

Worksheet 1

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Date of

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2023

Subject Name:Data Structure _____

1. Aim/Overview of the practical:

i) Kingdom Of Fire and Ice

There is a kingdom in land of fire and ice known as westros. The kingdom is ruled by mad king Amen Targareyan. Further more Westros is divided into two territories. One territory known as ice because it is always snowing and other Fire beacuse of volcano near by area. There is rebellion to overthrow the mad king to bring peace to Westros. There is a secret attack on red fort by rebellion force lead by Luke Skywalker. There is snitch in rebellion force. He trades the secret attack plan to mad king. However mad king has superpower to sense disturbance in the force. He sends out his best knights to scout the rebellion force. He got to know that rebel force outmatch city guards one to hundred. Moreover he came to know that Luke is last jedi who can detroy him.In order to win this battle against rebels, the mad king decided to use N common folks as soldiers. He select a bunch of people from a territory and train them .Now king can only select odd number of people from land of fire and from land of ice in one go. He cannot select bunch of people consecutively from either territory.In how may ways the mad king could assemble his army to battle against rebel forces ? Note: The number of people in each territory is infinte

ii) Chef has decided to go to a gold mine along with NN of his friends (thus, total $N+1N+1$ people including Chef go to the gold mine). The gold mine contains a total of XX kg of gold. Every person has the capacity of carrying up $\text{atmost } YY$ kg of gold. Will Chef and his friends together be able to carry up all the gold from the gold mine assuming that they can go to the mine exactly once.

iii) The game of billiards involves two players knocking 3 balls around on a green baize table. Well, there is more to it, but for our purposes this is sufficient. The game consists of several rounds and in each round both players obtain a score, based on how well they played. Once all the rounds have been played, the total score of each player is determined by adding up the scores in all the rounds and the player with the higher total score is declared the winner. The Siruseri Sports Club organises an annual billiards game where the top two players of Siruseri play against each other. The Manager of Siruseri Sports Club decided to add his own twist to the game by changing the rules for determining the winner. In his version, at the end of each round, the **cumulative score** for each player is calculated, and the leader and her current lead are found. Once all the rounds are over the player who had the maximum lead at the end of any round in the game is declared the winner.

Consider the following score sheet for a game with 5 rounds:

Round	Player 1	Player 2
1	140	82
2	89	134
3	90	110
4	112	106
5	88	90

The total scores of both players, the leader and the lead after each round for this game is given below:

Round	Player 1	Player 2	Leader	Lead
1	140	82	Player 1	58
2	229	216	Player 1	13
3	319	326	Player 2	7

4	431	432	Player 2	1
5	519	522	Player 2	3

Note that the above table contains the cumulative scores.

The winner of this game is Player 1 as he had the maximum lead (58 at the end of round 1) during the game.

Your task is to help the Manager find the winner and the winning lead. You may assume that the scores will be such that there will always be a single winner. That is, there are no ties.

- iv) Given an integer N , let us consider a triangle of numbers of N lines in which a number a_{11} appears in the first line, two numbers a_{21} and a_{22} appear in the second line, three numbers a_{31} , a_{32} and a_{33} appear in the third line, etc. In general, i numbers $a_{i1}, a_{i2}, \dots, a_{ii}$ appear in the i^{th} line for all $1 \leq i \leq N$. Develop a program that will compute the largest of the sums of numbers that appear on the paths starting from the top towards the base, so that:
- on each path the next number is located on the row below, more precisely either directly below or below and one place to the right.
- v) You are asked to calculate factorials of some small positive integers.

2. Steps for experiment/practical/Code:

i)

```
#include <stdio.h>

#include<inttypes.h>

void multiply(uint64_t F[2][2], uint64_t M[2][2],uint64_t k);

void power(uint64_t F[2][2], uint64_t n,uint64_t k);

uint64_t fib(uint64_t n,uint64_t k)
```

```
{
uint64_t F[2][2] = {{1,1},{1,0}};

if (n == 0)

    return 0;

power(F, n-1,k);

return F[0][0];

}

void power(uint64_t F[2][2], uint64_t n,uint64_t k)

{

    if( n == 0 || n == 1)

        return;

    uint64_t M[2][2] = {{1,1},{1,0}};

    power(F, n/2,k);

    multiply(F, F,k);

    if (n%2 != 0)

        multiply(F, M, k);

}

void multiply(uint64_t F[2][2], uint64_t M[2][2],uint64_t k)

{

    uint64_t x = (F[0][0]*M[0][0] + F[0][1]*M[1][0])%k;

    uint64_t y = (F[0][0]*M[0][1] + F[0][1]*M[1][1])%k;
```

```
uint64_t z = (F[1][0]*M[0][0] + F[1][1]*M[1][0])%k;
```

```
uint64_t w = (F[1][0]*M[0][1] + F[1][1]*M[1][1])%k;
```

```
F[0][0] = x;
```

```
F[0][1] = y;
```

```
F[1][0] = z;
```

```
F[1][1] = w;
```

```
}
```

```
int main()
```

```
{
```

```
uint64_t n,k,t;
```

```
scanf("%llu",&t);
```

```
while(t--)
```

```
{
```

```
    scanf("%llu",&n);
```

```
    scanf("%llu",&k);
```

```
    printf("%llu\n", (2*fib(n,k))%k);
```

```
}
```

```
return 0;
```

}

ii)

```
#include <iostream>
using namespace std;
```

```
int main() {
    // your code goes here
    int t;
    cin>>t;
    while(t-->0)
    {
        int n,x,y;
        cin>>n>>x>>y;
        if((n+1)*y>=x)
            cout<<"YES"<<endl;
        else
            cout<<"NO"<<endl;
    }
    return 0;
}
```

iii)

```
#include <iostream>
#include<climits>
using namespace std;
```

```
int main() {
    int n;
    cin>>n;
    int a1[n],a2[n],max1=INT_MIN,max2=INT_MIN,sum1=0,sum2=0;
    for(int i=0;i<n;i++){
        cin>>a1[i]>>a2[i];
        sum1+=a1[i],sum2+=a2[i];
        if(sum1>sum2){
            max1=max(max1,sum1-sum2);
        }
        if(sum1<sum2){
```

```
        max2=max(max2,sum2-sum1);
    }
}
if(max1>max2){
    cout<<1<<" "<<max1<<endl;
}
if(max2>max1){
    cout<<2<<" "<<max2<<endl;
}

    return 0;
}
```

iv)

```
#include<bits/stdc++.h>
using namespace std;
int main(){
    int i,j,t,n;
    cin>>t;
    while(t--){
        cin>>n;
        int a[n][n];
        for(int i=0;i<n;i++){
            for(j=0;j<=i;j++){
                cin>>a[i][j];
            }
        }
        for(int i=n-2;i>=0;i--){
            for(j=0;j<=i;j++){
                if((a[i][j]+a[i+1][j])>(a[i][j]+a[i+1][j+1]))
                    a[i][j]=a[i][j]+a[i+1][j];
                else
                    a[i][j]=a[i][j]+a[i+1][j+1];
            }
        }
        cout<<a[0][0]<<endl;
    }
    return 0;
}
```

v)

```
#include <bits/stdc++.h>
#include <boost/multiprecision/cpp_int.hpp>
#include <iostream>
using namespace std;
using namespace boost::multiprecision;

int main() {
    // your code goes here
    int t;
    cin>>t;
    while(t-->0)
    {
        int n;
        cin>>n;
        cpp_int fact=1;
        for(int i=n;i>0;i--)
            fact=fact*i;
        cout<<fact<<endl;
    }

    return 0;
}
```


3. Observations/Discussions/ Complexity Analysis:

i)

The screenshot displays the CodeChef interface for the 'Fire and Ice' problem. The page is divided into several sections:

- Problem Header:** 'Fire and Ice' with a difficulty rating of 'NA' and an 'Expand' button.
- Submissions Tab:** Shows 'Others' Submissions' and 'My Submissions'.
- My Submissions Table:**

ID	Result	Time	Mem	Lang	Date
84178082	✓	0.58s	5M	C++14	15 seconds ago
- Submission Details:**
 - Status:** ✓ Correct Answer (Submission ID: 84178082)
 - Time:** 0.58s
 - Sub-Task Table:**

Sub-Task	Task #	Result (time)
1	0	AC (0.324433)
- Buttons:** 'Upload code as file', 'Compile & Run', and 'Submit Code'.

ii)

Browser tabs: (1) WhatsApp, Gold Mining - Prob, Solution: 84132044, The Lead Game - P, Sums in a Triangle, Small factorials - P, +

Address bar: codechef.com/viewsolution/84132044

```
12     if((n+1)*y>=x)
13         cout<<"YES"<<endl;
14     else
15         cout<<"NO"<<endl;
16     }
17     return 0;
18 }
19
```

0:0

Subtask Info

Status: ✔ Correct Answer Submission ID: [84132044](#)

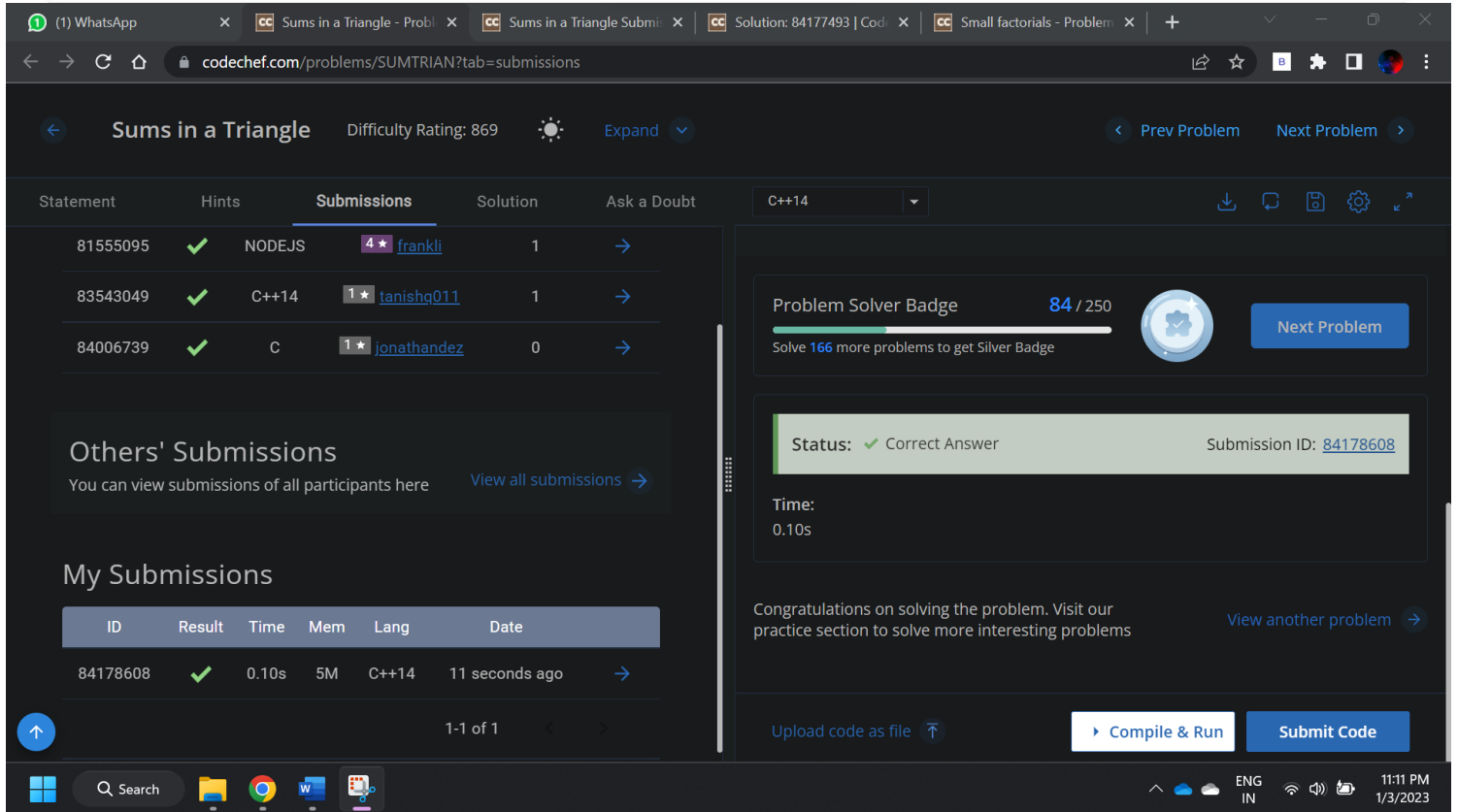
Score:	Time:	Memory:
100	0.01s	5.4M

Sub-Task	Task #	Result (time)
1	1	AC (0.003882)
1	2	AC (0.005587)
1	3	AC (0.005628)

Windows taskbar: Search, File Explorer, Chrome, Word, Task View, System tray: Network, Cloud, ENG IN, 11:07 PM 1/3/2023

iii)

iv)



The screenshot shows the CodeChef website interface for the problem "Sums in a Triangle". The page displays a list of submissions from other users, including their IDs, languages, and results. The "My Submissions" section shows a successful submission with ID 84178608. The right panel provides details about the submission, including the status "Correct Answer", the submission ID, and the time taken (0.10s). It also includes a progress bar for the "Problem Solver Badge" and a congratulatory message.

Statement	Hints	Submissions	Solution	Ask a Doubt
81555095	✓	NODEJS 4★ frankli	1	→
83543049	✓	C++14 1★ tanishq011	1	→
84006739	✓	C 1★ jonathandez	0	→

Others' Submissions
You can view submissions of all participants here [View all submissions →](#)

My Submissions

ID	Result	Time	Mem	Lang	Date
84178608	✓	0.10s	5M	C++14	11 seconds ago

Submission Details:
 Status: ✓ Correct Answer
 Submission ID: [84178608](#)
 Time: 0.10s

Congratulations on solving the problem. Visit our practice section to solve more interesting problems [View another problem →](#)

[Upload code as file](#) [Compile & Run](#) [Submit Code](#)

v)

Browser tabs: (1) WhatsApp | Small factorials - Problems | Cod... | Solution: 84133079 | CodeChef

codechef.com/viewsolution/84133079

```
18     cpp_int fact=1;
19     for(int i=n;i>0;i--)
20         fact=fact*i;
21     cout<<fact<<endl;
22 }
23
24     return 0;
25 }
26
27
28
29
30
```

0:0

Subtask Info

Status: ✓ Correct Answer Submission ID: [84133079](#)

Time:	Memory:
0.00s	5.2M

Windows taskbar: Search, File Explorer, Chrome, Word, Teams, 11:12 PM 1/3/2023

Evaluation Grid (To be created as per the SOP and Assessment guidelines by the faculty):

Sr. No.	Parameters	Marks Obtained	Maximum Marks
1.			
2.			
3.			