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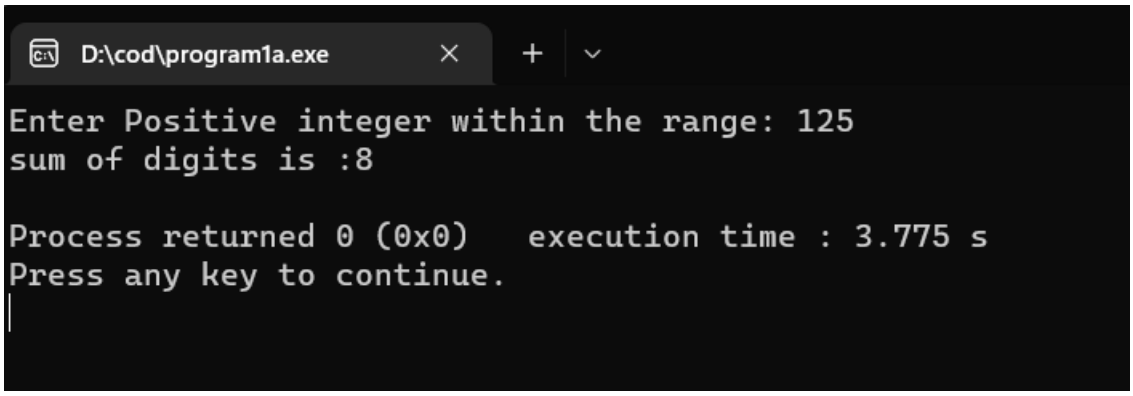
1. a) Write a C++ program to find the sum of individual digits of a positive integer.

```
#include<iostream>
using namespace std;
int main()
{
   int n,sum=0,m;
   cout<<"Enter Positive integer within the range: ";
   cin>>n;
   while(n>0)
   {
     m=n%10;
     sum=sum+m;
     n=n/10;
   }
   cout<<"sum of digits is :"<<sum<<endl;
   return 0;
}
```

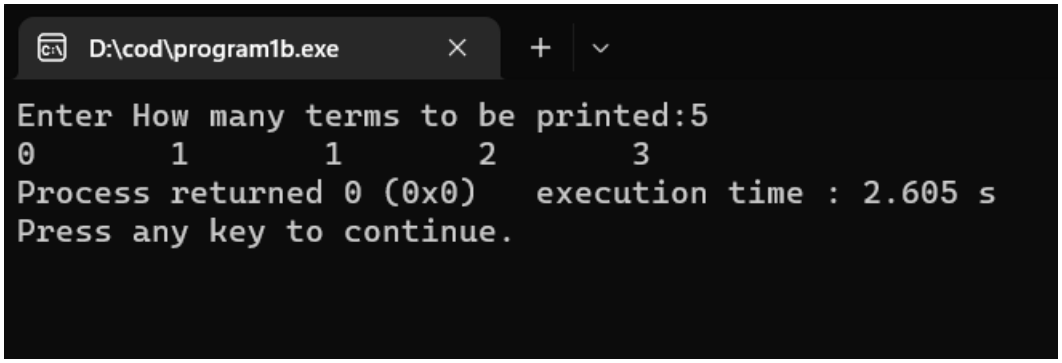
Output:


D:\cod\program1a.exe
Enter Positive integer within the range: 125
sum of digits is :8
Process returned 0 (0x0)   execution time : 3.775 s
Press any key to continue.

b) Write a C++ Program to generate first n terms of Fibonacci sequence.

```
#include<iostream>
using namespace std;
int main() {
  int n1=0,n2=1,n3,i,number;
 cout<<"Enter How many terms to be printed:";
 cin>>number;
 cout<<n1<<"      "<<n2<<"      ";
 for(i=2;i<number;++i)
 {
  n3=n1+n2;
  cout<<n3<<"      ";
  n1=n2;
  n2=n3;
 }
   return 0;
}
```

Output:

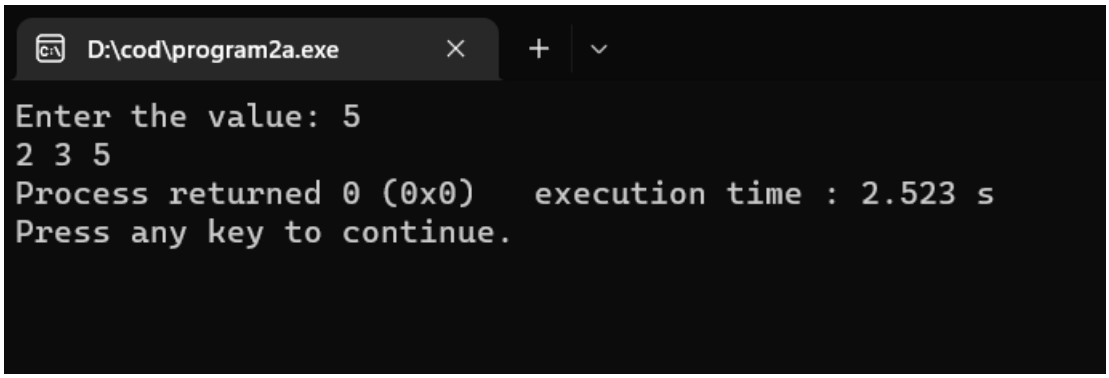

D:\cod\program1b.exe
Enter How many terms to be printed:5
0 1 1 2 3
Process returned 0 (0x0) execution time : 2.605 s
Press any key to continue.

2. a) Write a C++ program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.

```
#include<iostream>
using namespace std;
int main(){
   int num, i, j, Prime, n;
   cout << "Enter the value: ";
   cin >> num;

   for(i = 2; i <= num; i++){
      Prime = 0;
      for(j = 2; j <= i/2; j++)
         {
          if(i % j==0)
          {
             Prime = 1;
             break;
          }
      }
      if(Prime==0 && num!=1)
         cout<< i << " ";
   }
  return 0;
}
```

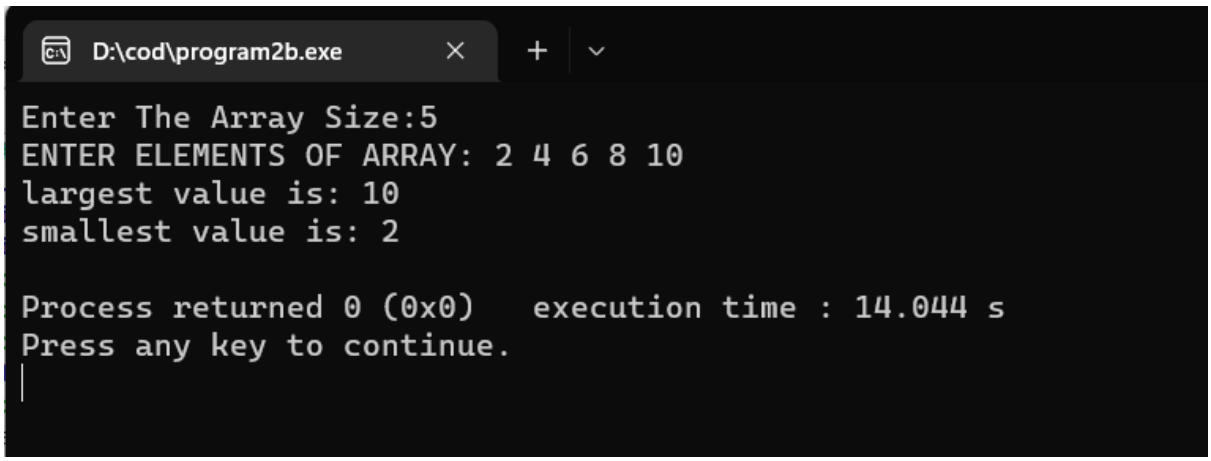
Output:


D:\cod\program2a.exe
Enter the value: 5
2 3 5
Process returned 0 (0x0)   execution time : 2.523 s
Press any key to continue.

b) Write a C++ program to find both the largest and smallest number in a list of integers.

```
#include<iostream>
using namespace std;
int main(){
int a[50],i,n,small,large;
cout<<"Enter The Array Size:";
cin>>n;
cout<<"ENTER ELEMENTS OF ARRAY: ";
for(i=0;i<n;i++)
cin>>a[i];
small=a[0];
large=a[0];
for(i=0;i<n;i++){
if(a[i]<small)
small=a[i];
if(a[i]>large)
large=a[i];
}
cout<<"largest value is: "<<large<<endl;
cout<<"smallest value is: "<<small<<endl;
return 0;
}
```

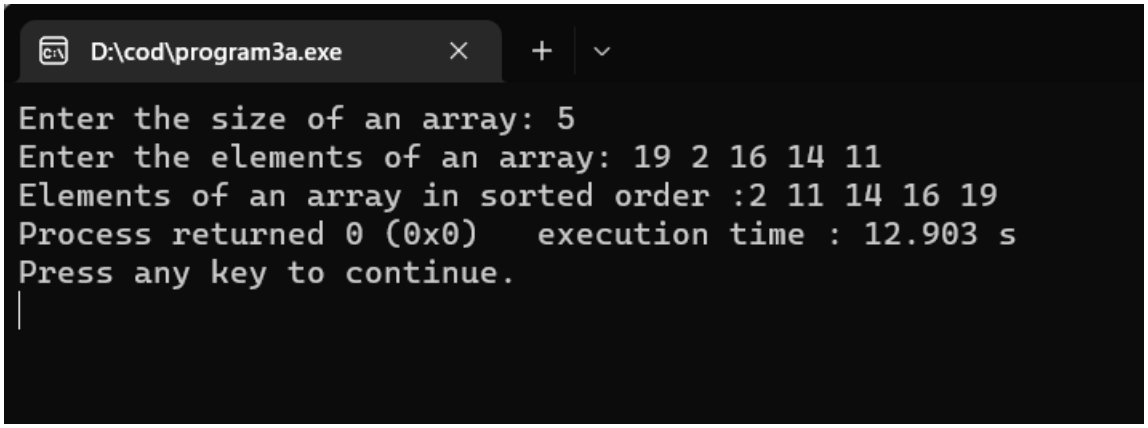
Output:


D:\cod\program2b.exe
Enter The Array Size:5
ENTER ELEMENTS OF ARRAY: 2 4 6 8 10
largest value is: 10
smallest value is: 2
Process returned 0 (0x0)   execution time : 14.044 s
Press any key to continue.

3. a) Write a C++ program to sort a list of numbers in ascending order.

```
#include <iostream>
using namespace std;
int main(){
int arr[100];
int size,i,j,temp;
cout<<"Enter the size of an array: ";
cin>>size;
cout<<"Enter the elements of an array: ";
for(i=0; i<size; i++){
cin>>arr[i];
}
for(i=0; i<size; i++){
for(j=i+1;j<size; j++){
if(arr[j]<arr[i]) {
temp = arr[i];
arr[i] = arr[j];
arr[j] = temp;
}
} }
cout<<"Elements of an array in sorted order :";
for(i=0;i<size;i++){
cout<<arr[i]<<" ";
}
return 0;
}
```

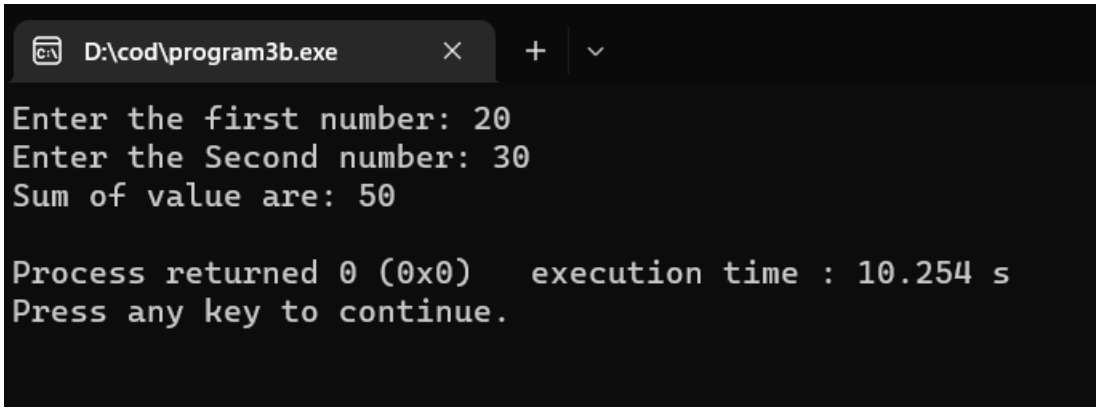
Output:


D:\cod\program3a.exe
Enter the size of an array: 5
Enter the elements of an array: 19 2 16 14 11
Elements of an array in sorted order :2 11 14 16 19
Process returned 0 (0x0)   execution time : 12.903 s
Press any key to continue.

b) Write a Program to illustrate New and Delete Keywords for dynamic memory allocation.

```
#include <iostream>
using namespace std;
int main(){
 int* p1,*p2,sum;
 p1 = new int;
 p2 = new int;
 cout<<"Enter the first number: ";
 cin>>*p1;
 cout<<"Enter the Second number: ";
 cin>>*p2;
 sum = *p1+*p2;
 cout<<"Sum of value are: "<<sum<<endl;
 delete p1;
 delete p2;
 return 0;
}
```

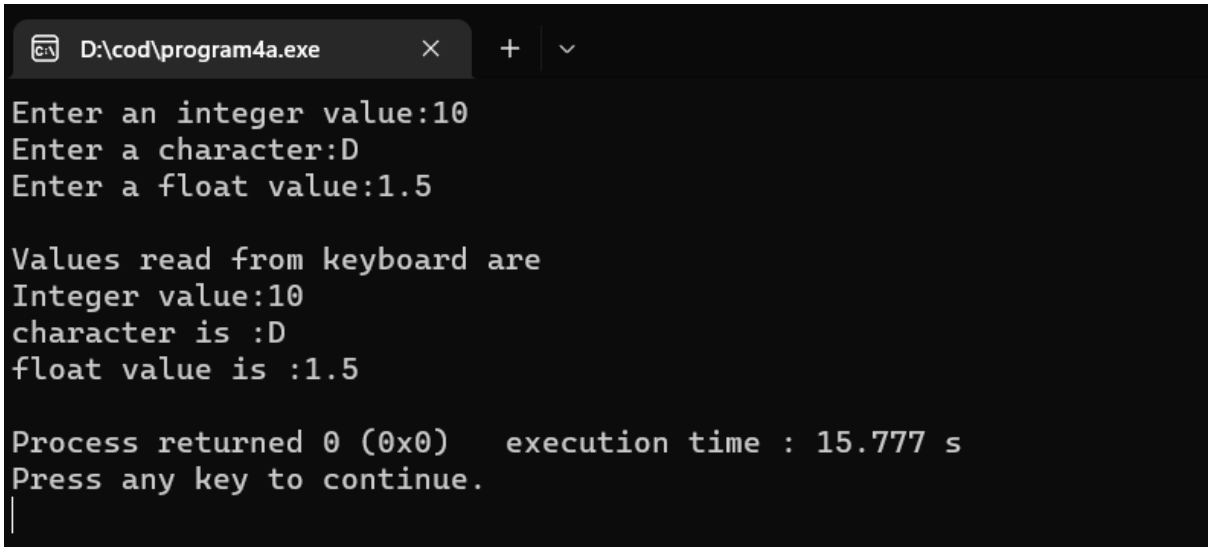
Output:


D:\cod\program3b.exe
Enter the first number: 20
Enter the Second number: 30
Sum of value are: 50
Process returned 0 (0x0)   execution time : 10.254 s
Press any key to continue.

4. a) Write a program Illustrating Class Declarations, Definition, and Accessing Class Members.

```
#include<iostream>
using namespace std;
class simple{
 private: int a;
 char b;
 float c;
 public:
 void get_data(){
 cout<<"Enter an integer value:";
 cin>>a;
 cout<<"Enter a character:";
 cin>>b;
 cout<<"Enter a float value:";
 cin>>c;
 }
 void print_data(){
 cout<<"\nValues read from keyboard are\n";
 cout<<"Integer value:"<<a<<endl;
 cout<<"character is :"<<b<<endl;
 cout<<"float value is :"<<c<<endl;
 }
};
int main(){
 simple s;
 s.get_data();
 s.print_data();
}
```

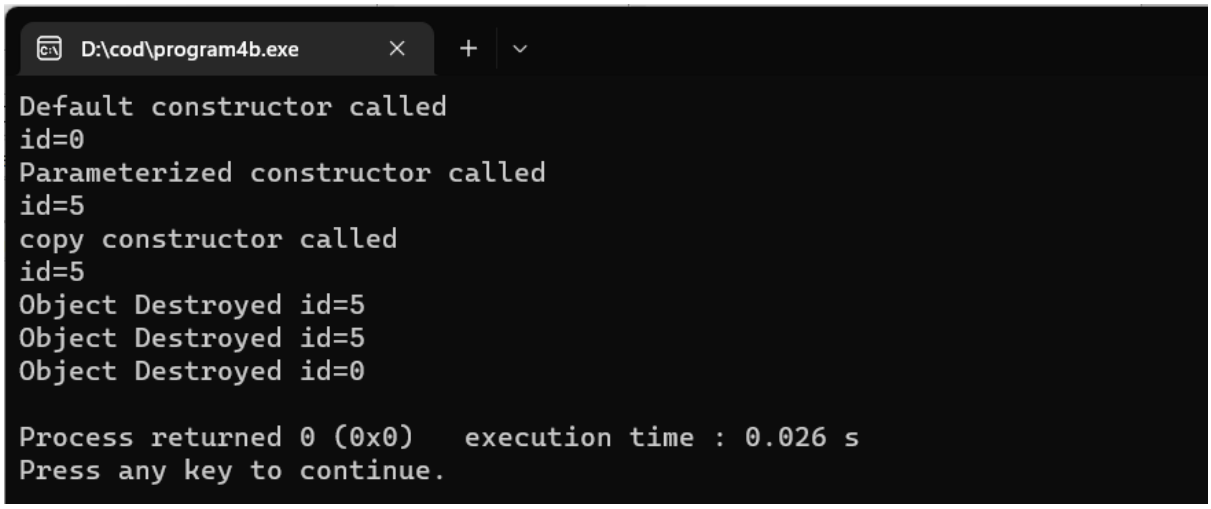
Output:


D:\cod\program4a.exe
Enter an integer value:10
Enter a character:D
Enter a float value:1.5
Values read from keyboard are
Integer value:10
character is :D
float value is :1.5
Process returned 0 (0x0)   execution time : 15.777 s
Press any key to continue.

4. b) Program to illustrate default constructor, parameterized constructor and copy constructors.

```
#include <iostream>
using namespace std;
class code {
 int id;
 int count;
 public: code () {
 cout << "Default constructor called\n";
 id = 0;
 cout << "id=" << id << endl;
 }
 code (int a) {
 cout << "Parameterized constructor called\n";
 id = a;
 cout << "id=" << id << endl;
 }
 code (code& x) {
 cout << "copy constructor called\n";
 id = x.id;
 cout << "id=" << id << endl;
 }
 ~code () {
 cout << "Object Destroyed "  ;
 cout << " id=" << id << endl;
 }
};
int main () {
 code d;
code a (5);
 code b=a;
 return 0;
}
```

Output:


D:\cod\program4b.exe
Default constructor called
id=0
Parameterized constructor called
id=5
copy constructor called
id=5
Object Destroyed id=5
Object Destroyed id=5
Object Destroyed id=0
Process returned 0 (0x0) execution time : 0.026 s
Press any key to continue.

4. c) Write a Program to Implement a Class STUDENT having Following Members:

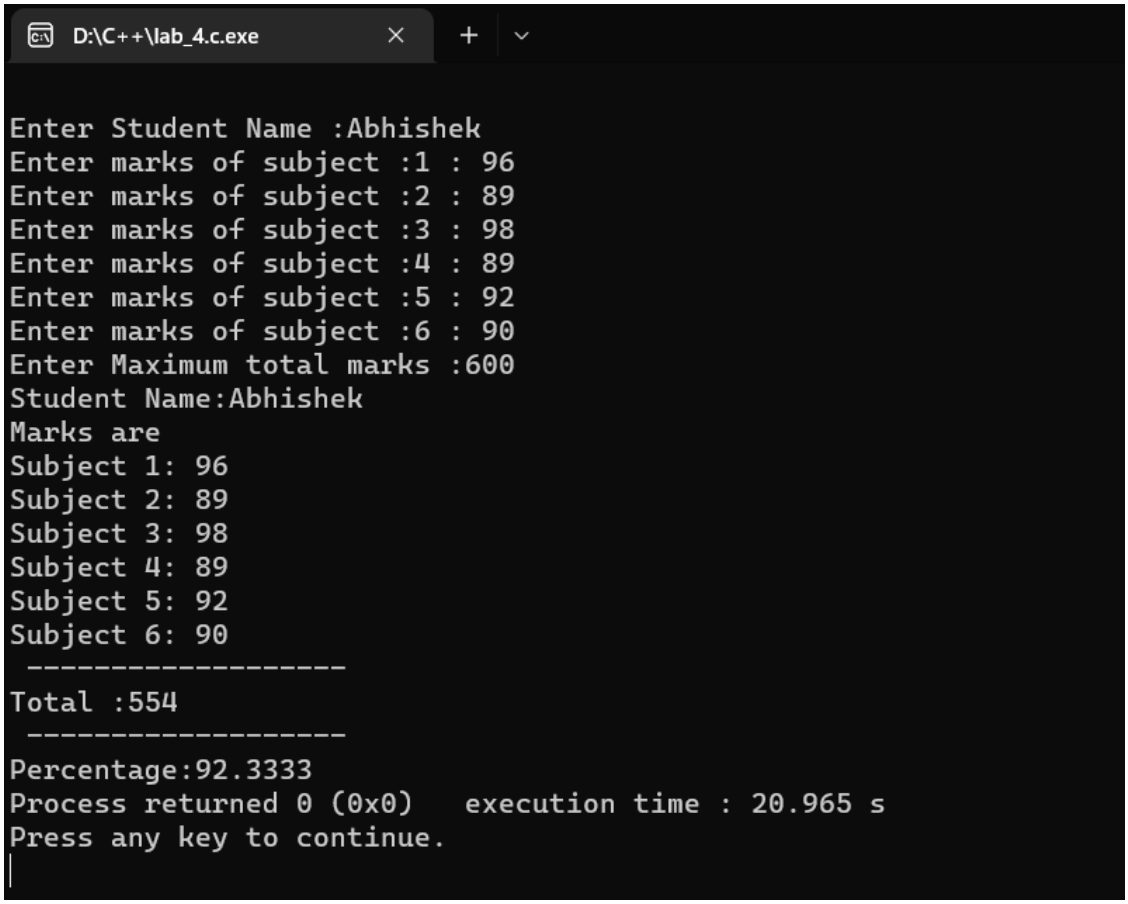
Member functions	**Member Description assign ()**
Member	**Description**
Sname	**Name of the student**
Marks	**array Marks of the student**
total	**Total marks obtained**
Tmax	**Total maximum marks**

Member functions	**Member Description**
assign ( )	**Assign Initial Values**
compute ( )	**to Compute Total, Average**
display ( )	**to Display the Data.**

```
#include<iostream>
using namespace std;
class student{
 char sname[50];
 float marks[6];
 float total;
 float max_marks;
 public: void assign();
 void compute();
 void display();
};
void student::assign(){
 cout<<endl<<"Enter Student Name :";
 cin>>sname;
 for(int i=0;i<6;i++){
 cout<<"Enter marks of subject :"<<i+1<<" : ";
 cin>>marks[i];
 }
 cout<<"Enter Maximum total marks :";
 cin>>max_marks;
}
void student::compute(){
 total=0;
 for(int i=0;i<6;i++)
 total+=marks[i];
}
void student::display(){
 cout<<"Student Name:"<<sname<<endl;
```

```
 cout<<"Marks are\n";
 for(int i=0;i<6;i++)
 cout<<"Subject "<<i+1<<": "<<marks[i]<<endl;
 cout<<" -------------------\n";
 cout<<"Total :"<<total<<endl;
 cout<<" -------------------\n";
 float per;
 per=(total/max_marks)*100;
 cout<<"Percentage:"<<per;
}
int main(){
 student obj;
 obj.assign();
 obj.compute();
 obj.display();
 return 0;
}
```

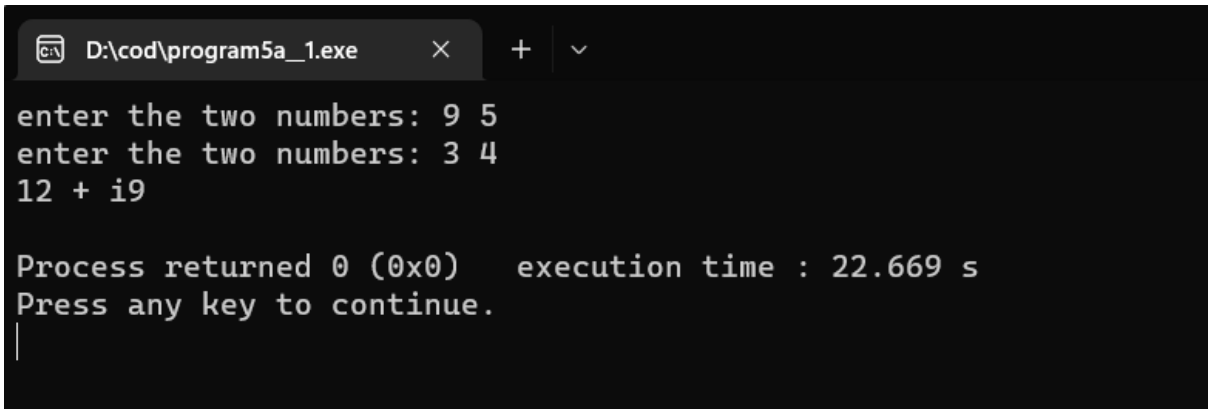
Output:


D:\C++\lab_4.c.exe
Enter Student Name :Abhishek
Enter marks of subject :1 : 96
Enter marks of subject :2 : 89
Enter marks of subject :3 : 98
Enter marks of subject :4 : 89
Enter marks of subject :5 : 92
Enter marks of subject :6 : 90
Enter Maximum total marks :600
Student Name:Abhishek
Marks are
Subject 1: 96
Subject 2: 89
Subject 3: 98
Subject 4: 89
Subject 5: 92
Subject 6: 90
Total :554
Percentage:92.3333
Process returned 0 (0x0) execution time : 20.965 s
Press any key to continue.

5. a) Write a Program to Demonstrate the
i) Operator Overloading.

```
#include<iostream>
using namespace std;
class Complex {
 private: int real, imag;
 public: Complex(int r = 0,int i = 0){
 real = r;
 imag = i;
 }
 Complex operator + (Complex obj){
 Complex res;
 res.real = real + obj.real;
 res.imag = imag + obj.imag;
 return res;
 }
 void print(){
 cout << real << " + i" << imag << '\n';
 }
};
int main(){
    int p,q,x,y;
    cout<<"enter the two numbers: ";
    cin>>p>>q;
    cout<<"enter the two numbers: ";
    cin>>x>>y;
    Complex c1(p, q),c2(x, y);
    Complex c3 = c1 + c2;
    c3.print();
}
```

Output:

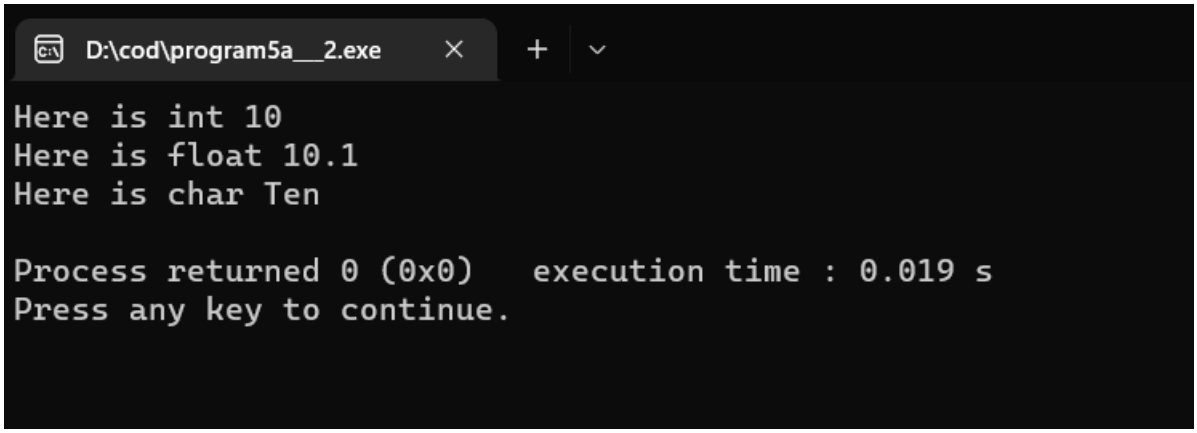

D:\cod\program5a_1.exe
enter the two numbers: 9 5
enter the two numbers: 3 4
12 + i9
Process returned 0 (0x0)   execution time : 22.669 s
Press any key to continue.

ii) Function Overloading.

```
#include <iostream>
using namespace std;
void print(int i)
{
 cout<<"Here is int "<<i<<endl;
}
void print(double f)
{
 cout<<"Here is float "<<f<<endl;
}
void print(char const *c)
{
 cout<<"Here is char "<<c<<endl;
}
int main(){

 print(10);
 print(10.10);
 print("Ten");
 return 0;
}
```

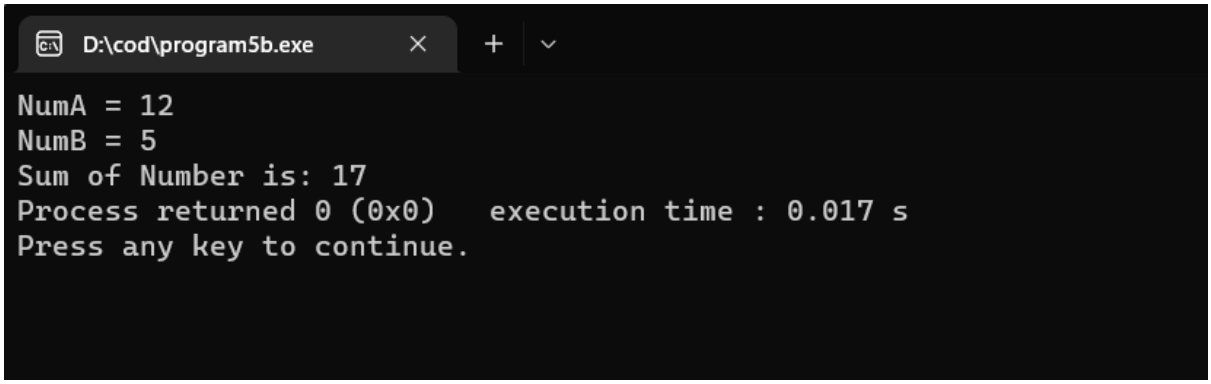
Output:


D:\cod\program5a__2.exe
Here is int 10
Here is float 10.1
Here is char Ten
Process returned 0 (0x0)   execution time : 0.019 s
Press any key to continue.

b) Write a Program to Demonstrate Friend Function and Friend Class.

```
#include <iostream>
using namespace std;
class ClassB;
class ClassA {
 private: int numA;
 friend class ClassB;
 public: ClassA(){
 numA = 12;
 }
};
class ClassB {
 private: int numB,sum;
 public: ClassB(){
 numB=5;
 sum=0;
 }
 void add(){
 ClassA objectA;
 cout<<"NumA = "<<objectA.numA<<endl;
 cout<<"NumB = "<<numB<<endl;
 sum= objectA.numA + numB;
 }
 friend int sum(ClassB);
};
int sum(ClassB b){
 cout<<"Sum of Number is: "<<b.sum;
}
int main(){
 ClassB objectB;
objectB.add();
 sum(objectB);
 return 0;
}
```

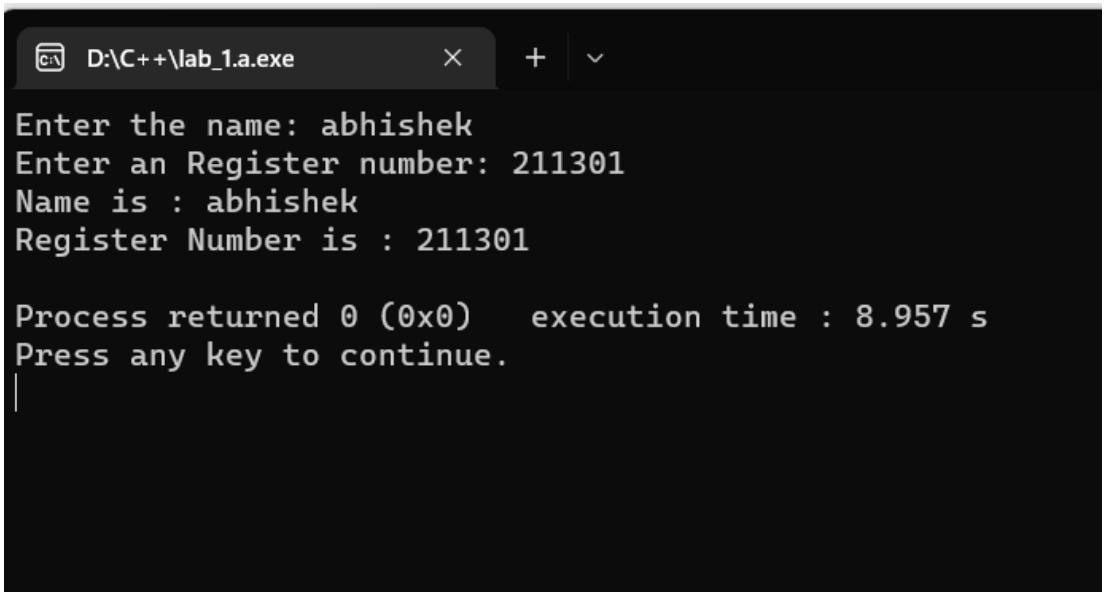
Output:


D:\cod\program5b.exe
NumA = 12
NumB = 5
Sum of Number is: 17
Process returned 0 (0x0)   execution time : 0.017 s
Press any key to continue.

6. a) Write a Program to Access Members of a STUDENT Class Using Pointer to Object Members.

```
#include <iostream>
using namespace std;
class Student{
private:
int Regno;
char name[20];
public: Student(){
Regno=0;
};
void inputRegno(){
cout<<"Enter the name: ";
cin>>name;
cout<<"Enter an Register number: ";
cin>>Regno;
}
void displayRegno(){
cout<<"Name is : "<<name<<endl;
cout<<"Register Number is : "<<Regno<<endl;
}
};
int main(){
Student S;
Student *ptr;
ptr = new Student; //creating & assigning memory
ptr->inputRegno();
ptr->displayRegno();
return 0;
}
```

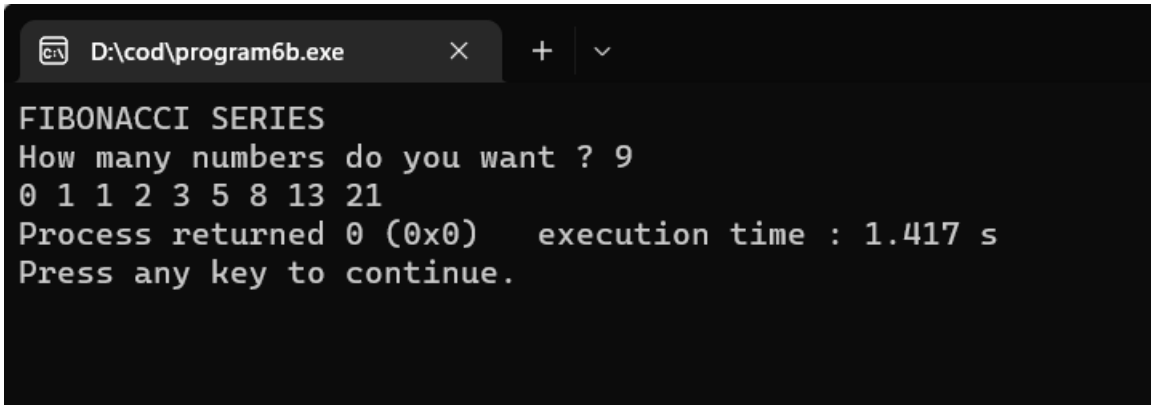
Output:


D:\C++\lab_1.a.exe
Enter the name: abhishek
Enter an Register number: 211301
Name is : abhishek
Register Number is : 211301
Process returned 0 (0x0)   execution time : 8.957 s
Press any key to continue.

b) Write a Program to Generate Fibonacci Series use Constructor to Initialize the Data Members.

```
#include <iostream>
using namespace std;
class fibonacci{
int n1,n2;
public:
fibonacci(){
n1 = 0; n2 = 1;
}
void series(int n){
int i,next;
cout << n1 << " " << n2 << " " ;
for(i=1; i <= n-2; i++){
next = n1 + n2;
cout << next << " " ;
n1 = n2;
n2 = next;
}
}
};
int main(){
fibonacci fib;
int n;
cout << "FIBONACCI SERIES " << endl ;
cout << "How many numbers do you want ? ";
cin >> n;
fib.series(n);
}
```

Output:


D:\cod\program6b.exe
FIBONACCI SERIES
How many numbers do you want ? 9
0 1 1 2 3 5 8 13 21
Process returned 0 (0x0)   execution time : 1.417 s
Press any key to continue.

7) Write a C++ program to implement the matrix ADT using a class. The operations supported by this ADT are:

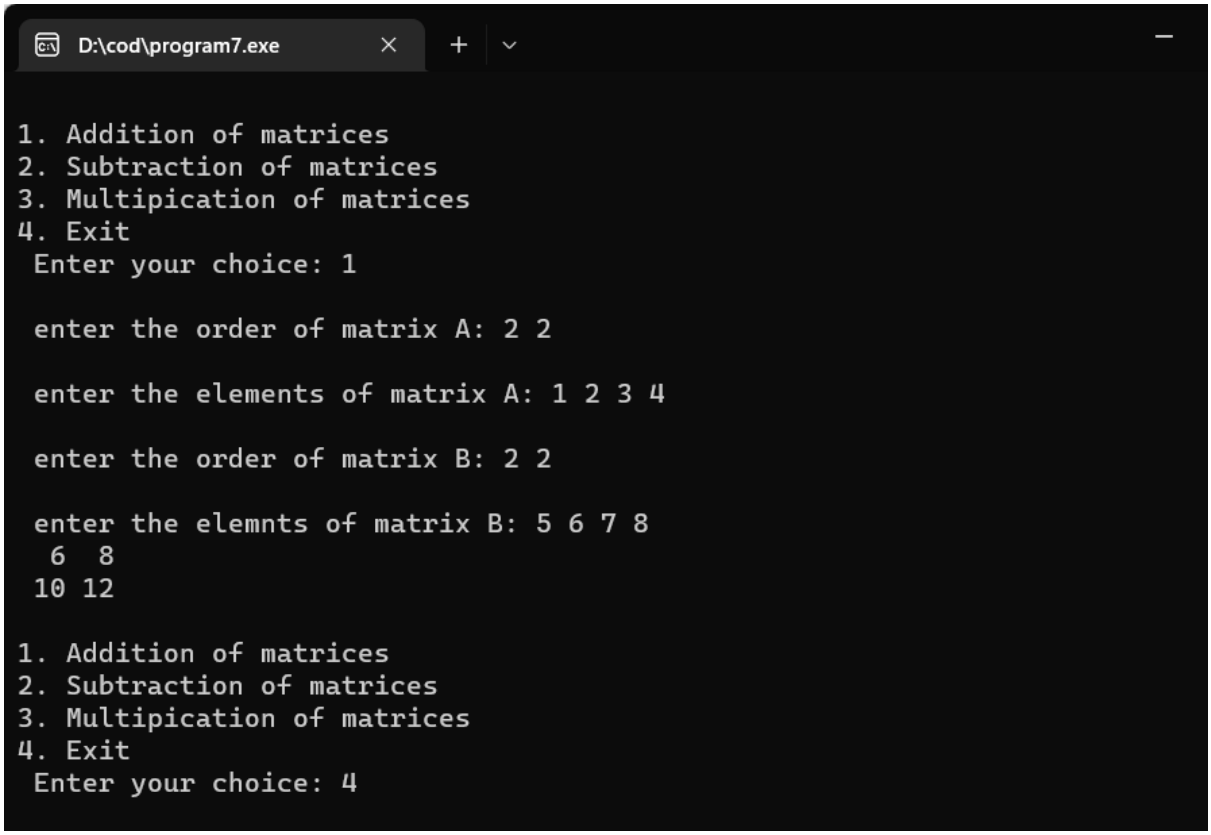
a) Reading a matrix. b) Addition of matrices. c) Printing a matrix. d) Subtraction of matrices.
e) Multiplication of matrices.

```
#include<iostream>
#include<iomanip>
using namespace std;
class matrix{
protected: int i,j,a[10][10],b[10][10],c[10][10];
int m1,n1,m2,n2;
public: virtual void read()=0;
virtual void display()=0;
virtual void sum()=0;
virtual void sub()=0;
virtual void mult()=0;
};
class result:public matrix{
public: void read();
void sum();
void sub();
void mult();
void display();
};
void result :: read(){
cout<<"\n enter the order of matrix A: ";
cin>>m1>>n1;
cout<<"\n enter the elements of matrix A: ";
for(i=0;i<m1;i++){
for(j=0;j<n1;j++){
cin>>a[i][j];
}
}
cout<<"\n enter the order of matrix B: ";
cin>>m2>>n2;
cout<<"\n enter the elemnts of matrix B: ";
for(i=0;i<m2;i++){
for(j=0;j<n2;j++){
cin>>b[i][j];
}
}
}
void result :: display(){
for(i=0;i<m1;i++){
```

```
for(j=0;j<n1;j++){
cout.width(3);
cout<<c[i][j];
}
cout<<"\n";
}
}
void result::sum(){
if((m1!=m2)||(n1!=n2)) {
cout<<"the order should be same for addition";
}
else{
for(i=0;i<m1;i++){
for(j=0;j<n1;j++){
c[i][j]=a[i][j]+b[i][j];
}
}
}
}
void result::sub(){
if((m1!=m2)||(n1!=n2)) {
cout<<"the order should be same for subtraction ";
}
else{
for(i=0;i<m1;i++){
for(j=0;j<n1;j++){
c[i][j]=a[i][j]-b[i][j];
}
}
}
}
void result::mult(void){
if(n2!=m2) {
cout<<"Invalid order limit ";
}
else{
for(i=0;i<m1;i++){
for(j=0;j<n2;j++){
c[i][j]=0;
for(int k=0;k<n1;k++){
c[i][j]+=a[i][k]*b[k][j];
}
}
}
}
}
int main(){
```

```
int ch;
class matrix *p;
class result r;
p=&r;
while(1) {
cout<<"\n1. Addition of matrices ";
cout<<"\n2. Subtraction of matrices ";
cout<<"\n3. Multipication of matrices ";
cout<<"\n4. Exit";
cout<<"\n Enter your choice: ";
cin>>ch;
switch(ch) {
case 1:p->read();
p->sum();
p->display();
break;
case 2:(p)->read();
p->sub();
p->display();
break;
case 3:p->read();
p->mult();
p->display();
break;
case 4:exit(0);
}
}
}
```

Output:

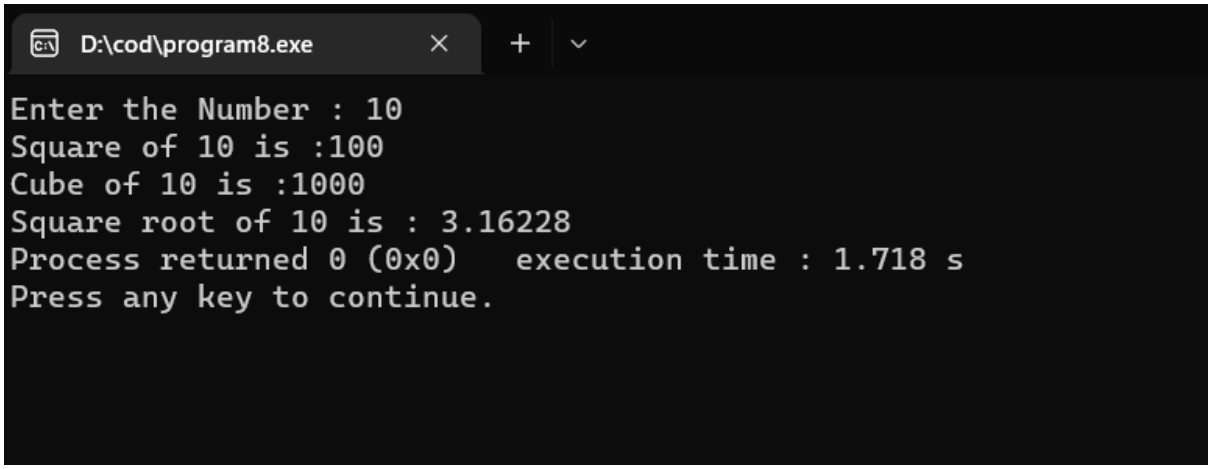

D:\cod\program7.exe
1. Addition of matrices
2. Subtraction of matrices
3. Multipication of matrices
4. Exit
Enter your choice: 1
enter the order of matrix A: 2 2
enter the elements of matrix A: 1 2 3 4
enter the order of matrix B: 2 2
enter the elemnts of matrix B: 5 6 7 8
6 8
10 12
1. Addition of matrices
2. Subtraction of matrices
3. Multipication of matrices
4. Exit
Enter your choice: 4

8) Write C++ programs that illustrate how the following forms of inheritance are supported: a)Single inheritance b)Multiple inheritance c)Multi level inheritance d)Hierarchical inheritance.

```
#include<iostream>
#include<cmath>
using namespace std;
class top{
 public : int a;
 void getdata(){
 cout<<"Enter the Number : ";
 cin>>a;
 }
};
class middle :public top{ //single inheritance
 public: int b;
 void square(){
 getdata();
 b=a*a;
 cout<<"Square of "<<a<<" is :"<<b;
 }
};
class bottom :public middle{ //Multi level inheritance
 public: int c;
 void cube(){
 square();
 c=b*a;
 cout<<"\nCube of "<<a<<" is :"<<c;
 }
};
class Squareroot{
 public :int num;
 void root(int num){
 cout<<"\nSquare root of "<<num<<" is : "<<sqrt(num);
 }
};
class result: public Squareroot,public bottom{ //Multiple inheritance
 public: int x;
 void display(){
 cube();
 x = a;
 root(x);
 }
};
int main(){
 result b1;
```

```
 b1.display();
 return 0;
}
```

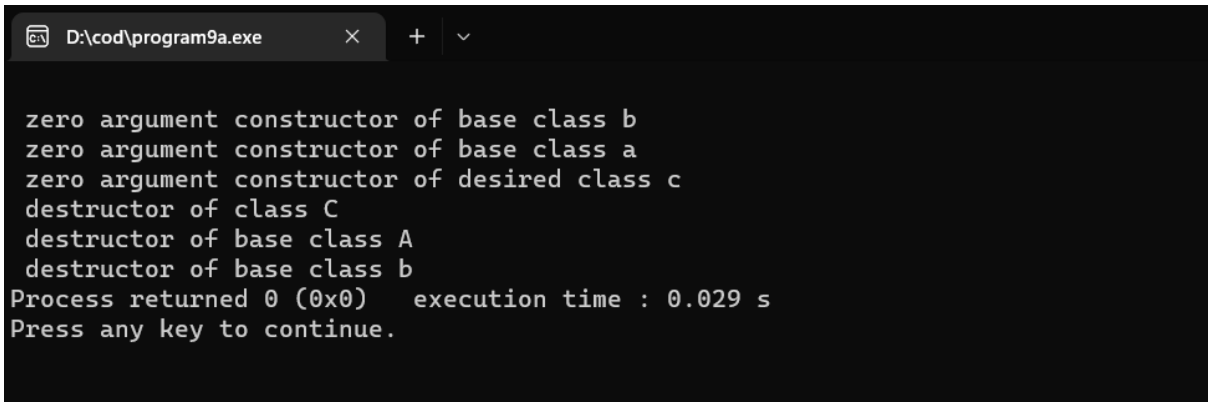
Output:


D:\cod\program8.exe
Enter the Number : 10
Square of 10 is :100
Cube of 10 is :1000
Square root of 10 is : 3.16228
Process returned 0 (0x0)   execution time : 1.718 s
Press any key to continue.

9. a) Write a C++ program that illustrates the order of execution of constructors and destructors when new class derived from more than one base class.

```
#include<iostream>
using namespace std;
class A{
public:A(){
cout<<"\n zero argument constructor of base class a";
}
~A(){
cout<<"\n destructor of base class A";
}
};
class B{
public:B(){
cout<<"\n zero argument constructor of base class b";
}
~B(){
cout<<"\n destructor of base class b";
}
};
class C:public B,A{
public:C(){
cout<<"\n zero argument constructor of desired class c";
}
~C(){
cout<<"\n destructor of class C";
}
};
int main()
{
C obj;
}
```

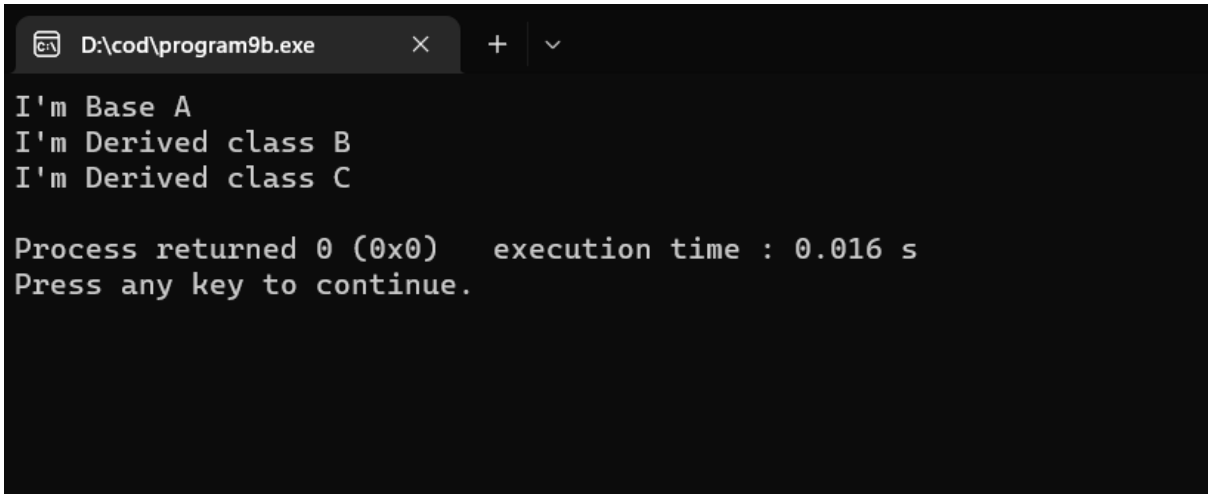
Output:


D:\cod\program9a.exe
zero argument constructor of base class b
zero argument constructor of base class a
zero argument constructor of desired class c
destructor of class C
destructor of base class A
destructor of base class b
Process returned 0 (0x0) execution time : 0.029 s
Press any key to continue.

b) Write a Program to Invoking Derived Class Member Through Base Class Pointer.

```
#include
<iostream>
using namespace
std;
class A{
public: virtual
void print_me() {
cout<< "I'm Base
A" <<endl;
}
};
class B : public
A{
public: void
print_me(){
cout<< "I'm
Derived class
B"<<endl;
}
};
class C : public
A{
public: void
print_me(){
cout<< "I'm
Derived class C"
<<endl;
}
};
int main(){
A a;
B b;
C c;
A* p = &a;
p->print_me();
p = &b;
p->print_me();
p = &c;
p->print_me();
return 0;
}
```

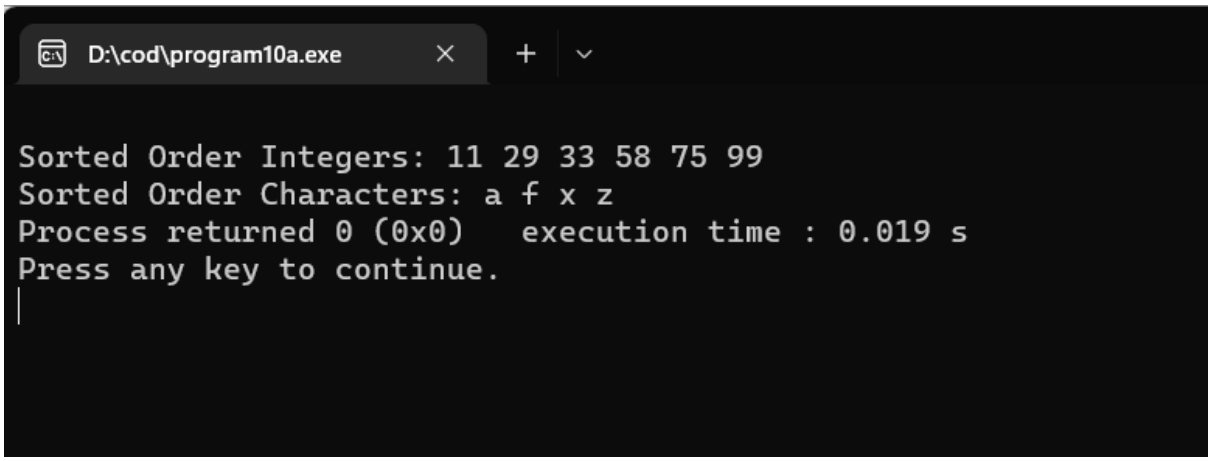
Output:


D:\cod\program9b.exe
I'm Base A
I'm Derived class B
I'm Derived class C
Process returned 0 (0x0)   execution time : 0.016 s
Press any key to continue.

10. a) Write a Template Based Program to Sort the Given List of Elements.

```
#include<iostream>
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]={99,58,75,33,29,11};
 char b[4]={'z','f','x','a'};
 bubble(a,6);
 cout<<"\nSorted Order Integers: ";
 for(int i=0;i<6;i++)
 cout<<a[i]<<" ";
 bubble(b,4);
 cout<<"\nSorted Order Characters: ";
 for(int j=0;j<4;j++)
 cout<<b[j]<<" ";
}
```

Output:

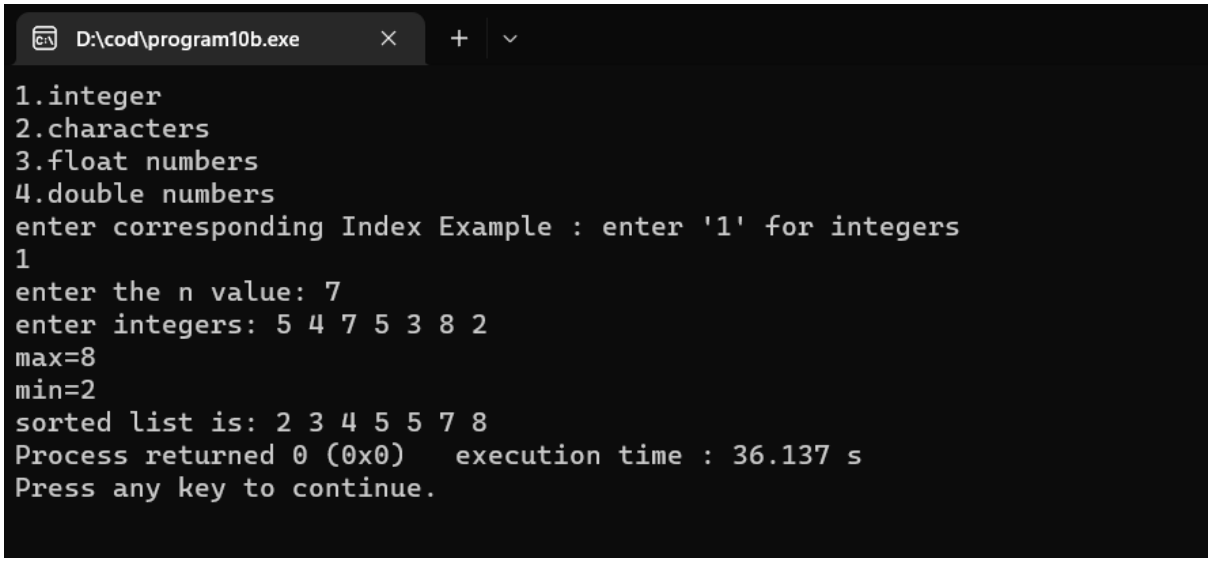

D:\cod\program10a.exe
Sorted Order Integers: 11 29 33 58 75 99
Sorted Order Characters: a f x z
Process returned 0 (0x0)   execution time : 0.019 s
Press any key to continue.

b) 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>
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";
 cout<<"sorted list is: ";
 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;
 cout<<"enter the n value: ";
 cin>>n;
 switch(ch){
 case 1:cout<<"enter integers: ";
 for(i=0;i<n;i++)
 cin>>a[i];
 maxmin(a,n);
 break;
 case 2: cout<<"enter characters: ";
 for(i=0;i<n;i++)
 cin>>c[i];
 maxmin(c,n);
```

```
 break;
 case 3: cout<<"enter floatnumbers: ";
 for(i=0;i<n;i++)
 cin>>f[i];
 maxmin(f,n);
 break;
 case 4: cout<<"enter doublenumbers: ";
 for(i=0;i<n;i++)
 cin>>d[i];
 maxmin(d,n);
 break;
 default:cout<<"Invalid choice entered...";
 }
 return 0;
}
```

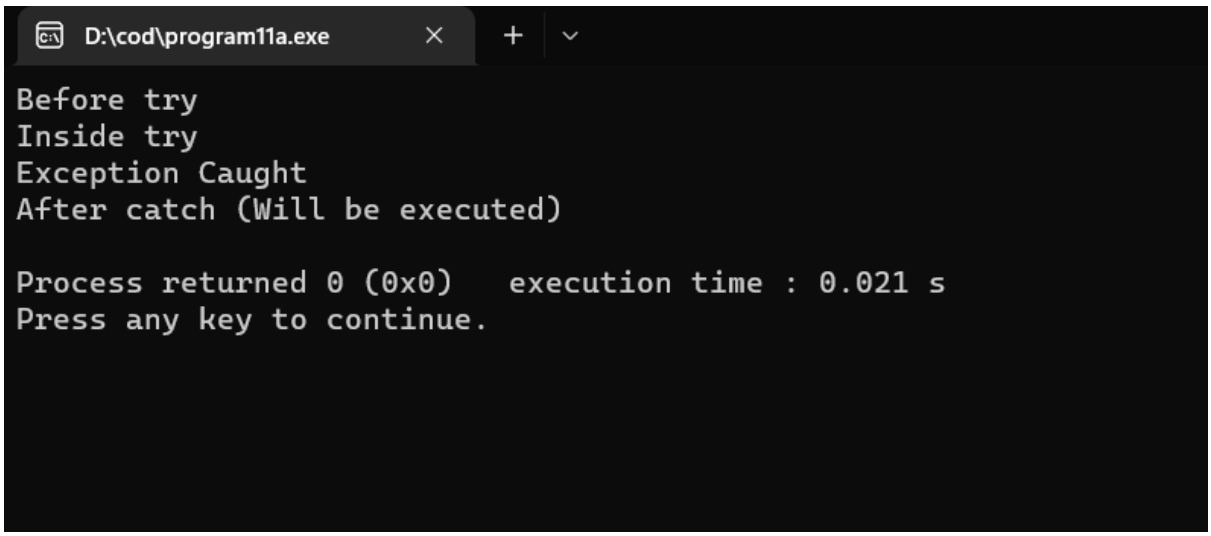
Output:


D:\cod\program10b.exe
1.integer
2.characters
3.float numbers
4.double numbers
enter corresponding Index Example : enter '1' for integers
1
enter the n value: 7
enter integers: 5 4 7 5 3 8 2
max=8
min=2
sorted list is: 2 3 4 5 5 7 8
Process returned 0 (0x0)   execution time : 36.137 s
Press any key to continue.

11. a) Write a Program Containing a Possible Exception. Use a Try Block to Throw it and a Catch Block to Handle it Properly.

```
#include <iostream>
using namespace std;
int main(){
 int x = -1;
 cout << "Before try \n";
 try {
 cout << "Inside try \n";
 if (x < 0){
 throw x;
 cout << "After throw (Never executed) \n";
 }
 }
 catch (int x ) {
 cout << "Exception Caught \n";
 }
 cout << "After catch (Will be executed) \n";
 return 0;
}
```

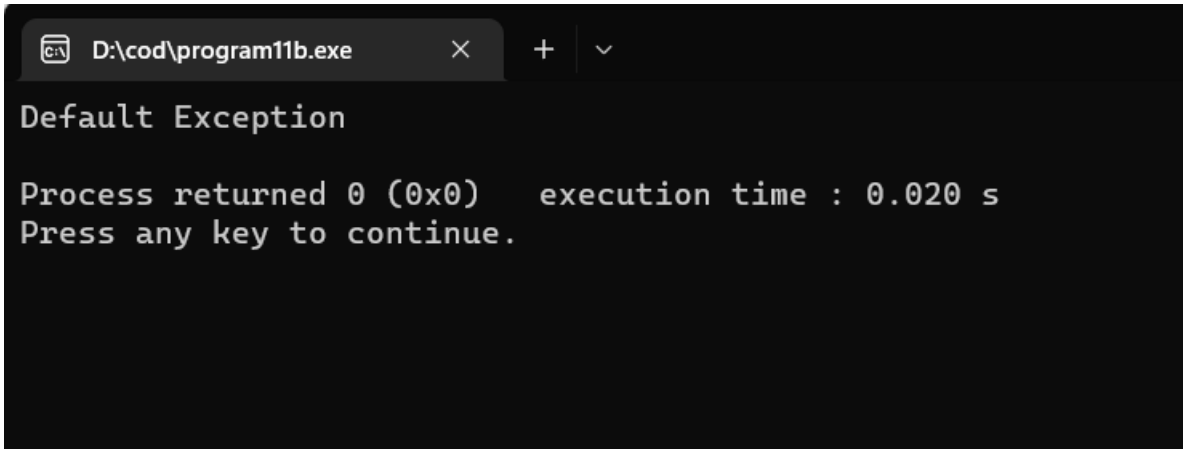
Output:


D:\cod\program11a.exe
Before try
Inside try
Exception Caught
After catch (Will be executed)
Process returned 0 (0x0)   execution time : 0.021 s
Press any key to continue.

b) Write a Program to Demonstrate the Catching of All Exceptions.

```
#include <iostream>
using namespace std;
int main(){
 try {
 throw 10;
 }
 catch (char excp){
 cout << "Caught " << excp;
 }
 catch (...){
 cout << "Default Exception\n";
 }
 return 0;
}
```

Output:


D:\cod\program11b.exe
Default Exception
Process returned 0 (0x0)   execution time : 0.020 s
Press any key to continue.