - The Sum off all numbers from **1** to **A-1** ( $1+2+3+... +A-1$ )

So final formula will be:  $sum = ((B*(B+1))/2) - ((A-1)*A)/2$

You can also use the given formula also :

$$sum = n*(A+B)/2$$

Reference : <http://www.purplemath.com/modules/series4.htm>

## Problem H: Rescue the Avengers

**Category:** Maths

**Problem Setter:** Mehedi Hasan

**Alternate Writer:** Debashish saha Pranta

**Special Thanks:** Muhaiminul Islam Jim

**Analysis:** You may have notice that there was only 1 living avengers. So in the first day he can rescue one more avengers and then the count becomes 2. In the second day, now there is 2 living avengers, then another 2 avengers can be rescued, so count becomes 4. In the third day count becomes 8. In the fourth day count becomes 16. Now you can see the count is rising as a power of two (it gets doubled every day). So you can run a loop where  $i = 1$  and increment loop ( $i += i$  or  $i = 2 * i$ ) and where  $i < n$  and print the value of counter or (you can calculate  $2^x \geq n$  where  $x$  is the minimum number of required day )

## Problem I: Princess mAina (ময়না) and infinity gauntlet

**Category:** Stopper, Square root decomposition, Segment tree, Binary Indexed Tree

**Problem Setter:** Muhaiminul Islam Jim

**Alternate Writer:** Mahmud Sajjad Abeer

**Special Thanks:** Nesar Ahammed Jony, Pranto Das

**Analysis:** As there can be  $10^5$  queries at max and gauntlet size can also be of size  $10^5$ , naive solutions will lead into a “Time Limit Exceed” verdict. You have to optimize your solution a bit more. For that, you may use either of the techniques from Square root decomposition, segment tree or binary indexed tree.

**Judge & alternate solutions can be found here:**

<https://github.com/diu-take-off/Take-Off-Summer-2018>

**Chief Judge:-**

**Mohammad Mahmudur Rahman,**

Associate Professor(Adjunct), DIU

CEO and Founder, MuktoSoft and CodeMarshal

ACM ICPC World Finalist, 2007

Former Judge ACM ICPC

**Judges:** Muhaiminul Islam Jim, Pranto Das, Nesar Ahammed Jony.

**Special Thanks:** Prof. Syed Akhter Hossain, Mohammad Mahmudur Rahman, CodeMarshal, Department of Computer Science & Engineering, DIU Computer & Programming Club, Mahmud Sajjad Abeer.

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