Indian Institute of Technology (Indian School of Mines), Dhanbad

Algorithm Design & Analysis

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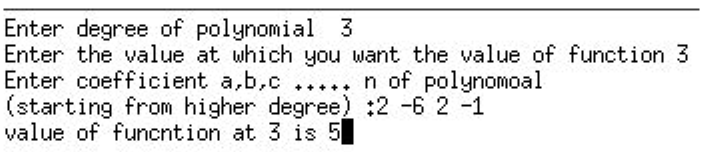
1.Horner’s rule is a means for evaluating a polynomial at a point using a minimum number of multiplications.

```
#include<bits/stdc++.h>
using namespace std;

int main(){
        int n,w;
        cout<<"Enter degree of polynomial  ";
        cin>>n;
        int x0;
        cout<<"Enter the value at which you want the value of function ";
        cin>>x0;
        cout<<"Enter coefficient a,b,c ..... n of polynomoal"<<endl<<"(starting from higher degree) :";
        int a[n+2],b[n+2];
        for(int i=n;i>=0;i--)
                cin>>a[i];
        b[n+1]=0;
        for(int i=n;i>=0;i--){
                b[i]=a[i]+b[i+1]*x0;
        }
        cout<<"value of funcntion at "<<x0<<" is "<<b[0];
        return 0;
}
```

OUTPUT:-



```
Enter degree of polynomial  3
Enter the value at which you want the value of function 3
Enter coefficient a,b,c ..... n of polynomoal
(starting from higher degree) :2 -6 2 -1
value of funcntion at 3 is 5
```

2.Given n (n>0), determine whether is the sum of all of its divisors, that is, whether n is the sum of all t such that , 1<=t<n and t divides n . Write a program to solve this problem.

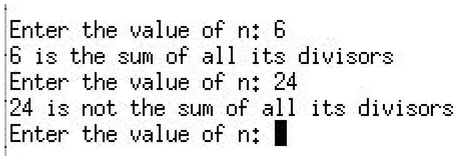
```
#include<bits/stdc++.h>
using namespace std;

int main()
{
        int n,sum=0;
        while(1){
                cout<<"\nEnter the value of n: ";
                cin>>n;

                for(int i=1;i<n;i++)
                {
                        if(n%i==0)
                                sum=sum+i;
                }
                if(sum==n)
                        cout<<n<<" is the sum of all its divisors";
                else
                        cout<<n<<" is not the sum of all its divisors";
        }

        return 0;
}
```

OUTPUT:-



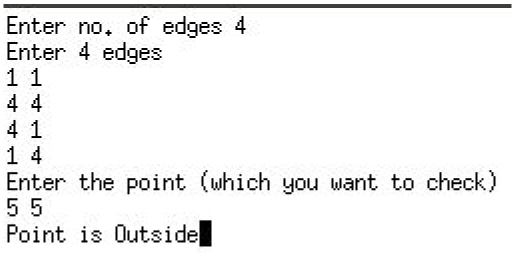
```
Enter the value of n: 6
6 is the sum of all its divisors
Enter the value of n: 24
24 is not the sum of all its divisors
Enter the value of n: █
```

3. Write a program to determine whether a point in a 2-D plane is in the interior or exterior of a simple polygon.

```
#include<bits/stdc++.h>
using namespace std;
const int m=1e5;
int polx[m],poly[m];

int main()
{
        int n,x,y,left=0,right=0;
        cout<<"Enter no. of edges ";
        cin>>n;
        cout<<"Enter "<<n<<" edges"<<endl;
        for(int i=0;i<n;i++)
                cin>>polx[i]>>poly[i];
        cout<<"Enter the point (which you want to check) "<<endl;
        cin>>x>>y;

        for(int i=0;i<n;i++){
                for(int j=0;j<n;j++){
                        if((poly[i]>=y && poly[j]<=y)||(poly[i]<=y && poly[j]>=y)){
                                if(polx[i]>x && polx[j]>x)
                                        right++;
                                else if(polx[i]<x && polx[j]<x)
                                        left++;
                                else{
                                        float k =(poly[i]-y)/(y-poly[j]);
                                        float int_x=(k*polx[j]+poly[i])/(k+1);
                                        if(int_x<x)
                                                left++;
                                        else
                                                right++;
        }}}}
        left/=2;  right/=2;
        if(left%2==0)
                cout<<"Point is Outside";
        else
                cout<<"Point is Inside";
        return 0;
```



```
Enter no. of edges 4
Enter 4 edges
1 1
4 4
4 1
1 4
Enter the point (which you want to check)
5 5
Point is Outside
```

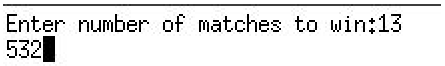
```
}
```

4. **Write a program to find the number of possible outcomes in a two-team playoff when the winner is the first team to win 5 out of 9, 6 out of 11, 7 out of 13, and 8 out of 15**

```
#include<bits/stdc++.h>
using namespace std;

int fact(int n){
        if(n<=1)
                return 1;
        return n*fact(n-1);
}

int main(){
        int n,w;
        cout<<"Enter number of matches to win:";
        cin>>n;
        w=(n+1)/2;
        int ans= fact(n)/(fact(w)*fact(n-w));
        cout<<ans;
        return 0;
}
```



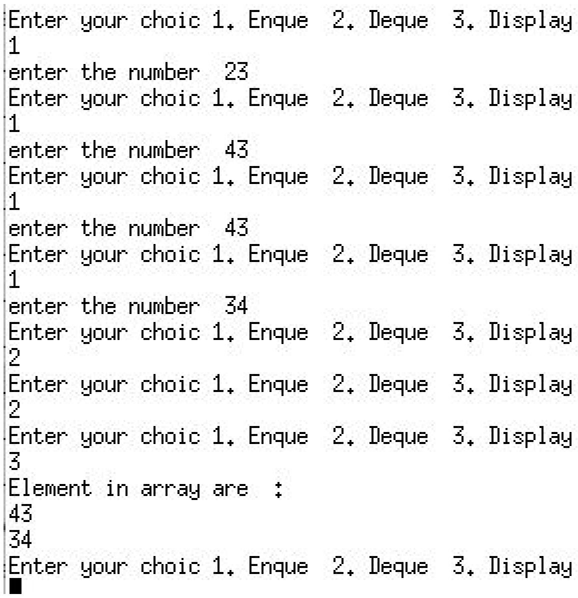
```
Enter number of matches to win:13
532
```

5. **We design a new representation of queue. A queue will be a pair of two stacks, St_in and St_out. We always add elements to St_in and always remove them from St_out. When necessary, we can reverse the St_in queue to obtain St_out by calling a user defined Reverse function. Write a program to performe a sequence of n operations, each of which could be ENQUEUE (insertion) or DEQUEUE (deletion) in this data sturucture.**

```
#include<bits/stdc++.h>
using namespace std;
int main(){
        vector <int> st_in,st_out,v3;
        int x;
        int k=0;
        while(1){
                cout<<"Enter your choic ";
        cout<<"1. Enque  ";
        cout<<"2. Deque  ";
        cout<<"3. Display"<<endl;
        cin>>x;
        switch(x){
            case 1: {
                int n;
                cout<<"enter the number  ";
                cin>>n;
                st_in.push_back(n);
                k++;
                st_out=st_in;
                reverse(st_out.begin(),st_out.end());
            }
            break;
            case 2: {
                reverse(st_in.begin(),st_in.end());
                st_in.pop_back();
                reverse(st_in.begin(),st_in.end());
                k--;
                st_out.pop_back();

            }
            break;
            case 3: {
                cout<<"Element in array are  :"<<endl;
                for(int i=0;i<k;i++)
                    cout<<st_in[i]<<endl;
            }
        }
    }
    return 0;
}
```

OUTPUT:-



```
Enter your choic 1. Enque  2. Deque  3. Display
1
enter the number  23
Enter your choic 1. Enque  2. Deque  3. Display
1
enter the number  43
Enter your choic 1. Enque  2. Deque  3. Display
1
enter the number  43
Enter your choic 1. Enque  2. Deque  3. Display
1
enter the number  34
Enter your choic 1. Enque  2. Deque  3. Display
2
Enter your choic 1. Enque  2. Deque  3. Display
2
Enter your choic 1. Enque  2. Deque  3. Display
3
Element in array are  :
43
34
Enter your choic 1. Enque  2. Deque  3. Display
```