

## Problem Set

### Topic: If, If else, Nested if, For Loop, Nested For

1. Find the output of the program

```
main()
{
    int x,f,y;
    x=1;
    f=x+1;
    y=f-x;
    x=3;
    y=y+x;
    cout<<f<<" , " <<x<<" , " <<y;
    system("pause");
}
```

2. Two masses of 3 kg and 5 kg are kept at positions 2 cm and 4 cm respectively. Display their centre of mass. Repeat the calculation with the first mass moved to 3 cm without retyping any formula.
3. Generate all elements of the sequence given by the starter formula  $a_1 = 2$  and the recursion formula  $a_{i+1} = 2a_i - 3$  for  $i = 1, 2, \dots, 12$ .
4. Generate first 9 elements of an arithmetic sequence with first element as 3 and common difference as 2.
5. Generate first 10 elements of a geometric sequence with first element as 4 and common ratio as 3.
6. Generate a matrix containing all the elements given by  $a_{ij} = (i - 1)^2 j^3 \delta_{ij}$  for  $i, j = 1, 2, 3$ . Display normally.
7. Given that

$$f(x) = \begin{cases} \frac{2}{x}, & \text{for } x < 1 \\ x, & \text{for } 1 \leq x < 2 \\ x^2, & \text{for } 2 \leq x \end{cases}$$

Evaluate  $f(x)$  at  $x = 2.5$ .

8. Calculate the mean value of first 100 odd numbers. (A.M =  $\frac{\sum_{i=1}^n X}{n}$ ).
9. Write a C++ code to write the expression of the range of a projectile as a initial speed  $v_0$  and angle  $\theta$ . Use it to calculate the range of projectiles thrown with angles  $0, \frac{\pi}{8}, \frac{\pi}{4}, \dots, \pi$  rad., with initial speed as 2 m/s.
10. Generate an identity matrix of order  $5 \times 5$ .
11. Three capacitance  $1.5 \mu\text{F}$ ,  $2.7 \mu\text{F}$ ,  $2.1 \mu\text{F}$ ,  $3.1 \mu\text{F}$ . Display the equivalence capacitance which is less than  $4.5 \mu\text{F}$ , that can be obtained by combining any two capacitance in parallel.

```
//100 Even, Odd(Array)
#include<iostream>
using namespace std;
main()
{
    int x[100] , i;
    for (i=0; i<100; i++)
    {
        x[i]=i+1;
        if (x[i]%2==0)
        {cout<<x[i]<<" = Even"<<endl;}
        else
        {cout<<x[i]<<" = Odd"<<endl;}
    }
    system("pause");
}
```

```
//fabonacci series(do while)
#include<iostream>
using namespace std;
main()
{
    int s, a=0, b=1, c=2;
    cout<<a<<endl<<b<<endl;
    do
    {
        s=a+b;
        a=b; b=s;
        c++;
        cout<<s<<endl;
    }
    while(c<20);
    system("pause");
}
```

```
//100 prime(while)
#include<iostream>
using namespace std;
main()
{
    int x[100], p, a=1, b, c=0;
    while(c<100)
    {
        p=0;
        for(b=2; b<a; b=b+1)
        {
            if(a%b==0)
            { p=1; break; }
        }
        if(p==0)
        {
            x[c]=a;
            cout<<x[c]<<endl;
            c=c+1;
        }
        a=a+1;
    }
    return 0;
}
```

```
//fabonacci series(while)
#include<iostream>
using namespace std;
main()
{
    int a=0, b=1, s, c=2;
    cout<<a<<endl<<b<<endl;
    while(c<20)
    {
        s=a+b; a=b; b=s; c++;
        cout<<s<<endl;
    }
    system("pause");
}
```

```
//Fabounachii Series(for)
#include<iostream>
using namespace std;
main()
{
    int s, a=0, b=1;
    cout<<"Fabunacci Serie "<<endl;
    cout<<a<<endl<<b<<endl;
    for (int c=2; c<20; c++)
    {
        s=a+b; a=b; b=s;
        cout<<s<<endl;
    }
    system("pause");
}
```

```
//fact_of_all_even_No_from_1 to 50
#include<iostream>
#include<math.h>
using namespace std;
main()
{
    for (int x=1; x<51; x++)
    {
        double f=1;
        if (x%2==0)
        {
            for (int m=x; m>0; m - -)
            {f=f*m;}
            cout<<"Fact of "<<x<<" = "<<f<<endl;
        }
    }
    system("pause");
}
```

```
//Factorial between 5 to 25
#include<iostream>
using namespace std;
main()
{
    long double x, f=1;
    cout<<"Factorial between 5 to 25 :- "<<endl;
    for(x=5; x<=25; x++)
    {
        for(int m=x; m>0; m--)
        {f=f*m;}
        cout<<"Factorial of "<<x<<"="<<f<<endl;
    }
    system("pause");
}
```

```
//all_prime_bw_x&y
#include<iostream>
using namespace std;
main()
{
    int x, y, m, p=0;
    cout<<"Enter x ?"<<endl;
    cin>>x;
    cout<<"enter y ?"<<endl;
    cin>>y;
    for(x; x<y; x++)
    { p=0;
        for(int m=2; m<x; m++)
        {
            if(x%m ==0)
            {p=1; break;}
        }
        if(p==0)
        {cout<<x<<endl;}
    }
    system("pause");
}
```

```
//Basic Calculator
#include<iostream>
using namespace std;
main()
{
    float a,b,c,d;
    cout<<"Basic Calculator b/w two no.s : "<<endl;
    cout<<"enter first number:"<<endl;
    cin>>a;
    cout<<"enter second number:"<<endl;
    cin>>b;
    cout<<"enter number 1 for sum"<<endl;
    cout<<"enter number 2 for difference"<<endl;
    cout<<"enter number 3 for multiple"<<endl;
    cout<<"enter number 4 for divide"<<endl;
    cin>>c;
    if(c==1)
    {d=a+b;}
    else if(c==2)
    {d=a-b;}
    else if(c==3)
    {d=a*b;}
    else if(c==4)
    {d=a/b;}
    cout<<"ans="<<d<<endl;
    system("pause");
}
```

```
//Factorial
#include<iostream>
using namespace std;
main()
{
    int x, f=1;
    cout<<"Finding Factorial : "<<endl;
    cout<<"Number = ";
    cin>>x;
    for (int m=x; m>0; m--)
    {f=f*m;}
    cout<<"Factoeial = "<<f<<endl;
    system("pause");
}
```

```
//Check Prime(Array)
#include<iostream>
using namespace std;
main()
{
    int x[5]={7,5,11,33,82}, p=0;
    for(int k=0; k<5; k++)
    {
        for(int y=2;y<x[k];y++)
        {
            if(x[k]%y==0)
            {p=1;
            break;}
        }
        if(p==0)
        {cout<<"Prime"<<endl;}
        else
        {cout<<"Not Prime"<<endl;}
    }
    system("pause");
}
```

```
//Grade(if else)
#include<iostream>
using namespace std;
main()
{
    char Grade;
    cout<<"Enter the Grade
="<<endl;
    cin>>Grade;
    if(Grade=='A')
    cout<<"Exelent Grade"<<endl;
    else if(Grade == 'B')
    cout<<"Good Grade"<<endl;
    else if(Grade=='C')
    cout<<"Fare Grade"<<endl;
    else
    cout<<"Bad Grade"<<endl;
    system("pause");
}
```

```
//Voweles
#include<iostream>
using namespace std;
main()
{
    char Alphabet;
    cout<<"Alphbet = ";
    cin>>Alphabet;
if(Alphabet=='a' || Alphabet=='e' || Alphabet
=='i' || Alphabet=='o' || Alphabet=='u')
    {cout<<"Voweles"<<endl;}
    else
    {cout<<"Consunents"<<endl;}
    system("pause");
}
```

```
//Prime Factorial (while)
#include<iostream>
using namespace std;
main()
{
    int x, y=2, p=0;
    cout<<"number=";
    cin>>x;
    while(y<x)
    {
        if(x%y==0)
        {p=1;}
        y++;
    }
    int f=1, m;
    if(p==0)
    {
        for(m=x;m>0;m--)
        {f=f*m;}
        cout<<"prime factorial="<<f<<endl;
    }
    system("pause");
}
```

```
//Table
#include<iostream>
using namespace std;
main()
{
    int n, c;
    cout<<"Table of ";
    cin>>n;
    for (int m=1; m<=10; m++)
    {
        c=n*m;
        cout<<n<<"x"<<m<<"="<<c<<endl;
    }
cout<<c;
    return 0;
}
```

```
//Table(Array)
#include<iostream>
using namespace std;
main()
{
    int c[100];
    int n;
    cout<<"enter any number=";
    cin>>n;
    for( int m=1; m<=100; m++)
    {
        c[m]=n*m;
        cout<<n<<"x"<<m<<"="<<c[m]<<endl;
    }
cout<<c[2];
    return 0;
}
```

```
//Greatest & Smallest No.
```

```
#include<iostream>
```

```
using namespace std;
```

```
main()
```

```
{
```

```
    int x,y,z;
```

```
    cout<<"enter x"<<endl;
```

```
    cin>>x;
```

```
    cout<<"enter y"<<endl;
```

```
    cin>>y;
```

```
    cout<<"enter z"<<endl;
```

```
    cin>>z;
```

```
    if(x>y)
```

```
    {
```

```
        if(x>z)
```

```
        {
```

```
            if(y>z)
```

```
        {cout<<x<<"greatest"<<z<<"smallest"<<endl;}
```

```
        else
```

```
        {cout<<x<<"greatest"<<y<<"smallest"<<endl;}
```

```
        }
```

```
        else
```

```
        {cout<<z<<"greatest"<<y<<"smallest"<<endl;}
```

```
        }
```

```
        else if(y>z)
```

```
        {
```

```
            if(x>z)
```

```
        {cout<<y<<"greatest"<<z<<"smallest"<<endl;}
```

```
        else
```

```
        {cout<<y<<"greatest"<<x<<"smallest"<<endl;}
```

```
        }
```

```
        else
```

```
        {cout<<z<<"greatest"<<x<<"smallest"<<endl;}
```

```
        system("pause");
```

```
    }
```

```
//Grade(case)
```

```
#include<iostream>
```

```
using namespace std;
```

```
main()
```

```
{
```

```
    char Grade;
```

```
    cout<<"Grade is : "<<endl;
```

```
    cin>>Grade;
```

```
    switch(Grade)
```

```
    {
```

```
        case'A':
```

```
            {cout<<"Exelent Grade"<<endl; break;}
```

```
        case'B':
```

```
            {cout<<"Good Grade"<<endl; break;}
```

```
        case'C':
```

```
            {cout<<"Fare Grade"<<endl; break;}
```

```
        default:
```

```
            {cout<<"Bad Grade"<<endl; break;}
```

```
    }
```

```
    system("pause");
```

```
}
```

```
//Values Swaping
```

```
#include<iostream>
```

```
using namespace std;
```

```
main()
```

```
{
```

```
    int a, b, c;
```

```
    cout<<"Values For Interchanging : "<<endl;
```

```
    cout<<"a = ";
```

```
    cin>>a;
```

```
    cout<<"b = ";
```

```
    cin>>b;
```

```
    c=a; a=b; b=c;
```

```
    cout<<"After Values Interchanging : "<<endl;
```

```
    cout<<"a = "<<a<<endl<<"b = "<<b<<endl;
```

```
    system("pause");
```

```
}
```

```
//Sum of Square of 1st 50 Even Numbers
#include<iostream>
using namespace std;
main()
{
    int s =0;
    for (int x=0; x<100; x=x+1)
    {
        if(x%2==0)
        {s=s+x*x;}
    }
    cout<<"sum = "<<s<<endl;
    system("pause");
}
```

```
//interchanging
#include<iostream>
using namespace std;
main()
{
    double x, y;
    cout<<"Three Digits = ";
    cin>>x;
    int q1, q2, r1, r2, a1, a2;
    q1=x/100;
    a1=x;
    r1=a1%100;
    q2=r1/10;
    a2=r1;
    r2=a2%10;
    y=(r2*100)+(q2*10)+q1;
    cout<<"Reverse of "<<x<<" = "<<y<<endl;
    system("pause");
}
```

```
//Identity Order Matrix
#include<iostream>
using namespace std;
main()
{
    int a, b;
    cout<<"Order = ";
    cin>>b;
    for(int i=1; i<=b; i++)
    {
        for(int j=1;j<=b;j++)
        {
            if(i==j)
            {a=1;}
            else
            {a=0;}
            cout<<a<<" ";
        }
        cout<<endl;
    }
    system("pause");
}
```

```
//P1
#include<iostream>
using namespace std;
main()
{
    int x, f, y;
    x=1;
    f=x+1;
    y=f-x;
    x=3;
    y=y+x;
    cout<<f<<","<<x<<","<<y<<endl;
    system("pause");
}
```

```
//P2
#include<iostream>
using namespace std;
main()
{
    float m1=3, m2=5, r2=4, r1, c;
    for(int i=0; i<2; i++)
    {cout<<"For r1 = " ; cin>>r1;
    c=(m1*r1+m2*r2)/(m1+m2);
    cout<<"Centre of mass = "<<c<<<endl;}}
    system("pause");
}
```

```
//P4
#include<iostream>
using namespace std;
main()
{
    int a=3, d=2;
    for(int n=0;n<9;n++)
    {
        cout<<a<<<endl;
        a=a+d;
    }
    system("pause");
}
```

```
//P7
#include<iostream>
using namespace std;
main()
{
    float x;
    cout<<"x = "; cin>>x;
    if(x<1)
    {cout<<2/x<<<endl;}
    else if(x>=1&& x<2)
    {cout<<x<<<endl;}
    else if(x>=2)
    {cout<<x*x<<<endl;}
    system("pause");
}
```

```
//P3
#include<iostream>
using namespace std;
main()
{
    int a=2;
    for(int i=0;i<12;i++)
    { cout<<a<<<endl;
      a=(2*a)-3;      }
    system("pause");
}
```

```
//P5
#include<iostream>
using namespace std;
main()
{
    int a=4, r=3;
    for(int n=0;n<10;n++)
    {
        cout<<a<<<endl;
        a=a*r;
    }
    system("pause");
}
```

```
//P9
#include<iostream>
#include<math.h>
using namespace std;
main()
{
    float vi=2.5,g=9.81,r;
    for(int x=0;x<=180;x=x+15)
    {
        r=vi*vi*sin(2*x*180.0/3.14)/g;
        cout<<r<<<endl;
    }
    system("pause");
}
```



```
//P8
#include<iostream>
using namespace std;
main()
{
    int a, n, d=2;
    for(n=1 ;n<100;n++)
    { cout<<a<<endl;
      a=3+(n-1)*d;    }
    return 0;
}
```

```
//P10
#include<iostream>
using namespace std;
main()
{
    int a;
    for(int i=0; i<=5; i++)
    {
        for(int j=0; j<=5; j++)
        {
            if(i==j)
            {a=1;}
            else
            {a=0;}
            cout<<a<<" ";
        }
        cout<<endl;
    }
    system("pause");
}
```

```
//P6
#include<iostream>
using namespace std;
main()
{
    int a;
    for(int i=1; i<=3; i++)
    {
        for(int j=1; j<=3; j++)
        {
            a=(i-1)^2*(j^3);
            if(i==j)
            {a=a*1;}
            else
            {a=a*0;}
            cout<<a<<" ";
        }
        cout<<endl;
    }
    system("pause");
}
```

```
//Pre, Post increment
#include<iostream>
using namespace std;
main()
{
    int a,b;
    a=3;
    b=a++;
    cout<<b<<endl;
    b=++a;
    cout<<b<<endl;
    system("pause");
}
```

```
//P11
#include<iostream>
using namespace std;
main()
{
    double c1=1.5,c2=2.7,c3=2.1,c4=3.1,ceq;
    if(c1+c2<4.5)
    { ceq=c1+c2; cout<<"c1+c2="<<ceq<<" "<<endl; }
    if(c1+c3<4.5)
    { ceq=c1+c3; cout<<"c1+c3="<<ceq<<" "<<endl; }
    if(c1+c4<4.5)
    { ceq=c1+c4; cout<<"c1+c4="<<ceq<<" "<<endl; }
    if(c2+c3<4.5)
    { ceq=c2+c3; cout<<"c2+c3="<<ceq<<" "<<endl; }
    if(c2+c4<4.5)
    { ceq=c2+c4; cout<<"c2+c4="<<ceq<<" "<<endl; }
    if(c3+c4<4.5)
    { ceq=c3+c4; cout<<"c3+c4="<<ceq<<" "<<endl; }
    system("pause");
}
```

```
//Prime(do while)
#include<iostream>
using namespace std;
main()
{
    int x, y=2, p=0;
    cout<<"number=";
    cin>>x;
    do
    {
        if(x%y==0)
        {p=1;}
        y++;
    }
    while(y<x);
    if(p==0)
    {cout<<"prime"<<endl;}
    else
    {cout<<"Not prime"<<endl;}
    system("pause");
}
```

```
//Prime (for)
#include<iostream>
using namespace std;
main()
{
    int x,p=0;
    cout<<"number=";
    cin>>x;
    for(int y=2 ;y<x; y++)
    {
        if(x%y==0)
        {p=1;}
    }
    if(p==0)
    {cout<<"prime"<<endl;}
    else
    {cout<<"not prime"<<endl;}
    system("pause");
}
```

```
//Prime (while)
#include<iostream>
using namespace std;
main()
{
    int x, y=2, p=0;
    cout<<"number=";
    cin>>x;
    while (y<x)
    {
        if(x%y==0)
        {p=1;}
        y++;
    }
    if(p==0)
    {cout<<"prime"<<endl;}
    else
    {cout<<"not prime"<<endl;}
    system("pause");
}
```

```
//Prime Factorial (5-20)
#include<iostream>
using namespace std;
main()
{
    int p;
    for(int x=5; x<20; x++)
    {
        p=0;
        for(int y=2; y<x; y++)
        {
            if(x%y==0)
            {p=1; break;}
        }
        if(p==0)
        {
            long double f=1;
            for (int m=x; m>0; m- -)
            {f=f*m;}
            cout<<x<<" factoeial="<<f<<endl;
        }
    }
    system("pause");
}
```

```
//Comma Operator
#include<iostream>
using namespace std;
main()
{
    int a, b;
    cout<<"b = ";
    cin>>b;
    a=(b, b+5);
    cout<<"a = "<<a<<endl;
    system("pause");
}
```

```
//series 1,2,3,6,5,10,7,14,.....20 terms
#include<iostream>
using namespace std;
main()
{
    int x=0, y=0, c=0;
    y++;
    x=x+2;
    cout<<y<<endl;
    cout<<x<<endl;
    for(x && y; c<10; c++)
    {
        y=y+2;
        x=x+4;
        cout<<y<<endl;
        cout<<x<<endl;
    }
    system("pause");
}
```

```
//Devisible by 3&5
#include<iostream>
using namespace std;
main()
{
    int m;
    cout<<"Number = ";
    cin>>m;
    if (m%3==0&& m%5==0)
    {cout<<"Divisible by 3 & 5"<<endl;}
    else
    {cout<<"Not Divisible by 3 & 5"<<endl;}
    system("pause");
}
```

```
//series 1,3,5,7,9,,11,.....20 terms
#include<iostream>
using namespace std;
main()
{
    int x=0 ,c=0;
    x++;
    cout<<x<<endl;
    for(x; c<20; c++)
    {
        x=x+2;
        cout<<x<<endl;
    }
}
```

```
//series 1,3,6,10,15,21.
#include<iostream>
using namespace std;
main()
{
    float x,y;
    for(x=1; x<7; x++)
    {
        y=(x*(x+1))/2;
        cout<<y<<endl;
    }
}
```

```
//series 2,6,10,14,18.....20 terms
#include<iostream>
using namespace std;
main()
{
    int x=0, c=0;
    x=x+2;
    cout<<x<<endl;
    for(x; c<20; c++)
    {
        x=x+4;
        cout<<x<<endl;
    }
}
```

```
//Square Number
#include<iostream>
#include<math.h>
using namespace std;
main()
{
    int y;
    cout<<"Number = ";
    cin>>y;
    int x = sqrt(y);
    if(x*x==y)
    {cout<<"Square Number"<<endl;}
    else
    {cout<<"Not Square Number"<<endl;}
    system("pause");
}
```

## Array Programs:

```
//100 Even, Odd(Array)
#include<iostream>
using namespace std;
main()
{
    int a[100],even[50],odd[50],e=0,o=0;
    cout<<"Array Elements : "<<endl;
    for(int i=0;i<100;i++)
    {
        a[i]=i+1;
        cout<<a[i]<<endl;
        if(a[i]%2==0)
        { even[e]=a[i]; e++; }
        else
        { odd[o]=a[i]; o++; }
    }
    cout<<"Array Even Elements : "<<endl;
    for(int i=0;i<50;i++)
    { cout<<even[i]<<endl; }
    cout<<"Array Odd Elements : "<<endl;
    for(int i=0;i<50;i++)
    { cout<<odd[i]<<endl; }
}
```

```
//2d Linear Search with frequency
#include<iostream>
using namespace std;
main()
{
    int x[3][3]={{1,2,3},{4,2,6},{7,8,9}},n,p=0;
    cout<<"Enter number to serch : "<<endl;
    cin>>n;
    for(int k=0;k<3;k++)
    {
        for(int m=0;m<3;m++)
        {
            if(n==x[k][m])
            {
                p++;
            }
        }
    }
    if(p==0)
    {
        cout<<"Not found"<<endl;
    }
    else
    {
        cout<<"Found with freaquency "<<p<<endl;
    }
    return 0;
}
```

```
//sum of odd no.s in 1st 100:
#include<iostream>
using namespace std;
main()
{
    int m[100],s=0;
    for(int i=0;i<100;i++)
    {
        m[i]=i+1;
        if(m[i]%2!=0)
        {
            cout<<m[i]<<endl;
            s=s+m[i];
        }
    }
    cout<<"Sum of Odd = "<<s<<endl;
}
```

```
//arrayprime-100
#include<iostream>
using namespace std;
main()
{
    int x[100],p,a=1,b,c=0,i;
    while(c<100)
    {
        p=0;
        for(b=2;b<a;b++)
        {
            if(a%b==0)
            {
                p=1;
                break;
            }
        }
        if(p==0)
        {
            x[c]=a;
            cout<<x[c]<<endl;
            c=c+1;
        }
        a=a+1;
    }
}
```

```
//Linear Search for 100 no.s:
#include<iostream>
using namespace std;
int main()
{
    int m[100],n,p=0;
    cout<<"Enter no. to search : ";
    cin>>n;
    for(int i=0;i<100;i++)
    {
        m[i]=i+1;
        if(n==m[i])
        { cout<<"found"<<endl; p=1; }
    }
    if(p==0)
    { cout<<"not found"<<endl; }
}
```

```
/* C++ Program - Binary Search */
#include<iostream>
using namespace std;
main()
{
    int arr[100],size,n,p=0;
    cout<<"Enter array size : ";
    cin>>size;
    cout<<"Enter sorted array elements : "<<endl;
    for(int i=0;i<size;i++)
    {
        cin>>arr[i];
    }
    cout<<"Enter number to search : ";
    cin>>n;
    int high=size-1;
    for(int low=0;low<=high;)
    {
        int mid=(low+high)/2;

        if(n==arr[mid])
        {
            p=1;
            break;
        }
        else if(n<arr[mid])
        {
            high=mid-1;
        }
        else if(n>arr[mid])
        {
            low=mid+1;
        }
    }
    if(p==1)
    {
        cout<<"found"<<endl;
    }
    else
    {
        cout<<"not found"<<endl;
    }
    return 0;
}
```

```
//Assending Bubble Sort(10 comparision;10 bubble up):
#include<iostream>
using namespace std;
int main()
{
    int m[10],size=10;
    cout<<"Enter 10 array Values : "<<endl;
    for(int k=0;k<10;k++)
    {
        cin>>m[k];
    }
    cout<<"After Assending Sorting : "<<endl;
    for(int i=0;i<size;i++) //how many sort
    {
        for(int j=0;j<size-1;j++) //values sorting
        {
            if(m[j+1]<m[j]) //swaping
            {
                int d = m[j];
                m[j] = m[j+1];
                m[j+1] = d;
            }
        }
    }
    for(int e=0;e<10;e++) //output
    { cout<<m[e]<<endl; }
}
```

```
//Dessending Bubble Sort(10 comparision;10 bubble up):
#include<iostream>
using namespace std;
int main()
{
    int m[10],size=10;
    cout<<"Enter 10 array Values : "<<endl;
    for(int k=0;k<10;k++)
    {
        cin>>m[k];
    }
    cout<<"After Dessending Sorting : "<<endl;
    for(int i=0;i<size;i++) //how many sort
    {
        for(int j=0;j<size-1;j++) //values sorting
        {
            if(m[j+1]>m[j]) //swaping
            {
                int d = m[j];
                m[j] = m[j+1];
                m[j+1] = d;
            }
        }
    }
    for(int e=0;e<10;e++) //output
    { cout<<m[e]<<endl; }
}
```

```
/* C++ Program - Assending Insertion Sort */
#include<iostream>
using namespace std;
int main()
{
    int arr[100], size, temp, i, j;
    cout<<"Enter array size : ";
    cin>>size;
    cout<<"Enter array elements : "<<endl;
    for(i=0;i<size;i++)
    {
        cin>>arr[i];
    }
    for(i=1;i<size;i++)
    {
        temp = arr[i];
        j=i-1;
        while(j>=0 && arr[j]>temp)
        {
            arr[j+1] = arr[j];
            j--;
        }
    }
}
```

```
        arr[j+1]=temp;
    }
    cout<<"array after sorting : "<<endl;
    for(i=0;i<size;i++)
    {
        cout<<arr[i]<<endl;
    }

    return 0;
}
```

```
//Greatest & Smallest with Bubble Assending Sorting:
```

```
#include<iostream>
using namespace std;
int main()
{
    int m[100],size = 0,temp = 0;
    cout<<"Enter Size : ";
    cin>>size;
    cout<<"Enter values for sorting : "<<endl;
    for(int k=0;k<size;k++)
    {
        cin>>m[k];
    }
    cout<<"after sorting : "<<endl;
    for(int i=0;i<size;i++)
    {
        for(int j=0;j<size-1;j++)
        {
            if(m[j+1]<m[j])
            {
                temp = m[j];
                m[j] = m[j+1];
                m[j+1] = temp;
            }
        }
    }
    for(int e=0;e<size;e++)
    { cout<<m[e]<<endl; }
    cout<<"Greatest = "<<m[size-1]<<endl<<"Smallest = "
    <<m[0]<<endl;
}
```

```
//sum of even no.s in 1st 100:
```

```
#include<iostream>
using namespace std;
main()
{
    int m[100],s=0;
    for(int i=0;i<100;i++)
    {
        m[i]=i+1;
        if(m[i]%2==0)
        {
            cout<<m[i]<<endl;
            s=s+m[i];
        }
    }
    cout<<"Sum of Even = "<<s<<endl;
}
```

```
//parallel capacitance:
```

```
#include<iostream>
#include<math.h>
using namespace std;
int main()
{
    cout<<"The Equivalence Capacitance in Parallel : "<<endl;
    float c[4]={2.1*pow(10,-6),2.7*pow(10,-6),3.1*pow(10,-3),1.1*pow(10,-3)};
    for(int i=0;i<4;i++)
    {
        for(int j=i+1;j<4;j++)
        {
            if(c[i]+c[j]<4.5*pow(10,-3))
            {cout<<c[i]<<" + "<<c[j]<<" = "<<c[i]+c[j]<<endl;}
        }
    }
    return 0;
}
```

```
//series capacitance:
```

```
#include<iostream>
#include<math.h>
using namespace std;
int main()
{
    float c[4]={2.1*pow(10,-6),2.7*pow(10,-6),3.1*pow(10,-3),1.1*pow(10,-3)};
    cout<<"The Equivalence Capacitance in series : "<<endl;
    for(int i=0;i<4;i++)
    {
        for(int j=i+1;j<4;j++)
        {
            if((c[i]*c[j])/(c[i]+c[j])<4.5*pow(10,-3))
            {
                cout<<"("<<c[i]<<" * "<<c[j]<<") / "<<"("<<c[i]<<"
                + "<<c[j]<<")"<<" = "<<(c[i]*c[j])/(c[i]+c[j])<<endl;
            }
        }
    }
    return 0;
}
```



```
//factorial of 1st 100 no.s & sum:
#include<iostream>
using namespace std;
main()
{
    int m[100];
    double s=0;
    for(int i=0;i<100;i++)
    {
        m[i]=i+1;
        double f=1;
        for(int n=1;n<=m[i];n++)
        {f=f*n;}
        cout<<"Factorial of "<<m[i]<<" = "<<f<<endl;
        s = s + f;
    }
    cout<<"Sum of 100 Factorials = "<<s<<endl;
}
```

```
//sum of prime no.s in 1st 100:
#include<iostream>
using namespace std;
main()
{
    int x[100],s=0;
    for(int i=0;i<100;i++)
    {
        x[i]=i+1;
        int c=0;
        for(int y=2;y<x[i];y++)
        {
            if(x[i]%y==0)
            { c=1; break; }
        }
        if(c==0)
        { cout<<x[i]<<endl; s=s+x[i]; }
    }
    cout<<"Sum of Prime = "<<s<<endl;
}
```

```
//sum of Not prime no.s in 100:
#include<iostream>
using namespace std;
main()
{
    int x[100],s=0;
    for(int i=0;i<100;i++)
    {
        x[i]=i+1;
        int c=0;
        for(int y=2;y<x[i];y++)
        {
            if(x[i]%y==0)
            { c=1; break; }
        }
        if(c==1)
        { cout<<x[i]<<endl; s=s+x[i]; }
    }
    cout<<"Sum of Not Prime = "<<s<<endl;
}
```

```
//Table(Array)
#include<iostream>
using namespace std;
main()
{
    int c[100];
    int n;
    cout<<"enter any number=";
    cin>>n;
    for(int m=1;m<=100;m++)
    {
        c[m]=n*m;
        cout<<n<<"x"<<m<<"="<<c[m]<<endl;
    }
    cout<<c[2];
    return 0;
}
```

## 1D & 2D Array Functions:

```
//factorial array function:
#include<iostream>
using namespace std;
void factorial(int a[10],int size);
main()
{
    int a[10]={1,2,3,4,5,6,7,8,9,10};
    factorial(a,10);
}
void factorial(int a[10],int size)
{
    int fact=1,i,j;
    for(i=0;i<size;i++)
    {
        for(j=1;j<=a[i];j++)
        {
            fact=fact*j;
        }
        cout<<a[i]<<"! = "<<fact<<endl;
        fact = 1;
    }
}
```

```
//Prime array function
#include<iostream>
using namespace std;
void prime(int a[10],int size);
main()
{
    int a[10]={1,2,3,4,5,6,7,8,9,10};
    prime(a,10);
}
void prime(int a[10],int size)
{
    int p=1,i,j;
    for(i=0;i<size;i++)
    {
        p=1;
        if(a[i]==1)
        { i++; }
        for(j=2;j<a[i];j++)
        {
            if(a[i]%j==0)
            { p=0; break; }
        }
        if(p==1)
        { cout<<a[i]<<" is Prime"<<endl; }
    }
}
```

```
//Not Prime Factorial :
#include<iostream>
using namespace std;
double factorial(int x);
void checkprime(int x[], int size);
double factorial(int x)
{
    double f=1;
    for(int i=2;i<=x;i++)
    {
        f=f*i;
    }
    return f;
}
void checkprime(int x[], int size)
{
    for(int i=0;i<size;i++)
    {
        int p=0;
        for(int y=2;y<x[i];y++)
        {
            if(x[i]%2==0)
            {
                p=1;
                break;
            }
        }
        if(p==1)
        {
            double f = factorial(x[i]);
            cout<<x[i]<<"! = "<<f<<endl;
        }
    }
}
main()
{
    int m[6]={1,5,9,8,6,4};
    checkprime(m,6);
}
```

```
//Define a function that gets 2 Matrices of order
3by3 & Add them.
```

```
#include<iostream>
```

```
using namespace std;
```

```
void Addmet(int x[][3],int y[][3], int row, int col);
```

```
main()
```

```
{
```

```
    int a[3][3] = {{1,2,3},{4,5,6},{7,8,9}};
```

```
    int b[3][3] = {{1,2,3},{4,5,6},{7,8,9}};
```

```
    Addmet(a,b,3,3);
```

```
}
```

```
void Addmet(int x[][3],int y[][3], int row, int col)
```

```
{
```

```
    for(int i=0;i<row;i++)
```

```
    {
```

```
        for(int j=0;j<col;j++)
```

```
        {
```

```
            cout<<x[i][j]+y[i][j]<<"\t";
```

```
        }
```

```
        cout<<endl;
```

```
    }
```

```
}
```

```
//Define a function that get 2D Array of order 3by3 &
Display its message.
```

```
#include<iostream>
```

```
using namespace std;
```

```
void display (int x[][3], int row, int col);
```

```
main()
```

```
{
```

```
    int a[2][3] = {{1,2,3},{4,5,6}};
```

```
    display(a,2,3);
```

```
    return 0;
```

```
}
```

```
void display (int x[][3], int row, int col)
```

```
{
```

```
    for(int i=0;i<row;i++)
```

```
    {
```

```
        for(int j=0;j<col;j++)
```

```
        {
```

```
            cout<<x[i][j]<<"\t";
```

```
        }
```

```
        cout<<endl;
```

```
    }
```

```
}
```

```
//store random no from 1to500 to 50*60 array, convert this
//2d into 1d array and find out prime no. from 1d array.
```

```
#include<iostream>
```

```
#include<cmath>
```

```
#include<stdlib.h>
```

```
void P(int n);
```

```
void R(int x[50][60]);
```

```
using namespace std;
```

```
main()
```

```
{
```

```
    int x[50][60];
```

```
    R(x);
```

```
    system("pause");
```

```
}
```

```
void R(int x[50][60])
```

```
{
```

```
    for (int i=0;i<50;i++)
```

```
    {
```

```
        for(int j=0;j<60;j++)
```

```
        { x[i][j]=rand()%500; }
```

```
    }
```

```
    int k=0,y[3000];
```

```
    for (int i=0;i<50;i++)
```

```
    {
```

```
        for(int j=0;j<60;j++)
```

```
        { y[k]=x[i][j]; k++; }
```

```
    }
```

```
    for(k=0;k<50*60;k++)
```

```
    { P(y[k]); }
```

```
}
```

```
void P(int n)
```

```
{ int m,p=0;
```

```
    for(m=2;m<n;m++)
```

```
    {
```

```
        if(n%m==0)
```

```
        { p=p+1; }
```

```
    }
```

```
    if (p==0)
```

```
    { cout<<n<<" is prime"<<endl; }
```

```
}
```

//Define a function that gets 2 Matrices of order 2by3 & 3by4 and Multiple them.

```
#include<iostream>
using namespace std;
void Mulmet(int x[2][3],int y[3][4], int row, int col1, int col2);
main()
{
    int a[2][3] = {{1,2,3},{4,5,6}};
    int b[3][4] = {{1,2,3,4},{5,6,7,8},{9,10,11,12}};
    Mulmet(a,b,2,3,4);
}
void Mulmet(int x[2][3],int y[3][4], int row, int col1, int col2)
{
    int sum = 0;
    for(int i=0;i<row;i++)
    {
        for(int j=0;j<col2;j++) //row 2 also.
        {
            for(int k=0;k<col1;k++)
            {
                sum = sum+x[i][k]*y[k][j];
            }
            cout<<sum<<"\t";
        }
        cout<<endl;
    }
}
```

//Find Sum of Diagonal Elements of 3by3 Matrix :

```
#include<iostream>
using namespace std;
int sumdigonal(int x[3][3], int row);
main()
{
    int x[3][3] = {{1,2,6},{3,6,5},{6,2,1}};
    cout<<"Sum of Diagonal Elements are = "
    "<<sumdigonal(x,3)<<endl;
    system("pause");
}
int sumdigonal(int x[3][3], int row)
{
    int i,j=2,sum=0;
    for(int i=0;i<row;i++)
    {
        sum = sum+x[i][j];
        j--;
    }
    return sum;
}
```

```
#include<iostream>
using namespace std;
void MultiMat(int x[][5], int y[][3], int r1, int c1, int c2);
void Display(int m[][3], int r1, int c2);
main()
{
    int x[2][5] = {{1,2,3,4,5},{6,7,8,9,10}};
    int y[5][3] = {{1,2,3},{4,5,6},{7,8,9},{10,11,12},{13,14,15}};
    MultiMat(x,y,2,5,3);
}
void MultiMat(int x[][5], int y[][3], int r1, int c1, int c2)
{
    int z[r1][3];
    for(int i=0;i<c2;i++)
    {
        for(int j=0;j<r1;j++)
        {
            z[j][i]=0;
            for(int k=0;k<c1;k++)
            {
                z[j][i] = z[j][i]+x[j][k]*y[k][i];
            }
        }
    }
    Display(z, r1, c2);
}
void Display(int m[][3], int r1, int c2)
{
    for(int i=0;i<r1;i++)
    {
        for(int j=0;j<c2;j++)
        {
            cout<<m[i][j]<<"\t";
        }
        cout<<endl;
    }
}
```

## Function Examples:

```
//f1 Prime No
#include<iostream>
using namespace std;
void primeno();
main()
{
    primeno();
    system("pause");
}
void primeno()
{
    int n,i,p=0;
    cout<<"Number = ";
    cin>>n;
    for(i=2;i<n;i++)
    {
        if(n%i==0)
        {
            p=1; break;
        }
    }
    if(p==0)
    {cout<<"Prime"<<endl;}
    else
    {cout<<"Not Prime"<<endl;}
}
```

```
//f3 Table:
#include<iostream>
#include<stdlib.h>
using namespace std;
int Table();
main()
{
    Table();
    system("pause");
}
int Table()
{
    int n,c;
    cout<<"Table of ";
    cin>>n;
    for(int m=1;m<=10;m++)
    {
        c=n*m;

        cout<<n<<"x"<<m<<"="<<c<<endl;
    }
    return c;
}
```

```
//f2 Voweles
#include<iostream>
#include<stdlib.h>
using namespace std;
void voweles(char Alphabet);
main()
{
    char Alphabet;
    cout<<"Alphabet = ";
    cin>>Alphabet;
    voweles(Alphabet);
    system("pause");
}
void voweles(char Alphabet)
{
    if(Alphabet=='a' | Alphabet=='e' | Alphabet=='i' | Alphabet=='o' | Alphabet=='u')
    {cout<<"Voweles"<<endl;}
    else
    {cout<<"Consunents"<<endl;}
}
```

```
//f3 prime
#include<iostream>
#include<stdlib.h>
using namespace std;
int prime();
main()
{
    if(prime()==0)
    {cout<<"Prime"<<endl;}
    else
    {cout<<"Not prime"<<endl;}
    system("pause");
}
int prime()
{
    int x,p=0;
    cout<<"Nnumber = ";
    cin>>x;
    for(int y=2;y<x;y++)
    {
        if(x%y==0)
        {p=1;}
    }
    return p;
}
```

```
//f3 Average
#include<iostream>
#include<stdlib.h>
using namespace std;
int Avg();
main()
{
    cout<<Avg();
    system("pause");
}
int Avg()
{
    float a,b,c;
    cout<<"Enter two numbesrs for Average : "<<endl;
    cin>>a>>b;
    c = (a+b)/2;
    return c;
}
```

```
//f3 primefact (5-20)
#include<iostream>
#include<stdlib.h>
using namespace std;
double primfact();
main()
{
    primfact();
    system("pause");
}
double primfact()
{
    double f;
    for(int x=5;x<20;x++)
    {
        int p=0;
        for(int y=2;y<x;y++)
        {
            if(x%y==0)
            {p=1;break;}
        }
        if(p==0)
        {
            f=1;
            for (int m=2;m<=x;m++)
            {f=f*m;}
            cout<<x<<" Factoeial = "<<f<<endl;
        }
    }

    return f;
}
```

```
//f4 Factorial
#include<iostream>
#include<stdlib.h>
using namespace std;
int Fact(int x);
main()
{
    int a;
    cout<<"No = ";
    cin>>a;
    cout<<"Factorial = "<<Fact(a)<<endl;
    system("pause");
}
int Fact(int x)
{
    int f = 1;
    for(int i=2;i<=x;i++) or for(int i=x;i>=1;i--)
    {
        f = f * i;
    }
    return f;
}
```

```
//f4 Trace
#include<iostream>
#include<cmath>
using namespace std;
float T(float x[3][3],int y);
main()
{
    float a[3][3]={{1.2,2.3,3.4},{4.5,5.6,6.7},{7.8,8.9,9.1}};
    cout<<"Trace = "<<T(a,3)<<endl;
    system("pause");
}
float T(float x[3][3],int y)
{
    float sum=0;
    for (int i=0;i<y;i++)
    {
        for (int j=0;j<y;j++)
        {
            if(i==j)
            {
                sum=sum+x[i][j] ;
            }
        }
    }
    return sum;
}
```

```
//f4 Prime No
#include<iostream>
using namespace std;
bool primeno(int x);
main()
{
    int x;
    cout<<"Enter a No. to Check Prime : "<<endl;
    cin>>x;
    if(primeno(x)==0)
    {cout<<"This is Prime Number"<<endl;}
    else
    {cout<<"This is Not Prime Number"<<endl;}
    system("pause");
}
bool primeno(int n)
{
    int i,p=0;
    for(i=2;i<n;i++)
    {
        if(n%i==0)
        {
            p=1; break;
        }
    }
    return p;
}
```

F1 = Function of Type 1st

F2 = Function of Type 2nd

F3 = Function of Type 3rd

F4 = Function of Type 4th

## Problem Set 2 with Arrays:

## Problem Set

### Topic: 1D Array and 2D array

1. Given that two matrix  $A = a_{ij}$  and  $B = b_{ij}$ , where  $i$  represent no of rows and  $j$  represent no of columns write a c++ program to calculate the multiplication of given matrices.
2. Given that a matrix  $A = a_{ij}$ , where  $i$  represent no of rows and  $j$  represent no of columns write a c++ program to calculate the trace of a given matrix.
3. Given that two matrix  $A = a_{ij}$  and  $B = b_{ij}$ , where  $i$  represent no of rows and  $j$  represent no of columns write a c++ program to calculate the addition/subtraction of given matrices.
4. Given that two matrix  $A = a_{ij}$  and  $B = b_{ij}$ , where  $i$  represent no of rows and  $j$  represent no of columns write a c++ program to check that the given two matrix are equal or not.
5. Write a C++ program that rotates  $90^\circ$  clockwise/anti-clockwise a two dimensional array.
6. Given that a matrix  $A = a_{ij}$ , where  $i$  represent no of rows and  $j$  represent no of columns write a c++ program to calculate that interchange of  $R_1 \leftrightarrow R_2$ ,  $C_2 \leftrightarrow C_3$ .
7. Given that two vectors  $A = \{4, -3, 2, -1, 0\}$  and  $B = \{2.2, 4.4, 5, 6\}$  write a c++ program to calculate the inner/outer product of two vector and also find the angle between two vectors.
8. write a c++ program to counts as a frequency of  $x$  ( $x$  is any number that you will choose from the array) appears among the first  $n$  elements of the array `a[ ]`.
9. Given that `a[8] = {22, 33, 44, 55, 44, 33, 22}`, write a c++ program to check that the array is symmetry or not.
10. Given that a matrix  $A = a_{ij}$ , where  $i$  represent no of rows and  $j$  represent no of columns write a c++ program to calculate that transform a matrix in this way:

$$\begin{bmatrix} 1 & 2 & 3 \\ 3 & 4 & 5 \\ 6 & 7 & 8 \end{bmatrix} \rightarrow \begin{bmatrix} 1 & 2 & 1 \\ 3 & 1 & 5 \\ 1 & 7 & 1 \end{bmatrix}$$

## Problem Set 2 with Arrays:

```
//1d find a number with f
#include<iostream>
using namespace std;
main()
{
    int p=0,n;
    int a[10]={1,0,3,4,5,4,7,8,0,0};
    cout<<"Enter search number : "<<endl;
    cin>>n;
    for(int j=0;j<10;j++)
    {
        if(n==a[j])
            { p++; }
    }
    if(p==0)
    {
        cout<<"not found"<<endl;
    }
    else
    {
        cout<<"found with frequency = "<<p<<endl;
    }
    return 0;
}
```

```
//Diaonal & Anti Diagonal is 1
#include<iostream>
using namespace std;
main()
{
    int
    a[4][4]={{5,2,3,4},{5,6,7,8},{9,10,11,12},{13,14,15,16}},s=3;
    for(int i=0;i<4;i++)
    {
        for(int j=0;j<4;j++)
        {
            if(i==j || i+j==s)
            {
                a[i][j]=1;
            }
        }
    }
    for(int i=0;i<4;i++)
    {
        for(int j=0;j<4;j++)
        {
            cout<<a[i][j]<<"\t";
        }
        cout<<endl;
    }
}
```

//Check two 2D matrix Equals:

```
#include<iostream>
using namespace std;
main()
{
    int a[3][3]={{1,2,0},{4,5,6},{7,8,9}}, c=0;
    int b[3][3]={{1,2,0},{4,5,6},{7,1,9}};
    for(int i=0;i<3;i++)
    {
        for(int j=0;j<3;j++)
        {
            if(a[i][j]==b[i][j])
            { c=c+1; }
        }
    }
    if(c==9)
    {
        cout<<"Equals";
    }
    else
    {
        cout<<"Not Equal";
    }
}
```



```

//Transpose & Trace :
#include<iostream>
using namespace std;
main()
{
    int r,c,s=0;
    cout<<"Enter rows & columns of array : "<<endl;
    cin>>r>>c;
    int a[r][c];
    cout<<"Enter Elements : "<<endl;
    for(int i=0;i<r;i++)
    {
        for(int j=0;j<c;j++)
        {
            cin>>a[i][j];
        }
        cout<<endl;
    }
    cout<<"Matrix is : "<<endl;
    for(int i=0;i<r;i++)
    {
        for(int j=0;j<c;j++)
        {
            cout<<a[i][j]<<"\t";
        }
        cout<<endl;
    }
    cout<<"Transpose : "<<endl;
    for(int i=0;i<r;i++)
    {
        for(int j=0;j<c;j++)
        {
            cout<<a[j][i]<<"\t";
            if(i==j) //if is for Trace Finding.
            {
                s=s+a[i][j];
            }
        }
        cout<<endl;
    }
    cout<<"Trace = "<<s<<endl;
}

```

```

//symetric and skew symmetric matrix
#include<iostream>
using namespace std;
int main ()
{
    int A[10][10], m, n, x = 0, y = 0;
    cout << "Enter the number of rows and columns : "<<endl;
    cin >> m >> n;
    cout << "Enter the matrix elements : "<<endl;
    for (int i = 0; i < m; i++)
    {
        for (int j = 0; j < n; j++)
        {
            cin >> A[i][j];
        }
        cout<<endl;
    }
    for (int i = 0; i < m; i++)
    {
        for(int j = 0; j < n; j++)
        {
            if (A[i][j] != A[j][i])
            { x = 1; }
            else if (A[i][j] == -A[j][i])
            { y = 1; }
        }
    }
    if (x == 0)
    { cout << "The matrix is symmetric.\n "; }
    else if (y == 1)
    { cout << "The matrix is skew symmetric.\n "; }
    else
    { cout << "It is neither symmetric nor skew-symmetric.\n "; }
    for (int i = 0; i < m; i++)
    {
        for (int j = 0; j < n; j++)
        {
            cout << A[i][j] << " ";
        }
        cout << "\n ";
    }
    return 0;
}

```

```
//Rows & Columns Interchanging :
```

```
#include<iostream>
```

```
using namespace std;
```

```
main()
```

```
{
    int r,c,r1,r2,c1,c2;
    cout<<"Enter no of rows & columns of Matrix : "<<endl;
    cin>>r>>c;
    int a[r][c];
    cout<<"Enter Elements of Matrix : "<<endl;
    for(int i=0;i<r;i++)
    {
        for(int j=0;j<c;j++)
        { cin>>a[i][j]; }
        cout<<endl;
    }
    cout<<"Display Matrix normly : "<<endl;
    for(int i=0;i<r;i++)
    {
        for(int j=0;j<c;j++)
        { cout<<a[i][j]<<"\t"; }
        cout<<endl;
    }
    cout<<"Enter rows for swapping : "<<endl;
    cin>>r1>>r2;
    for(int j=0;j<c;j++)
    {
        int swap1 = a[r1-1][j];
        a[r1-1][j] = a[r2-1][j];
        a[r2-1][j] = swap1;
    }
    cout<<"After Rows Swapping : "<<endl;
    for(int i=0;i<r;i++)
    {
        for(int j=0;j<c;j++)
        { cout<<a[i][j]<<"\t"; }
        cout<<endl;
    }
    cout<<"Enter Columns for swapping : "<<endl;
    cin>>c1>>c2;
    for(int i=0;i<r;i++)
    {
        int swap2 = a[i][c1-1];
        a[i][c1-1] = a[i][c2-1];
        a[i][c2-1] = swap2;
    }
    cout<<"After columns Swapping : "<<endl;
    for(int i=0;i<r;i++) {
        for(int j=0;j<c;j++)
        { cout<<a[i][j]<<"\t"; }
        cout<<endl; }
    }
```

```
//cw & acw rot 90 & 180 :
```

```
#include<iostream>
```

```
using namespace std;
```

```
main()
```

```
{
    int r,c;
    cout<<"Enter rows & columns of array : "<<endl;
    cin>>r>>c;
    int a[r][c];
    cout<<"Enter Elements : "<<endl;
    for(int i=0;i<r;i++)
    {
        for(int j=0;j<c;j++)
        { cin>>a[i][j]; }
        cout<<endl;
    }
    cout<<"Matrix is : "<<endl;
    for(int i=0;i<r;i++)
    {
        for(int j=0;j<c;j++)
        { cout<<a[i][j]<<"\t"; }
        cout<<endl;
    }
    cout<<"Matrix after 90 cw rotation : "<<endl;
    for(int i=0;i<r;i++)
    {
        for(int j=c-1;j>=0;j--)
        { cout<<a[j][i]<<"\t"; }
        cout<<endl;
    }
    cout<<"Matrix after 90 acw rotation : "<<endl;
    for(int i=r-1;i>=0;i--)
    {
        for(int j=0;j<c;j++)
        { cout<<a[j][i]<<"\t"; }
        cout<<endl;
    }
    cout<<"Matrix after 180 rotation : "<<endl;
    for(int i=r-1;i>=0;i--)
    {
        for(int j=c-1;j>=0;j--)
        { cout<<a[i][j]<<"\t"; }
        cout<<endl;
    }
}
```

```

//Matrix Extract :
#include<iostream>
using namespace std;
main()
{
    int r,c,e,f,g,h;
    cout<<"Enter no of rows & columns of Matrix : "<<endl;
    cin>>r>>c;
    int a[r][c];
    cout<<"Enter Elements of Matrix : "<<endl;
    for(int i=0;i<r;i++)
    {
        for(int j=0;j<c;j++)
        { cin>>a[i][j]; }
        cout<<endl;
    }
    cout<<"Display Matrix normly : "<<endl;
    for(int i=0;i<r;i++)
    {
        for(int j=0;j<c;j++)
        { cout<<a[i][j]<<"\t"; }
        cout<<endl;
    }
    cout<<"Enter range of row Elements to Extract : "<<endl;
    cin>>e>>f;
    cout<<"Enter range of column Elements to Extract : "<<endl;
    cin>>g>>h;
    cout<<"After Extracting : "<<endl;
    for(int i=e-1;i<f;i++)
    {
        for(int j=g-1;j<h;j++)
        { cout<<a[i][j]<<"\t"; }
        cout<<endl;
    }
}

```

```

#include<iostream>
#include<cmath>
using namespace std;
main()
{
    int size,c=0,s1=0,s2=0,sum=0;
    float A,B;
    cout<<"Enter the no of components of 1st & 2nd Matrix = ";
    cin>>size;
    int a[size],b[size];
    cout<<"Enter Components of 1st Matrix : "<<endl;
    for(int i=0;i<size;i++)
    { cin>>a[i]; }
    cout<<"Enter Components of 2nd Matrix : "<<endl;
    for(int j=0;j<size;j++)
    {
        cin>>b[j];
    }
    for(int k=0;k<size;k++)
    {
        int c = a[k]*b[k];
        sum = sum + c;
    }
    cout<<"Dot Product = "<<sum<<endl;
    for(int i=0;i<size;i++)
    {
        s1 = s1 + pow(a[i],2);
        A = sqrt(s1);
        s2 = s2 + pow(b[i],2);
        B = sqrt(s2);
    }
    float ang = acos(sum/(A*B))*(180/3.141592654);
    cout<<"angle = "<<ang<<endl;
}

```

```
//2D Matrix Addition
#include<iostream>
using namespace std;
main()
{
    int row1,col1,row2,col2;
    cout<<"Enter no of rows & columns of 1st Matrix :
"<<endl;
    cin>>row1>>col1;
    cout<<"Enter no of rows & columns of 1st Matrix :
"<<endl;
    cin>>row2>>col2;
    int a[row1][col1], b[row2][col2];
    cout<<"Enter Elements of 1st Matrix : "<<endl;
    for(int i=0;i<row1;i++)
    {
        for(int j=0;j<col1;j++)
        {
            cin>>a[i][j];
        }
    }
    cout<<"Enter Elements of 2nd Matrix : "<<endl;
    for(int i=0;i<row2;i++)
    {
        for(int j=0;j<col2;j++)
        {
            cin>>b[i][j];
        }
    }
    cout<<"Display 1st Matrix normly : "<<endl;
    for(int i=0;i<row1;i++)
    {
        for(int j=0;j<col1;j++)
        {
            cout<<a[i][j]<<" ";
        }
        cout<<endl;
    }
}
```

```
cout<<"Display 2nd Matrix normly : "<<endl;
    for(int i=0;i<row2;i++)
    {
        for(int j=0;j<col2;j++)
        {
            cout<<b[i][j]<<" ";
        }
        cout<<endl;
    }
    if(row1==row2 && col1==col2)
    {
        cout<<"Sum of two Matrix : "<<endl;
        for(int i=0;i<row2;i++)
        {
            for(int j=0;j<col2;j++)
            {
                cout<<a[i][j]+b[i][j]<<"\t";
            }
            cout<<endl;
        }
    }
    else
    {
        cout<<"Matrix Addition is not Possible."<<endl;
    }
    return 0;
}
```

```
//Multiplication of 2 Matrices :
#include<iostream>
using namespace std;
main()
{
    int row1,col1,row2,col2;
    cout<<"Enter no of rows & columns of 1st Matrix : "<<endl;
    cin>>row1>>col1;
    cout<<"Enter no of rows & columns of 1st Matrix : "<<endl;
    cin>>row2>>col2;
    int a[row1][col1], b[row2][col2], c[row1][col2];
    cout<<"Enter Elements of 1st Matrix : "<<endl;
    for(int i=0;i<row1;i++)
    {
        for(int j=0;j<col1;j++)
        {
            cin>>a[i][j];
        }
    }
    cout<<"Enter Elements of 2nd Matrix : "<<endl;
    for(int i=0;i<row2;i++)
    {
        for(int j=0;j<col2;j++)
        {
            cin>>b[i][j];
        }
    }
    cout<<"Display 1st Matrix normally : "<<endl;
    for(int i=0;i<row1;i++)
    {
        for(int j=0;j<col1;j++)
        {
            cout<<a[i][j]<<" ";
        }
        cout<<endl;
    }
}
```

```
    cout<<"Display 2nd Matrix normally : "<<endl;
    for(int i=0;i<row2;i++)
    {
        for(int j=0;j<col2;j++)
        {
            cout<<b[i][j]<<" ";
        }
        cout<<endl;
    }
    if(col1 == row2)
    {
        cout<<"Matrix Multiplication Possible : "<<endl;
        for(int i=0;i<row1;i++)
        {
            for(int j=0;j<col2;j++)
            {
                c[i][j] = 0;
                for(int k=0;k<col1;k)
                {
                    c[i][j] = c[i][j] + a[i][k] * b[k][j];
                }
            }
        }
        cout<<"Multiplication = "<<endl;
        for(int i=0;i<row1;i++)
        {
            for(int j=0;j<col2;j++)
            {
                cout<<c[i][j]<<"\t";
            }
            cout<<endl;
        }
    }
    else
    {
        cout<<"Matrix Multiplication Not Possible"<<endl;
    }
    return 0;
}
```

## Lab Task

### Instructions:

- (1) Work on this lab individually, discussion is not allowed.
- (2) Evaluation on this lab will be conducted in this lab.
- (3) **Anyone caught being indulged in the act of plagiarism would be awarded as “0” marks in this lab.**
- (4) Declare all the variables with the appropriate names.
- (5) you can ONLY talk with your instructor.

### Objective:

The purpose of this lab how to solve the calculus problem like derivative and integration of the function  $f(x)$  and vector algebra problem like dot product of two vector.

#### Task 1:

Implement a function for integrating a function by means of Riemann Sums. Use the formula

$$\int_a^b f(x)dx = \sum_{j=1}^n f(a + jh)h,$$

where  $h = \frac{a-b}{n}$

#### Task 2:

Make a function that returns the numerical derivative of a given function  $f$  at a given point  $x$ . Use the formula

$$f'(x) = \frac{f(x+h) - f(x-h)}{2h},$$

where  $h = \frac{a-b}{n}$

#### Task 3:

Make a function that retruns the inner product of two vector (also called the “dot product” or “scalar product”) of the first  $n$  elements of vector  $a$  with the first  $n$  elements of vector  $b$ . This is defined as the sum of the products of corresponding terms.

#### Task 4:

Make a function that counts the number of times the item  $x$  appears among the first  $n$  elements of the array  $a[ ]$  and returns the count as the frequency of  $x$  in  $a$ .

# Lab Task 1

```
//Task 1 (integration) :
#include<iostream>
using namespace std;
float f(float x);
float integ(float a, float j , float h);
main()
{
    float a=0.0,b=1.0,n=1000.0,s=0.0;
    float h = (b-a)/n;
    for(int j=1;j<=n;j++)
    {
        s = s + integ(a,j,h)*h;
    }
    cout<<"Answer = "<<s<<endl;
    return 0;
}
float f(float x)
{
    return x;
}
float integ(float a, float j , float h)
{
    return f(a+j*h);
}
```

```
//Task 1: integration
#include<iostream>
using namespace std;
float f(float x);
float l(float a,float j,float h);
main()
{
    float a=0.0,b=5.0,n=100000.0,j;
    float h=(b-a)/n,sum=0.0;
    for(j=1;j<=n;j++)
    {
        sum=sum+l(a,j,h);
    }
    cout<<sum;
}
float f(float x)
{
    return 3*x*x;
}
float l(float a,float j,float h)
{
    float p=f(a+j*h)*h;
    return p;
}
```

```
//Task 2 (Derivatives) :
#include<iostream>
using namespace std;
float f(float x);
float der(float x, float h);
main()
{
    float a=0.0,b=1.0,n=1000.0,x=1.0;
    float h = (b-a)/n;
    cout<<"Answer = "<<der(x,h);
    return 0;
}
float f(float x)
{
    return x; //Derivative of x;
}
float der(float x, float h)
{
    return (f(x+h)-f(x-h))/(2*h);
}
```

```
//Task 2 (Derivatives):
#include<iostream>
#include<cmath>
using namespace std;
float f(float x);
float D(float a,float dx);
main()
{
    float a=1.0,b=3.0,n=10000.0,dx=(b-a)/n;
    cout<<D(a,dx);
}
float f(float x)
{
    return x;
}
float D(float a,float dx)
{
    float y=((f(a+dx)-f(a))/dx);
    return y;
}
```

```
//Task 3: Dot Product Function :
#include<iostream>
using namespace std;
void dotproduct(int a[], int b[], int size);
void dotproduct(int a[], int b[], int size)
{
    int c=0,sum=0;
    for(int k=0;k<size;k++)
    {
        int c=a[k]*b[k];
        sum=sum+c;
    }
    cout<<"Dot Product = "<<sum<<endl;
}
main()
{
    int a[5] = {1,4,5,6,7}, b[5] =
    {1,2,3,4,5};
    dotproduct(a,b,5);
}
```

//Task 4: Frequency Function :

```
#include<iostream>
```

```
using namespace std;
```

```
int Frequency(int a[], int size, int b);
```

```
int Frequency(int a[], int size, int b)
```

```
{
```

```
    int c=0;
```

```
    for(int k=0;k<10;k++)
```

```
    {
```

```
        if(b==a[k])
```

```
        {
```

```
            c++;
```

```
        }
```

```
    }
```

```
    return c;
```

```
}
```

```
main()
```

```
{
```

```
    int a[10] = {1,2,3,3,4,5,3,5,6,7}, b;
```

```
    cout<<"Enter no to check Frequency : "<<endl;
```

```
    cin>>b;
```

```
    cout<<"Frequency of "<<b<<" = "<<Frequency(a, 10, b)<<endl;
```

```
    system("pause");
```

```
}
```

//Task 3 General :

```
#include<iostream>
```

```
#include<cmath>
```

```
float P(float a[],float b[],int o);
```

```
using namespace std;
```

```
main()
```

```
{
```

```
    int o;
```

```
    cout<<"Enter the dimension of vectors = ";
```

```
    cin>>o;
```

```
    float a[o],b[o];
```

```
    cout<<"Enter the components of first vector
```

```
:"<<endl;
```

```
    for(int i=0;i<o;i++)
```

```
    {
```

```
        cin>>a[i];
```

```
    }
```

```
    cout<<"Enter the components of second vector
```

```
:"<<endl;
```

```
    for(int j=0;j<o;j++)
```

```
    {
```

```
        cin>>b[j];
```

```
    }
```

```
    cout<<"Inner product is = "<<P(a,b,o);
```

```
}
```

```
float P(float a[],float b[],int o)
```

```
{
```

```
    float c[o],sum;
```

```
    for(int i=0;i<o;i++)
```

```
    {
```

```
        c[i]=a[i]*b[i];
```

```
        sum=sum+c[i];
```

```
    }
```

```
    return sum;
```

```
}
```



## Lab Task

### Instructions:

- (1) Work on this lab individually, discussion is not allowed.
- (2) **Anyone caught being indulged in the act of plagiarism would be mark absent in this lab.**
- (3) Declare all the variables with the appropriate names.
- (4) you can ONLY talk with your instructor.

### Objective:

The purpose of this lab is how to use the array and function together.

#### Task 1:

Make C++ Program to display marks of 5 students by passing one-dimensional array to a function.

#### Task 2:

Make a function that search the element of an array a for the item x. if x is found, its return true if x is not found, its return false.

#### Task 3:

Make a function that appends the n elements of the array b onto the m elements of array a. For example if a is {22,33,44,55,66,77} and b is {20,30,40,50,60,70} then the function would transform a into {22,33,44,55,66,77,20,30,40,50,60,70}. Note that b is left unchanged and only n elements of a are changed.

#### Task 4:

Make a function that reverse the first n elements of the array. For example the array {22,33,44,55,66,77,88,99} would transform into {66,55,44,33,22,77,88,99}.

#### Task 5:

Make a function that returns true if and only if the array obtained by reversing the first n elements is the same as the original array. For example, if a is {22,33,44,55,44,33,22} then it returns true, if array is symmetric.

#### Task 6:

Make a function that rotates 90° clockwise a two dimensional array. For example

$$\begin{bmatrix} 11 & 22 & 33 \\ 44 & 55 & 66 \\ 77 & 88 & 99 \end{bmatrix} \text{ into the array } \begin{bmatrix} 77 & 44 & 11 \\ 88 & 55 & 22 \\ 99 & 66 & 33 \end{bmatrix}$$

## Lab Task 2:

```
//Task1:
#include<iostream>
#include<cmath>
using namespace std;
void M(float x[],int y);
main()
{
    float a[5];
    cout<<"Enter Marks of Students : "<<endl;
    for(int i=0;i<5;i++)
    {
        cin>>a[i];
    }

    M(a,5);
    system("pause");
}
void M(float x[],int y)
{
    for(int i=0;i<y;i++)
    {
        cout<<"Marks of Student "<<i+1<<" are = "<<x[i]<<endl;
    }
}
```

### Task 6:

```
#include<iostream>
using namespace std;
void rot90(int a[3][3], int size);
main()
{
    int a[3][3] = {{11,22,33},{44,55,66},{77,88,99}};
    rot90(a,3);
}
void rot90(int a[3][3], int size)
{
    for(int i=0;i<size;i++) //No Additional cout.
    {
        for(int j=size-1;j>=0;j--)
        {
            cout<<a[j][i]<<"\t";
        }
        cout<<endl;
    }
}
```

### //Task 2

```
#include<iostream>
using namespace std;
bool Frequency(int a[], int size, int b)
{
    int c=0;
    for(int k=0;k<10;k++)
    {
        if(b==a[k])
        {
            c++;
        }
    }
    if(c==0)
    {
        return false;
    }
    else
    {
        return true;
    }
}
main()
{
    int a[10] = {1,2,3,3,4,5,3,5,6,7}, b;
    cout<<"Searching Number = ";
    cin>>b;
    cout<<"It Returns : ";
    cout<<Frequency(a,10,b)<<endl;
    system("pause");
}
```

```

//LT 2.3 General
#include<iostream>
#include<cmath>
using namespace std;
void Mr(int a[],int b[],int x,int y);
main()
{
    int x,y;
    cout<<"enter the number of elements in first set";
    cin>>x;
    cout<<"enter the number of elements in second set";
    cin>>y;

    int a[x],b[y];
    cout<<"Enter the first set"<<endl;
    for(int i=0;i<x;i++)
    {
        cin>>a[i];
    }
    cout<<"Enter the second set"<<endl;
    for(int j=0;j<y;j++)
    {
        cin>>b[j];
    }
    Mr(a,b,x,y);
}
void Mr(int a[],int b[],int x,int y)
{   int c[x+y];
    for(int k=0;k<x;k++)
    {
        c[k]=a[k];
    }
    for(int i=x;i<x+y;i++)
    {
        c[i]=b[i-x];
    }
    for(int l=0;l<x+y;l++)
    {
        cout<<c[l]<<" ";
    }
}

```

```

//LT 2.4 General
#include<iostream>
#include<cmath>
using namespace std;
void Mr(int a[],int x,int y);
main()
{
    int x,y;
    cout<<"enter the number of elements in set";
    cin>>x;
    cout<<"enter the number of elements to be reversed ";
    cin>>y;

    int a[x];
    cout<<"Enter the first set"<<endl;
    for(int i=0;i<x;i++)
    {
        cin>>a[i];
    }

    Mr(a,x,y);
}
void Mr(int a[],int x,int y)
{   int b[x];
    for(int i=0;i<y;i++)
    {
        b[i]=a[x-i-1];
    }

    for(int j=y;j<x;j++)
    {
        b[j]=a[j];
    }
    for(int l=0;l<x;l++)
    {
        cout<<b[l]<<" ";
    }
}

```

```
//LT 2.5 General
#include<iostream>
using namespace std;
bool fn(int a[], int size);
main()
{
    int s;
    cout<<"Enter size of 1D array = ";
    cin>>s;
    int a[s];
    cout<<"Enter Elements : "<<endl;
    for(int i=0;i<s;i++)
    {
        cin>>a[i];
    }
    cout<<fn(a,s)<<endl;
}
bool fn(int a[], int size)
{
    int sum=0;
    for(int i=0;i<size/2;i++)
    {
        if(a[i]==a[size-i-1])
        {
            sum++;
        }
    }
    cout<<"It Returns : "<<endl;
    if(sum>=size/2)
    {
        return true;
    }
    else
    {
        return false;
    }
}
```

```
//LT 2.6 General
#include<iostream>
#include<cmath>
using namespace std;
void R90(float x[3][3]);
main()
{
    float a[3][3];
    int m,n;
    cout<<"Enter the Elements of 3by3 Matrix : "<<endl;
    for(m=0;m<3;m++)
    {
        for(n=0;n<3;n++)
        {
            cin>>a[m][n];
        }
    }
    cout<<endl;
    R90(a);
}
void R90(float x[3][3])
{
    cout<<"After 90 CW Rotation : "<<endl;
    for (int i=0;i<3;i++)
    {
        for (int j=2;j>=0;j--)
        {
            cout<<x[j][i]<<"\t";
        }
        cout<<endl;
    }
}
```