Programs:

1. Bubble sort using Function templates.

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

//Declaration of template class bubble
template <class bubble>
void bubbleSort(bubble a[], int n)
{
    int i, j;

    for (i = 0; i < n - 1; i++)
    {
        for (j = i + 1; j < n; j++)
        {
            if (a[i] > a[j])
            {
                bubble b;
                b = a[i];
                a[i] = a[j];
                a[j] = b;
            }
        }
    }
}

int main()
{
    int arr[20], k, i;
    char ch[20];

        cout << "\nEnter the number of elements in integer array:";
        cin >> k;
        cout << "\nEnter elements:";
        for (i = 0; i < k; i++)
            cin >> arr[i];

        bubbleSort(arr, k);
        cout << "\nSorted integer array: ";
        for (i = 0; i < k; i++)
            cout << arr[i] << "\t";

        cout << "\nEnter the number of characters in the array:";
        cin >> k;
        cout << "\nEnter elements:";
        for (i = 0; i < k; i++)
            cin >> ch[i];

        bubbleSort(ch, k);
        cout << "\nSorted character array: ";
        for (i = 0; i < k; i++)
```

```
            cout << ch[i] << "\t";

        cout << endl;

    getch();
    return 0;
}
```

Output:

```
Enter the number of elements in integer array:5

Enter elements:45
22
42
14
2

Sorted integer array: 2 14      22      42      45
Enter the number of characters in the array:5

Enter elements:v
c
a
m
s

Sorted character array: a       c       m       s       v
```

2. Function overloading of display(). The 3 forms will be
    a. Displaying 2 numbers of different types
    b. Displaying 1 template type variable and 1 built-in type

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

template <typename T>
void print(T num1){
      cout << "Number : " << num1 << endl;
}

template <typename T>
void print(T num1, int inNum){
      cout << "Number 1: " << num1 << endl;
      cout << "Number 2: " << inNum << endl;
}

int main() {
      int inNum;
      float flNum;
      cout << "Enter a number of interger type : ";
      cin >> inNum;
      print(inNum);
      cout << "Enter a number of float type : ";
      cin >> flNum;
      print(flNum);
      cout << endl << "--- overloaded function ---" << endl;
```

```
      print(flNum, inNum);
    return 0;
}
```

Output:

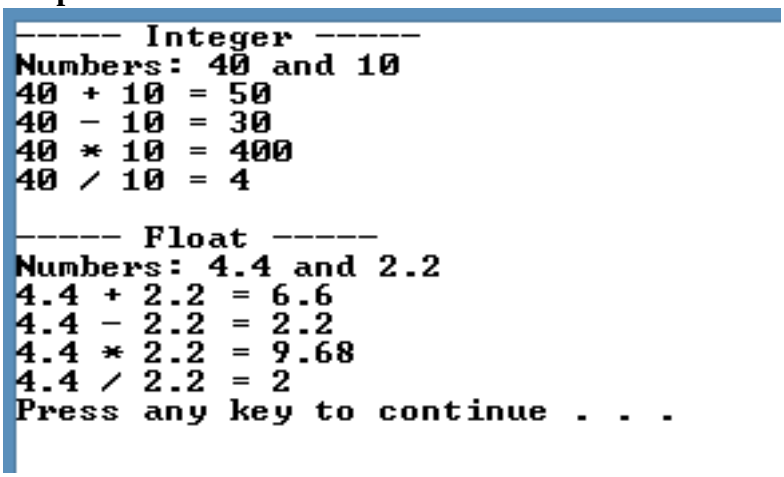
```
Enter a number of interger type : 4
Number : 4
Enter a number of float type : 2.2
Number : 2.2

--- overloaded function ---
Number 1: 2.2
Number 2: 4
Press any key to continue . . .
```

3. Program to add, subtract, multiply and divide two numbers using class template.

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

template <class T>
class Calculator {
   private:
    T num1, num2;

   public:
    Calculator(T n1, T n2) {
        num1 = n1;
        num2 = n2;
    }

    void displayResult() {
        cout << "Numbers: " << num1 << " and " << num2 << endl;
        cout << num1 << " + " << num2 << " = " << add() << endl;
        cout << num1 << " - " << num2 << " = " << subtract() << endl;
        cout << num1 << " * " << num2 << " = " << multiply() << endl;
        cout << num1 << " / " << num2 << " = " << divide() << endl;
    }

    T add() { return num1 + num2; }
    T subtract() { return num1 - num2; }
    T multiply() { return num1 * num2; }
    T divide() { return num1 / num2; }
};

int main() {
    Calculator<int> intNums(40, 10);
    Calculator<float> floatNums(4.4, 2.2);

    cout << "----- Integer -----" << endl;
    intNums.displayResult();

    cout << endl << "----- Float -----" << endl;
    floatNums.displayResult();
```

```
    return 0;
}
```

Output:

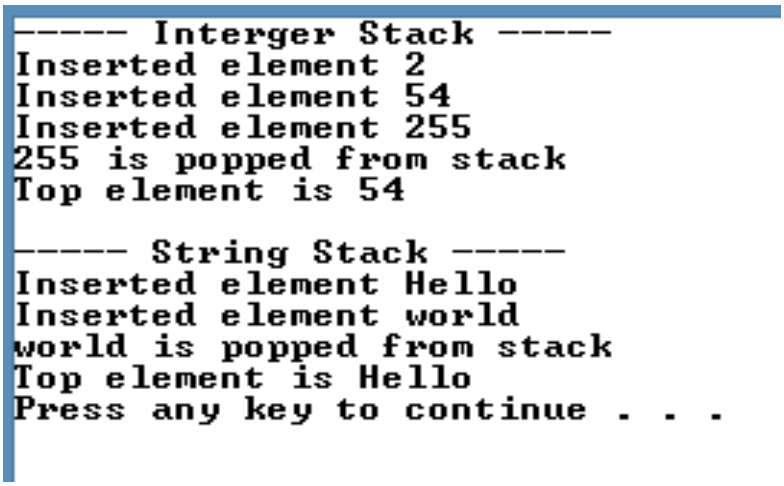


4. Define class Stack<> and implement generic methods to push and pop the elements from the stack

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

#define SIZE 5

template <class T> class Stack {
public:
    Stack();
    void push(T k);
    T pop();
    T topElement();
    bool isFull();
    bool isEmpty();

private:
    int top;
    T st[SIZE];
};

template <class T> Stack<T>::Stack() { top = -1; }

template <class T> void Stack<T>::push(T k)
{


    if (isFull()) {
        cout << "Stack is full\n";
    }


    cout << "Inserted element " << k << endl;
```

```
    top += 1;

    st[top] = k;
}

template <class T> bool Stack<T>::isEmpty()
{
    if (top == -1)
        return 1;
    else
        return 0;
}

template <class T> bool Stack<T>::isFull()
{
    if (top == (SIZE - 1))
        return 1;
    else

        return 0;
}

template <class T> T Stack<T>::pop()
{
    T popped_element = st[top];

    top--;

    return popped_element;
}

template <class T> T Stack<T>::topElement()
{
    T top_element = st[top];

    return top_element;
}

int main()
{
    Stack<int> integer_stack;
    Stack<string> string_stack;

      cout << "----- Interger Stack -----" << endl;
    integer_stack.push(2);
    integer_stack.push(54);
    integer_stack.push(255);
    cout << integer_stack.pop() << " is popped from stack" << endl;
    cout << "Top element is " << integer_stack.topElement() << endl;

    cout << "\n----- String Stack -----" << endl;
    string_stack.push("Hello");
    string_stack.push("world");
    cout << string_stack.pop() << " is popped from stack " << endl;
    cout << "Top element is " << string_stack.topElement() << endl;

    return 0;
}
```

Output:


----- Interger Stack -----
Inserted element 2
Inserted element 54
Inserted element 255
255 is popped from stack
Top element is 54
----- String Stack -----
Inserted element Hello
Inserted element world
world is popped from stack
Top element is Hello
Press any key to continue . . .