DATA STRUCTURES LABORATORY MANUAL – ICE 2144

III SEMESTER B. TECH

EXPT. 5 RECURSION AND TEMPLATES

1. Write a C++ program that uses function templates to find the largest and smallest number in a list of integers and to sort a list of numbers in ascending order.

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

template<class T>                //Template declaration
void maxmin(T a[],int n)        //Function Template
{
        int i;
        T temp;
        for(i=0;i<n;i++)
                for(int j=i+1;j<n;j++)
                {
                        if(a[i]>a[j])
                        {
                                temp=a[i];
                                a[i]=a[j];
                                a[j]=temp;
                        }
                }
        cout<<"max="<<a[n-1]<<"\n"<<"min="<<a[0]<<"\n";
/*After sorting an Array starting index consists of Small element and Final index
consists of Largest element */
cout<<"sorted list is: \n";
for(i=0;i<n;i++)
cout<<a[i]<<" ";
}
int main()
{
        int a[50], i, ch, n;
        double d[50];
        float f[50];
        char c[50];
        cout<<"1. integer"<<endl;
        cout<<"2. characters"<<endl;
        cout<<" 3. float numbers"<<endl;
        cout<<" 4. double numbers"<<endl;
        cout<<"enter corresponding Index Example: enter '1' for integers"<<endl;
        cin>>ch;        //Reading Choice from User
        cout<<"enter the n value\n";
        cin>>n; //Number of elements is independent of DATA TYPE
        switch(ch)
        {
```

```
                case 1:         //for operations over Integer Array
                        cout<<"enter integers\n";
                        for(i=0;i<n;i++)
                                cin>>a[i];
                        maxmin(a,n);
                break;
                case 2: //for operations over Character Array
                        cout<<"enter characters\n";
                        for(i=0;i<n;i++)
                                cin>>c[i];
                        maxmin(c,n);
                break;
                case 3: //for operations over Floating Array
                        cout<<"enter float numbers\n";
                        for(i=0;i<n;i++)
                                cin>>f[i];
                        maxmin(f,n);
                break;
                case 4: //for operations over Double
                        cout<<"enter double numbers\n";
                        for(i=0;i<n;i++)
                                cin>>d[i];
                        maxmin(d,n);
                break;
                default:
                        cout<<"Invalid choice entered...";
        }
return 0;
}
```

2. Write a template-based program to sort the given list of elements.

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

template<class T>
void bubble(T a[], int n)
{
        int i, j;
        for(i=0;i<n-1;i++)
        {
                for(j=0;j<n-1;j++)
                {
                        if(a[j]>a[j+1])
                        {
                                T temp;
```

```
                        temp = a[j];
                        a[j] = a[j+1];
                        a[j+1] = temp;
                    }
                }
            }
}
int main()
{
        int a[6]={17, 16, 15, 14, 9, -1};
        char b[4]={'z', 'b', 'x', 'a'};
        bubble(a,6);
        cout<<"\nSorted Order Integers: ";
        for(int i=0;i<6;i++)
                cout<<a[i]<<"\t";
        bubble(b,4);
        cout<<"\nSorted Order Characters: ";
        for(int j=0;j<4;j++)
                cout<<b[j]<<"\t";
        return 0;
}
```

3. Write a C++ program to find factorial of a given number. (using recursive and non-recursive functions)

```
#include<iostream>
#include<iomanip>
using namespace std;
int fact(int );
int fact_recur(int);
int main()
{
        int num,a,b;
        cout<< "Enter a number to find it's factorial: ";
        cin >> num;
        cout << "Factorial without using recursive function"<<endl;
        a=fact(num);
        cout<< "Factorial of given number "<<num<<" is "<<a<<endl;
        cout << "Factorial with using recursive function"<<endl;
        b=fact_recur(num);
        cout<< "Factorial of given number "<<num<<" is "<<b<<endl;
        return 0;
}
int fact(int num)
{
        int i;
```

```
        int fac=1;
        for(i=1;i<=num;i++)
                fac=fac*i;
        return fac;
}
int fact_recur(int num)
{
        if(num==1)
                return 1;
        else
                return (num*fact_recur(num-1));
}
```

Exercise:

1. Write a C++ program to find factorial of a given number using recursion.
2. Given two positive integers n and k, write a program to print all increasing sequences of length k such that the elements in every sequence are from the first n natural numbers.
3. Given a number n, write a program to check whether it's prime number or not using recursion.