SHARADCHANDRA PAWAR COLLEGE OF ENGINEERING

Otur, Pune

Department of Computer Engineering

LABORATORY MANUAL(2019 PATTERN)

2021-2022

OBJECT ORIENTED PROGRAMMING LABORATORY

SE-COMPUTER ENGINEERING

SEMESTER-I

Subject Code: **210247**

TEACHING SCHEME	EXAMINATION SCHEME
Lectures: 4Hrs/Week	Practical: 25 Marks
Practical: 2 Hrs/Week	Term Work: 25 Marks

-: Name of Faculty: -

PUJA GHOLAP

SPCOE, OTUR

INDEX

GROUP A

Group C

	defined records such as Item records (Item code, name, cost, quantity etc) using vector container.	
7	Write a program in C++ to use map associative container. The keys will be the names of states and the values will be the populations of the states. When the program runs, the user is prompted to type the name of a state. The program then looks in the map, using the state name as an index and returns the population of the state.	

GROUP A

Assignment No.	1 (GROUP A)
Title	Arithmetic operations on complex numbers using operator overloading.
Subject	Object Oriented Programming
Class	SE COMPUTER
Roll No.	
Date	
Signature	

Assignment No: 1

Title: Arithmetic operations on complex numbers using operator overloading.

Problem Statement: Implement a class Complex which represents the Complex Number data type. Implement the following operations:
1. Constructor (including a default constructor which creates the complex number 0+0i).
2. Overloaded **operator+** to add two complex numbers.
3. Overloaded **operator*** to multiply two complex numbers.
4. Overloaded << and >>to print and read Complex Numbers.

Prerequisites:

Object Oriented Programming

Objectives:

To learn the concept of constructor, default constructor, operator overloading using member function and friend function.

Theory:

Operator Overloading

It is a specific case of polymorphism where different operators have different implementations depending on their arguments. In C++ the overloading principle applies not only to functions, but to operators too. That is, of operators can be extended to work not just with built-in types but also classes. A programmer can provide his or her own operator to a class by overloading the built-in operator to perform some specific computation when the operator is used on objects of that class.

An Example of Operator Overloading

Complex a(1.2,1.3); *//this class is used to represent complex numbers*

Complex b(2.1,3); *//notice the construction taking 2 parameters for the real and imaginary part*

Complex c = a+b; *//for this to work the addition operator must be overloaded*

Arithmetic Operators

Arithmetic Operators are used to do basic arithmetic operations like addition, subtraction, multiplication, division, and modulus.

The following table list the arithmetic operators used in C++.

Operator	Action
+	Addition
-	Subtraction
*	Multiplication
/	Division
%	Modulus

With C++ feature to overload operators, we can design classes able to perform operations using standard operators. Here is a list of all the operators that can be overloaded:

Over loadable operators
+ - * / = <> += -= *= /= <<>>
<<= >>= == != <= >= ++ -- % & ^ ! |
~ &= ^= |= && || %= []

- To overload an operator in order to use it with classes we declare *operator functions*, which are regular functions whose names are the operator keyword followed by the operator sign that we want to overload. The format is:
- type operator operator-symbol (parameters) {/*...*/ }
- The **operator** keyword declares a function specifying what *operator-symbol* means when applied to instances of a class. This gives the operator more than one meaning, or "overloads" it. The compiler distinguishes between the different meanings of an operator by examining the types of its operands.

Syntax:

return_typeclass_name :: operator op(arg_list)

{

//function body

}

where,

- Return type is the value returned by the specified operation
- op is the operator to be overload.
- op is proceeding by the keyword operator.
- operator op is the function name

Process of the overloading has 3 steps

1. Create a class that define a data types that is used in the overloading operation
2. Declare the operator function operator op() in the public part of the class.

It may be either a member function or a friend function.

3. Define the operator function to implement the required operation

e.g.

Overloading Binary operators:

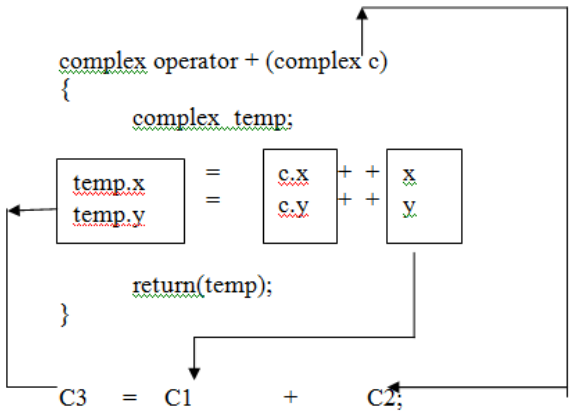
A statement like

C = sum (A, B); // functional notation

This functional notation can be replaced by a natural looking expression

C = A+B; // arithmetic notation

by overloading the + operator using an operator+ () function.



Facilities:

Linux Operating Systems, G++

Algorithm:

Step 1: Start the program

Step 2: Create a class complex

Step 3: Define the default constructor.

Step 4: Declare the operator function which are going to be overloaded and display function

Step 5: Define the overloaded functions such as +, -,/,* and the display function

For Addition:

(a+bi) + (x + yi) = ((a+x)+(b+y)i)

For Multiplication:

(a+bi) * (x + yi) = (((a*x)-(b*y)) + ((a*y) + (x*b))i)

Step 6: Create objects for complex class in main() function

Step 7:Create a menu for addition, multiplication of complex numbersand display the result

Step 8: Depending upon the choice from the user the arithmetic operators will invoke the overloaded operator automatically and returns the result

Step 9: Display the result using display function.

Input:

Complex numbers with real and imaginary values for two complex numbers.

Example :

Complex No 1: Real Part : 5

Imaginary part : 4

Complex No 2: Real Part : 5

Imaginary part : 4

Output:

Default constructor value=0+0i

Enter the 1st number
Enter the real part2
Enter the imaginary part4

Enter the 2nd number
Enter the real part4
Enter the imaginary part8

The first number is 2+4i
The second number is 4+8i

The addition is 6+12i

The multiplication is -24+32i

Conclusion:

Hence, we have studied concept of operator overloading.

Questions:

1. What is operator overloading?
2. What are the rules for overloading the operators?
3. State clearly which operators are overloaded and which operator are not overloaded?
4. State the need for overloading the operators.
5. Explain how the operators are overloaded using the friend function.
6. What is the difference between “overloading” and “overriding”?
7. What is operator function? Describe the syntax?
8. When is Friend function compulsory? Give an example?

Assignment No.	2 (GROUP A)
Title	Personnel information system using constructor, destructor, static member functions, friend class, this pointer, inline code and dynamic memory allocation.
Subject	Object Oriented Programming
Class	SE COMPUTER
Roll No.	
Date	
Signature	

Assignment No:2

Title: Personnel information system using constructor, destructor, static member functions, friend class, this pointer, inline code and dynamic memory allocation.

Problem Statement: Develop an object oriented program in C++ to create a database of the personnel information system containing the following information: Name, Date of Birth, Blood group, Height, Weight, Insurance Policy, number, Contact address, telephone number, driving license no. etc Construct the database with suitable member functions for initializing and destroying the data viz constructor, default constructor, copy, destructor, static member functions, friend class, this pointer, inline code and dynamic memory allocation operators-new and delete as well as exception handling

Prerequisites:

Object Oriented Programming

Objectives:

To learn the concept of constructor, default constructor, copy, destructor, static member functions, friend class, this pointer, inline code and dynamic memory allocation operators-new and delete.

Theory:

Constructor:

A special method of the class that will be automatically invoked when an instance of the class is created is called as constructor. Following are the most useful features of constructor.

1) Constructor is used for Initializing the values to the data members of the Class.
2) Constructor is that whose name is same as name of class.
3) Constructor gets Automatically called when an object of class is created.
4) Constructors never have a Return Type even void.
5) Constructor is of Default, Parameterized and Copy Constructors.

The various types of Constructor are as follows: -

Constructors can be classified into 3 types

1. Default Constructor
2. Parameterized Constructor
3. Copy Constructor

1. **Default Constructor: -** Default Constructor is also called as Empty Constructor which has no arguments and It is Automatically called when we create the object of class but Remember name of Constructor is same as name of class and Constructor never declared with the help of Return Type. Means we can't declare a Constructor with the help of void Return Type., if we never Pass or declare any Arguments then this called as the Copy Constructors.

2. Pa**rameterized Constructor: -** This is another type constructor which has some Arguments and same name as class name but it uses some Arguments So For this, we have to create object of Class by passing some Arguments at the time of creating object with the name of class. When we pass some Arguments to the Constructor then this will automatically pass the Arguments to the Constructor and the values will retrieve by the Respective Data Members of the Class.

3. **Copy Constructor: -** This is also another type of Constructor. In this Constructor we pass the object of class into the Another Object of Same Class. As name Suggests you Copy, means Copy the values of one Object into the another Object of Class .This is used for Copying the values of class object into an another object of class So we call them as Copy Constructor and For Copying the values We have to pass the name of object whose values we wants to Copying and When we are using or passing an Object to a Constructor then we must have to use the & Ampersand or Address Operator.

Destructor: As we know that Constructor is that which is used for Assigning Some Values to data Members and For Assigning Some Values this May also used Some Memory so that to free up the Memory which is Allocated by Constructor, destructor is used which gets Automatically Called at the End of Program and we doesn't have to Explicitly Call a Destructor and Destructor Can't be Parameterized or a Copy This can be only one Means Default Destructor which Have no Arguments. For Declaring a Destructor, we have to use ~tiled Symbol in front of Destructor.

Static members

A class can contain static members, either data or functions.

A static member variable has following properties:

- It is initialized to zero when the first object of its class is created. No other initialization is permitted.
- Only one copy of that member is created for the entire class and is shared by all the objects of that class.
- It is the visible only within the class but its lifetime is the entire program.

Static data members of a class are also known as "class variables", because there is only one unique value for all the objects of that same class. Their content is not different from one object static members have the same properties as global variables but they enjoy class scope. For that reason, and to avoid them to be declared several times, we can only include the prototype (its declaration) in the class declaration but not its definition (its initialization). In order to initialize a static data-member we must include a formal definition outside the class, in the global scope of this class to another. Because it is a unique variable value for all the objects of the same class, it can be referred to as a member of any object of that class or even directly by the class name (of course this is only valid for static members.

A static member function has following properties

- A static function can have access to only other static members (fun or var) declared in the same class
- A static function can be called using the class name instead of its object name

Class_name :: fun_name;

Static member functions are considered to have class scope. In contrast to non static member functions, these functions have no implicit this argument; therefore, they can use only static data members, enumerators, or nested types directly. Static member functions can be accessed without using an object of the corresponding class type.

The following restrictions apply to such static functions:

1. They cannot access non static class member data using the member-selection operators (. or –>).
2. They cannot be declared as virtual.
3. They cannot have the same name as a non-static function that has the same argument types.

E.g. // static members in classes

```
class StaticTest {
 private: static int x;
 public: static int count()
                        { return x;
                          }
                 };
intStaticTest::x = 9;
```

```
int main()
 {
printf_s("%d\n", StaticTest::count());
 }
```

Output

```
9
```

Friend functions:

In principle, private and protected members of a class cannot be accessed from outside the same class in which they are declared. However, this rule does not affect friends. Friends are functions or classes declared as such. If we want to declare an external function as friend of a class, thus allowing this function to have access to the private and protected members of this class, we do it by declaring a prototype of this external function within the class, and preceding it with the keyword friend.

Properties of friend function:

- It is not in the scope of the class to which it has been declared as friend.
- Since it is not in the scope of the class , it cannot be called using the object of that class
- It can be invoked like a normal function w/o the help of any object.
- It can be declared in private or in the public part of the class.
- Unlike member functions, it cannot access the member names directly and has to use an object name and dot operator with each member name.

```
// friend functions
#include <iostream>
using namespace std;

class CRectangle {
int width, height;
public:
   void set_values (int, int);
int area () {return (width * height);}
   friend CRectangle duplicate (CRectangle);
};

void CRectangle::set_values (int a, int b) {
  width = a;
```

```
  height = b;
}
CRectangle duplicate (CRectanglerectparam)
{
CRectanglerectres;
rectres.width = rectparam.width*2;
rectres.height = rectparam.height*2;
return (rectres);
}

int main () {
CRectanglerect, rectb;
rect.set_values (2,3);
rectb = duplicate (rect);
cout<<rectb.area();
return 0;
}
```

The duplicate function is a friend of CRectangle. From within that function we have been able to access the members width and height of different objects of type CRectangle, which are private members. Notice that neither in the declaration of duplicate() nor in its later use in main() have we considered duplicate a member of class CRectangle.

Friend classes

Just as we have the possibility to define a friend function, we can also define a class as friend of another one, granting that second class access to the protected and private members of the first one.

```
// friend class
#include <iostream>
using namespace std;
class CSquare;
class CRectangle
 {
int width, height;
  public:
int area ()
     {return (width * height);}
```

```
    void convert (CSquare a);
};

class CSquare {
  private:
int side;
  public:
    void set_side (int a)
      {side=a;}
    friend class CRectangle;
};

void CRectangle::convert (CSquare a) {
  width = a.side;
  height = a.side;
}

int main () {
CSquaresqr;
CRectanglerect;
sqr.set_side(4);
rect.convert(sqr);
cout<<rect.area();
return 0;
}
```

In this example, we have declared CRectangle as a friend of CSquare so that CRectangle member functions could have access to the protected and private members of CSquare, more concretely to CSquare::side, which describes the side width of the square..

Pointers:

A pointer is a derived data type that refers to another data variable by storing the variables memory address rather than data.

Declaration of pointer variable is in the following form :

```
Data_type * ptr_var;
```

Eg int *ptr;

Here ptr is a pointer variable and points to an integer data type.

We can initialize pointer variable as follows

```
int a, *ptr;  // declaration
ptr = &a    //initialization
```

Pointers to objects:

Consider the following eg

```
item X;                    // where item is class and X is object
```

Similarly we can define a pointer it_ptr of type item as follows

```
Item  *it_ptr ;
```

Object pointers are useful in creating objects at runtime. We can also access public members of the class using pointers.

```
Eg    item X;
      item  *ptr = &X;
```

the pointer 'ptr 'is initialized with address of X.

we can access the member functions and data using pointers as follows

```
ptr->getdata();
ptr->show();
```

this pointer:

C++ uses a unique keyword called this to represent an object that invokes a member function. thisis a pointer that points to the object for which this function was called. This unique pointer is automatically passed to a member function when it is called.

Important notes on this pointer:

- this pointer stores the address of the class instance, to enable pointer access of the members to the member functions of the class.
- this pointer is not counted for calculating the size of the object.
- this pointers are not accessible for static member functions.
- this pointers are not modifiable.

Facilities:

Linux Operating Systems, G++

Algorithm:

1. Start
2. Read personnel information such as Name, Date of Birth, Blood group, Height, Weight, Insurance Policy, number, Contact address, telephone number, driving license no..

3. Print all information from database.
4. Stop

Input:

Personnel information such as Name, Date of Birth, Blood group, Height, Weight, Insurance Policy, number, contact address, telephone number, driving license no.

Output:

Display personnel information from database. The result in following format:

	Name	DOB	…….	Driving License No
1				
2				
.				
.				
.				
N				

Conclusion:

Hence, we have successfully studied concept of constructor, default constructor, copy constructor, destructor, static member functions, friend class, this pointer, inline code and dynamic memory allocation operators-new and delete.

Questions:

1. What is static Function?
2. What is friend function? State the advantage of using the friend function.
3. What is friend class? Explain with examples.
4. Explain with examples pointers to object.
5. What is this pointer? Explain with examples.
6. State the advantages of this pointer.
7. What are inline functions?
8. How do we declare member of a class static?
9. What are demerits of friend function?
10. What is concept of constructor, destructor?
11. What are types of constructors?

Assignment No.	3 (GROUP A)
Title	Creating a class which uses the concept of inheritance, displays data and data members and uses the concept of exception handling.
Subject	Object Oriented Programming
Class	SE COMPUTER
Roll No.	
Date	
Signature	

Assignment No:3

Title: Creating a class which uses the concept of inheritance, displays data and data members and uses the concept of exception handling.

Problem Statement: Imagine a publishing company which does marketing for book and audio cassette versions. Create a class publication that stores the title (a string) and price (type float) of publications. From this class derive two classes: book which adds a page count (type int) and tape which adds a playing time in minutes (type float). Write a program that instantiates the book and tape class, allows user to enter data and displays the data members. If an exception is caught, replace all the data member values with zero values.

Prerequisites:

Object Oriented Programming

Objectives:

To learn the concept of inheritance and exception handling.

Theory:

Inheritance:

Inheritance in Object Oriented Programming can be described as a process of creating new classes from existing classes. New classes inherit some of the properties and behavior of the existing classes. An existing class that is "parent" of a new class is called a base class. New class that inherits properties of the base class is called a derived class. Inheritance is a technique of code reuse. It also provides possibility to extend existing classes by creating derived classes.

The basic syntax of inheritance is:

Class DerivedClass : accessSpecifier BaseClass

There are 3 access specifiers:

Namely public, private and protected.

public:

This inheritance mode is used mostly. In this the protected member of Base class becomes protected members of Derived class and public becomes public.

protected:

In protected mode, the public and protected members of Base class becomes protected members of Derived class.

private:

In private mode the public and protected members of Base class become private members of Derived class.

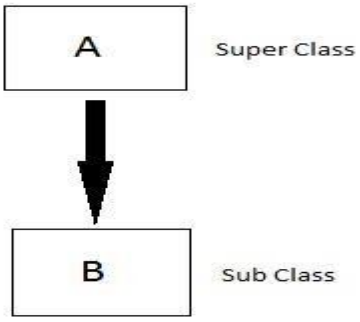
Types of Inheritance

In C++, we have 5 different types of Inheritance. Namely,

1. Single Inheritance
2. Multiple Inheritance
3. Hierarchical Inheritance
4. Multilevel Inheritance
5. Hybrid Inheritance

Single Inheritance:

In this type of inheritance one derived class inherits from only one base class. It is the most simplest form of Inheritance.



Syntax:

```
class subclass_name : access_modebase_class
{
  //body of subclass
};
```

// Single Inheritence

```
#include <iostream>
usingnamespacestd;
classVehicle
 {
  public:
```

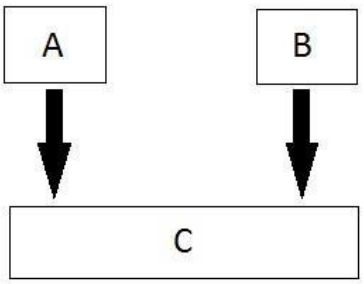
```
    Vehicle()
    {
      cout<< "This is a Vehicle"<<endl;
    }
};
classCar: publicVehicle
{

};
  int main()
{

    Car obj;
    return0;
}
```

Output:

```
This is a vehicle
```

Multiple Inheritance:

In this type of inheritance a single derived class may inherit from two or more than two base classes.



Syntax:

```
classsubclass_name : access_mode base_class1, access_mode base_class2, ....
{
  //body of subclass
};
```

// Multiple Inheritence

```
#include <iostream>
usingnamespacestd;

classVehicle {
  public:
  Vehicle()
    {
      cout<< "This is a Vehicle"<<endl;
    }
};
```

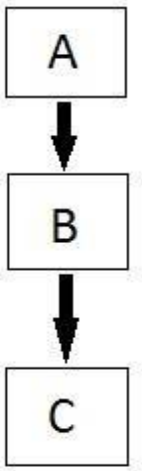
```
classFourWheeler {
  public:
  FourWheeler()
    {
      cout<< "This is a 4 wheeler Vehicle"<<endl;
    }
};

classCar: publicVehicle, publicFourWheeler
{

};

int main()
{

    Car obj;
    return 0;
}
```

Output:

```
This is a Vehicle
This is a 4 wheeler Vehicle
```

Multilevel Inheritance:

In this type of inheritance the derived class inherits from a class, which in turn inherits from some other class. The Super class for one, is sub class for the other.




```
// Multilevel Inheritance
#include <iostream>
using namespace std;

classVehicle
{
  public:
```

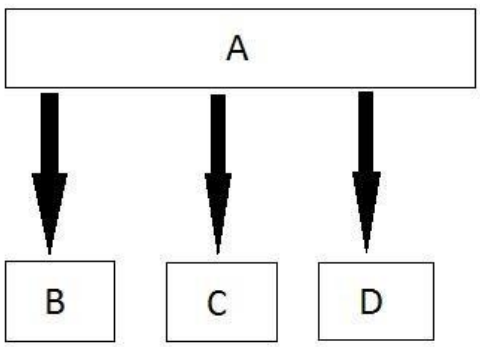
```
    Vehicle()
    {
      cout<< "This is a Vehicle"<<endl;
    }
};
Class fourWheeler : public Vehicle
{ public:
    fourWheeler()
    {
      cout<<"Objects with 4 wheels are vehicles"<<endl;
    }
};
Class Car: public fourWheeler{
  public:
     car()
     {
       cout<<"Car has 4 Wheels"<<endl;
     }
};

int main()
{

    Car obj;
    return0;
}
```

output:

```
This is a Vehicle
Objects with 4 wheels are vehicles
Car has 4 Wheels
```

Hierarchical Inheritance:

In this type of inheritance, multiple derived classes inherits from a single base class.




```
// Hierarchical Inheritance

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

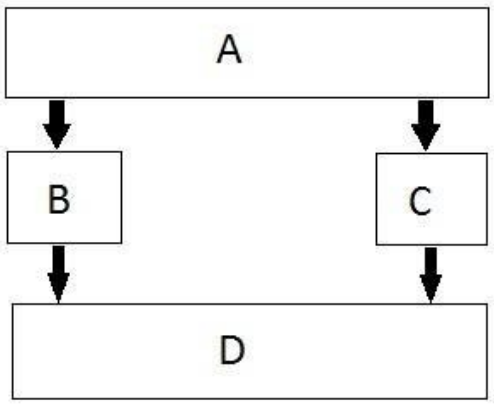
```
classVehicle
{
  public:
    Vehicle()
    {
      cout<< "This is a Vehicle"<<endl;
    }
};

classCar: publicVehicle
{

};
classBus: publicVehicle
{

};

intmain()
{

    Car obj1;
    Bus obj2;
    return0;
}
```

Output:

```
This is a Vehicle
This is a Vehicle
```

Hybrid Inheritance:

Hybrid Inheritance is combination of any 2 or more types of inheritances.




```
//Hybrid Inheritance

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

```
classVehicle
{
  public:
    Vehicle()
    {
      cout<< "This is a Vehicle"<<endl;
    }
};

classFare
{
    public:
    Fare()
    {
        cout<<"Fare of Vehicle\n";
    }
};

classCar: publicVehicle
{

};
classBus: publicVehicle, publicFare
{

};

int main({

    Bus obj2;
    return0;
}
```

Output:

```
This is a Vehicle
Fare of Vehicle
```

Exception Handling:

Exception handling is part of C++ and object oriented programming. they are added in C++ to handle the unwanted situations during program execution. If we do not type the program correctly then ot might result in errors. Main purpose of exception handling is to identify and report the runtime error in the program.

Famous examples are divide by zero, array index out of bound error, file not found, device not found, etc.

C++ exception handling is possible with three keywords iz. try, catch and throw. Exception handling performs the following tasks:-

- Find the problem in the given code. It is also called as hit exception.

- It informs error has occurred. It is called as throwing the exception.
- We receive the roe info. It is called as catching the exception.
- It takes the corrective action.It is called as exception handling.

TRY:- It is block code in which there are chances of runtime error.This block is followed by one or more catch block.Most error prone code is added in try block.

CATCH:- This is used to catch th exception thrown by the try blok. In catch block we take corrective action on throwing exception. If files are openend , we can take corrective action like closing file handles,closing database connetions,saving unsaved work ,etc.

THROW:- Program throws exception when problem occurs.It is possible with throw keyword.

SNYTAX:=

```
//normal program code
try{
throw exception
}
catch(argument)
{…
…
}
//rest of the code
```

```
// Exception Handling
#include <iostream>
using namespace std;
int main()
{

  int x = -1;
   // Some code
  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:

Before try

Inside try

Exception Caught

After catch (Will be executed)

Facilities:

Linux Operating Systems,G++

Algorithm:

1. Start.
2. Create classes Publication, book and tape.
3 .Publication class having data members title, price.
4. Class Book having data members pages and member functions getdata() and pudata().
5. Class Tape having data members minutes and member functions getdata() and pudata().
6. Create an object bof class book and object t of class tape.
7. Stop.

Input: A class publication that stores the title (a string) and price (type float) of publications. Derives two classes Book and Tape.

Output:

Display title and price from publication class. The result in following format:

Enter Title: OOP

Enter Price: 300

Enter Pages: 250

Enter Title: POP

Enter Price: 200

Enter Minutes: 60

Title: OOP

Price: 300

Pages: 250

Title: POP

Price: 200

Minutes: 60

Conclusion:

Hence, we have successfully studied concept of inheritance and exception handling.

Questions:

1. What is Inheritance?
2. What are types of Inheritance?
3. What is Single Inheritance?
4. What is Multiple Inheritance?
5. What is Hierarchical Inheritance?
6. What is Multilevel Inheritance?
7. What is Hybrid Inheritance?
8. What is Exception handling?
9. What are try catch block of exception handling?

GROUP B

Assignment No.	4(GROUP B)
Title	Write a C++ program that creates an output file, writes information to it, closes the file and open it again as an input file and read the information from the file.
Subject	Object OrientedProgramming
Class	S.E. (C.E.)
Roll No.	
Date	
Signature	

Assignment No: 4

Title: File handing

Problem Statement: Write a C++ program that creates an output file, writes information to it, closes the file and open it again as an input file and read the information from the file.

Prerequisites:

Object Oriented Programming

Objectives:

To learn the concept of File handing.

Theory:

Stream:

A stream is a sequence of bytes. It acts as source from which the input data can be obtained or as a destination to which the output data can be sent.

1. InputStream

Input Streams are used to hold input from a data producer, such as a keyboard, a file, or a network. The source stream that provides data to the program is called the input stream. A program extracts the bytes from the input stream. In most cases the standard input device is the keyboard. With the cin and "extraction" operator (>>) it is possible to read input from the keyboard.

2. OutputStream

Output Streams are used to hold output for a particular data consumer, such as a monitor, a file, or a printer. The destination stream that receives data from the program is called the output stream. A program inserts the bytes into an output stream. By default, the standard output of a program points at the screen. So with the cout operator and the "insertion" operator (<<) you can print a message onto thescreen.

iostream standard library provides cin and cout methods for reading from standard input and writing to standard outputrespectively.

file handling provides three new datatypes:

Data Type	Description
ofstream	This data type represents the output file stream and is used to create files and to write information to files.
ifstream	This data type represents the input file stream and is used to read information from files.
fstream	This data type represents the file stream generally, and has the capabilities of both ofstream and ifstream which means it can create files, write information to files, and read information from files.

To perform file processing in C++, header file

<iostream> and <fstream> must be included in your C++ source file.

Opening a File

- A file must be opened before you can read from it or write toit.
- Either the ofstream or fstream object may be used to open a file for writing andifstream object is used to open a file for reading purposeonly.
- Following is the standard syntax for open() function which is a member of fstream, ifstream and ofstreamobjects.

  void open(const char *filename, ios::openmode mode);
- Here, the first argument specifies the name and location of the file to be opened and the second argument of the open() member function defines the mode in which the file should be opened.

Mode Flag	Description
ios::app	Append mode. In this All output to that file to be appended to the end.
ios::ate	Open a file for output and move the read/write control to the end of thefile.
ios::in	Open a file for reading.
ios::out	Open a file for writing.
ios::trunk	If the file already exists, its contents will be truncated before opening the file.

- You can combine two or more of these values by ORing them together.
- For example, if you want to open a file in write mode and want to truncate it in case it already exists, following will be the syntax:

```
ofstreamoutfile;
outfile.open("file.dat", ios::out | ios::trunc );
```

- Similar way, you can open a file for reading and writing purpose asfollows:

```
fstreamafile;
afile.open("file.dat", ios::out | ios::in );
```

Closing a File

- When a C++ program terminates it automatically closes flushes all the streams, release all the allocated memory and close all the openedfiles.

- It is always a good practice that a programmer should close all the opened files before programtermination.

- Following is the standard syntax for close() function, which is a member of fstream, ifstream, and ofstream objects.
  void close();

Writing to a File

- While doing C++ programming, you write information to a file from your program using the stream insertion operator (<<) just as you use that operator to output information to the screen.

- The only difference is that you use an ofstream or fstream object instead of the cout object.

Reading from a File

- You read information from a file into your program using the stream extraction operator (>>) just as you use that operator to input information from the keyboard.

- The only difference is that you use an ifstream or fstream object instead of the cinobject.

Example

file .read ((char *)&V , sizeof (V)); file . Write ((char *)&V , sizeof (V));

- These function take two arguments. The first is the address of the variable V , and the second is the length of that variable in bytes . The address of variable must be cast to type char * (i.e pointer to character type) .

Facilities:

Linux Operating Systems, G++

Algorithm:

1. Start
2. Create aclass
3. Define data members roll number andname.
4. Define accept() to take name and roll number fromuser.
5. Define display() to display therecord.
6. In main() create the object of class and fstream class.
7. Take a limit from user in nvariable.

8. Open the file in out mode , call accept() to take record from user,then call write() to write that record into the file and at the end close that file.

9. Open the file in in mode, read the record from the file ,call display() function to display the record and at the end close that file.

10. Stop

Input:

how many record

you want3

1 abc

2 pqr

3 xyz

Output:

name=abc
Roll=1
name=pqr
Roll=2
name=xyz
Roll=3

Conclusion:

Hence, we have studied concept of File handing

Questions:

1. What is file handling?
2. What are the different benefits of file handling?
3. What is fstream class?
4. How to create object of fsream class?
5. Explain the syntax of read() ?
6. .Explain the syntax of write()?

Assignment No.	5(GROUP B)
Title	Write a function template selection sort. Write a program that inputs, sorts and outputs an integer array and a float array.
Subject	Object Oriented Programming
Class	SE COMPUTER
Roll No.	
Date	
Signature	

Assignment No: 5

Title: Function Template

Problem Statement: Implement a function template selection Sort. Write a program that inputs, sorts and outputs an integer array and a float array.

Prerequisites:

Object Oriented Programming

Objectives:

To learn the concept of Template.

Theory:

Templates

Templates are the foundation of generic programming, which involves writing code in a way that is independent of any particular type.

A template is a blueprint or formula for creating a generic class or a function. The library containers like iterators and algorithms are examples of generic programming and have been developed using template concept. There is a single definition of each container, such as vector, but we can define many different kinds of vectors for example, vector <int> or vector <string>.

You can use templates to define functions as well as classes, let us see how do they work:

Function Template:

The general form of a template function definition is shown here:

```
template <class type> ret-type func-name(parameter list)
{
   // body of function
}
```

Here, type is a placeholder name for a data type used by the function. This name can be used within the function definition.

The following is the example of a function template that returns the maximum of two values:

```
#include
<iostream>
#include
```

```
<string>
using
namespace
std;
  template <typename T>
  inline T const& Max (T const& a, T const& b)
  {
     return a < b ? b:a;
  }
  int main ()
  {
inti = 39; int j = 20;
     cout<< "Max(i, j): " << Max(i, j)
     <<endl; double f1 =13.5;
     double f2 =20.7;
     cout<< "Max(f1, f2): " << Max(f1, f2)
     <<endl; string s1 = "Hello";
     string s2 = "World";
     cout<< "Max(s1, s2): " << Max(s1, s2)
    <<endl; return 0;
  }
```

If we compile and run above code, this would produce the following result:

```
Max(i, j): 39
Max(f1, f2): 20.7
Max(s1, s2): World
```

Class Template:

Just as we can define functionb templates, we can also define class templates. The general form of a generic class declaration is shown here:

```
template <class type> class class-name
{
.
.
.
}
```

Here, type is the placeholder type name, which will be specified when a class is instantiated. You can define more than one generic data type by using a comma-separated list.

Following is the example to define class Stack<> and implement generic methods to push and pop
the elements from the stack:

```
#include <iostream>
#include <vector>
#include <cstdlib>
#include <string>
#include <stdexcept>
using namespace std;
 template <class T> class Stack
{
 private:
   vector<T>elems;      // elements

 public:
   void push(T const&); //push element
   voidpop();         // pop element
   Ttop()const;       // return top element bool empty()const
   {       //  return
      true if empty.
      returnelems.em
      pty();
   }
};

template <class T>
void Stack<T>::push (T const&elem)
{
    // append copy of passed element
     elems.push_back(elem);
}

 template<class T>
 void Stack<T>::pop ()
{
    if (elems.empty())
   {
      throw out_of_range("Stack<>::pop(): empty stack");
    }
            // remove last element
    elems.pop_back();
}

  template <class T>
  T Stack<T>::top () const
```

```
{
   if (elems.empty())
  {
      throw out_of_range("Stack<>::top(): empty stack");
   }
            // return copy of last element
   return elems.back();
}

int main()
{
   try
   {
      Stack<int> intStack; // stack of ints
      Stack<string>stringStack;      // stack ofstrings

       // manipulate int stack
       int Stack.push(7);
       cout<<intStack.top() <<endl;

         // manipulate string stack
       stringStack.push("hello");
       cout<<stringStack.top() <<std::endl; stringStack.pop();
      stringStack.pop();
   }
   catch (exception const& ex)
  {
      cerr<< "Exception: " <<ex.what()
      <<endl; return -1;
   }
}
```

If we compile and run above code, this would produce the following result:

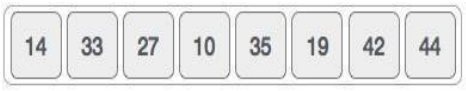
```
7
hello
Exception: Stack<>::pop(): empty stack
```

Selection Sort:

Selection sort is a sorting algorithm, specifically an in-placecomparison sort. It has O(n2) time complexity, making it inefficient on large lists, and generally performs worse than the similar insertion sort. Selection sort is noted for its simplicity, and it has performance advantages over more complicated algorithms in certain situations, particularly where auxiliary memory is limited

How selection sort works?

Example



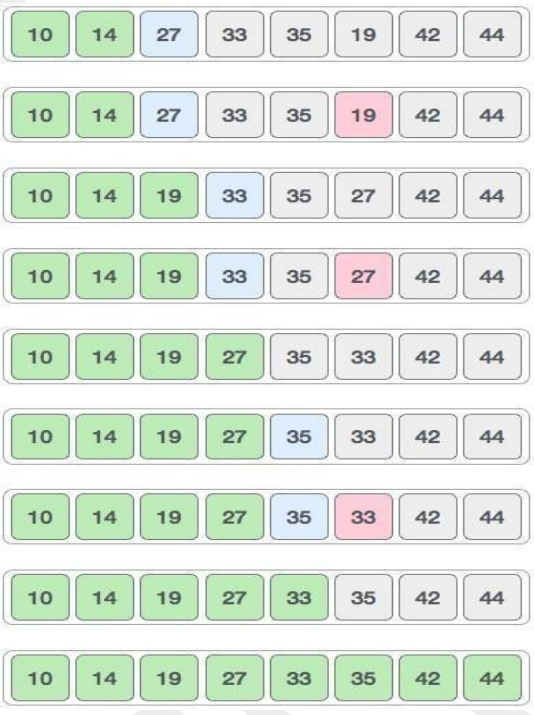
For the first position in the sorted list, the whole list is scanned sequentially. The first position where 14 is stored presently, we search the whole list and find that 10 is the lowest value.

So we replace 14 with 10. After one iteration 10, which happens to be the minimum value in the list, appears in the first position of sorted list.

For the second position, where 33 is residing, we start scanning the rest of the list in linear manner.

We find that 14 is the second lowest value in the list and it should appear at the second place. We swap these values.

After two iterations, two least values are positioned at the beginning in the sorted manner.
The same process is applied on the rest of the items in the array.
Pictorial depiction of entire sorting process is as follows −



Facilities:

Linux Operating Systems, G++

Algorithm:

1. Start
2. Declare the template parameterT.
3. Define template function for selectionsort.
4. In main() Define two arrays, one for integer and another for float. and take a input for both the arrays and call sorting function template to sort thenumber.
5. Stop

Input:

Selecn sort Integer Element
Enter how many elements
you want 5
Enter the
Integer element
7
5
8
9
3
Float Element
Enter how many elements
you want 5
Enter the
float element
3.8
9.4
5.5
2.2
6.7

Output:

Sorted list=
3 5 7 8 9

Sorted list=

2.2 3.8 5.5 6.7 9.4

Conclusion:

Hence, we have studied concept of Function Template.

Questions:

1. What is template?
2. What is Function template?
3. What is Class template?
4. Explain template with function overloading.
5. Explain template with non-type argument.

GROUP C

Assignment No.	6(GROUP C)
Title	Write C++ program using STL for sorting and searching user defined records such as records (Name, DOB, Telephone number etc) using vector container. OR Write C++ program using STL for sorting and searching user defined records such as (Item code, name, cost, quantity etc) using vector container.
Subject	Object Oriented Programming
Class	S.E. (C.E.)
Roll No.	
Date	
Signature	

Assignment No:6

Title: Personnel information system using sorting and searching for STL and vector container.

Problem Statement: Write C++ program using STL for sorting and searching user defined records such as personal records (Name, DOB, Telephone number etc) using vector container.
OR
Write C++ program using STL for sorting and searching user defined records such as Item records (Item code, name, cost, quantity etc) using vector container.

Prerequisites:

Object Oriented Programming

Objectives:

To learn the concept STL, searching, sorting and vector container.

Theory:

STL:

The Standard Template Library (STL) is a set of C++ template classes to provide common programming data structures and functions such as lists, stacks, arrays, etc. It is a library of container classes, algorithms, and iterators. It is a generalized library and so, its components are parameterized. A working knowledge of template classes is a prerequisite for working with STL.

STL has four components

- Algorithms
- Containers
- Functions
- Iterators

Algorithms

- The algorithm defines a collection of functions especially designed to be used on ranges of elements.They act on containers and provide means for various operations for the contents of the containers.
- Algorithm
  - Sorting
  - Searching
  - Important STL Algorithms
  - Useful Array algorithms
  - Partition Operations
  - Numeric

Containers

- Containers or container classes store objects and data. There are in total seven standard "first-class" container classes and three container adaptor classes and only seven header files that

provide access to these containers or container adaptors.

- Sequence Containers: implement data structures which can be accessed in a sequential manner.
  - vector
  - list
  - deque
  - arrays
  - forward_list(Introduced in C++11)
- Container Adaptors : provide a different interface for sequential containers.
  - queue
  - priority_queue
  - stack
- Associative Containers : implement sorted data structures that can be quickly searched (O(log n) complexity).
  - set
  - multiset
  - map
  - multimap
- Unordered Associative Containers : implement unordered data structures that can be quickly searched
  - unordered_set
  - unordered_multiset
  - unordered_map
  - unordered_multimap

Functions

- The STL includes classes that overload the function call operator. Instances of such classes are called function objects or functors. Functors allow the working of the associated function to be customized with the help of parameters to be passed.

Iterators

- As the name suggests, iterators are used for working upon a sequence of values. They are the major feature that allow generality in STL.

Utility Library

- Defined in header <utility>.
- pair

Sorting:

It is one of the most basic functions applied to data. It means arranging the data in a particular fashion, which can be increasing or decreasing. There is a builtin function in C++ STL by the name of sort(). This function internally uses IntroSort. In more details it is implemented using hybrid of QuickSort,

HeapSort and InsertionSort.By default, it uses QuickSort but if QuickSort is doing unfair partitioning and taking more than N*logN time, it switches to HeapSort and when the array size becomes really small, it switches to InsertionSort.

The prototype for sort is :

sort(startaddress, endaddress)

startaddress: the address of the first element of the array

endaddress: the address of the next contiguous location of the last element of the array.

So actually sort() sorts in the range of [startaddress,endaddress)

//Sorting

```
#include <iostream>
#include <algorithm>
 usingnamespacestd;

voidshow(inta[])
{
   for(inti = 0; i < 10; ++i)
      cout<< a[i] << " ";
}

intmain()
{
   inta[10]= {1, 5, 8, 9, 6, 7, 3, 4, 2, 0};
   cout<< "\n The array before sorting is : ";
   show(a);

   sort(a, a+10);

   cout<< "\n\n The array after sorting is : ";
   show(a);

   return0;

}
```

The output of the above program is :

The array before sorting is : 1 5 8 9 6 7 3 4 2 0

The array after sorting is : 0 1 2 3 4 5 6 7 8 9

Searching:

It is a widely used searching algorithm that requires the array to be sorted before search is applied. The main idea behind this algorithm is to keep dividing the array in half (divide and conquer) until the element is found, or all the elements are exhausted.

It works by comparing the middle item of the array with our target, if it matches, it returns true

otherwise if the middle term is greater than the target, the search is performed in the left sub-array. If the middle term is less than target, the search is performed in the right sub-array.

The prototype for binary search is :

binary_search(startaddress, endaddress, valuetofind)

startaddress: the address of the first element of the array.

endaddress: the address of the last element of the array.

valuetofind: the target value which we have to search for.

//Searching

```
#include <algorithm>
#include <iostream>

usingnamespacestd;

voidshow(inta[], intarraysize)
{
   for(inti = 0; i <arraysize; ++i)
      cout<< a[i] << " ";
}

intmain()
{
   inta[] = { 1, 5, 8, 9, 6, 7, 3, 4, 2, 0 };
   intasize = sizeof(a) / sizeof(a[0]);
   cout<< "\n The array is : ";
   show(a, asize);

   cout<< "\n\nLet's say we want to search for 2 in the array";
   cout<< "\n So, we first sort the array";
   sort(a, a + asize);
   cout<< "\n\n The array after sorting is : ";
   show(a, asize);
   cout<< "\n\nNow, we do the binary search";
   if(binary_search(a, a + 10, 2))
      cout<< "\nElement found in the array";
   else
      cout<< "\nElement not found in the array";

   cout<< "\n\nNow, say we want to search for 10";
   if(binary_search(a, a + 10, 10))
      cout<< "\nElement found in the array";
   else
      cout<< "\nElement not found in the array";

   return0;
}
```

Output:

The array is : 1 5 8 9 0 6 7 3 4 2 0

Let's say we want to search for 2 in the array

So, we first sort the array

The array after sorting is : 0 1 2 3 4 5 6 7 8 9

Now, we do the binary search

Element found in the array

Now, say we want to search for 10

Element not found in the array

Facilities:

Linux Operating Systems, G++

Algorithm:

1. Start.
2. Give a header file to use ‘vector’.
3. Create a vector naming ‘personal_records’.
4. Initialize variables to store name, birth date and telephone number.
5. Using iterator store as many records you want to store using predefined functions as push_back().
6. Create another vector ‘item_record’
7. Initialize variables to store item code, item name, quantity and cost.
8. Using iterator and predefined functions store the data.
9. Using predefined function sort(), sort the data stored according to user requirements.
10. Using predefined function search, search the element from the vector the user wants to check.
11. Display and call the functions using a menu**.**
12. End.

Input:

Personnel information such as name, DOB, telephone number.

Output:

Display personnel information from database. The result in following format:

***** Menu *****

1.Insert

2.Display

3.Search

4.Sort

5.Delete

6.Exit

Enter your choice:1

Enter Item Name: bat

Enter Item Quantity:2

Enter Item Cost:50

Enter Item Code:1

Conclusion:

Hence, we have successfully studied the concept of STL(Standard Template Library) and how it makes many data structures easy. It briefs about the predefined functions of STL and their uses such a search() and sort()

Questions:

1. What is STL?
2. What are four components of STL?
3. What is Sorting?
4. What is Searching?
5. What vector container?

Assignment No.	7(GROUP C)
Title	Write a program in C++ to use map associative container. The keys will be the names of states and the values will be the populations of the states. When the program runs, the user is prompted to type the name of a state. The program then looks inthe map, using the state name as an index and returns the population of the state
Subject	Object Oriented Programming
Class	SE COMPUTER
Roll No.	
Date	
Signature	

.

Assignment No:7

Title: To use map associative container.

Problem Statement: Write a program in C++ to use map associative container. The keys will be the names of states and the values will be the populations of the states. When the program runs, the user is prompted to type the name of a state. The program then looks in the map, using the state name as an index and returns the population of the state

Prerequisites:

Object Oriented Programming

Objectives:

To learn the concept of map associative container.

Theory:

Map associative co tainer:

Map associative con ainer are associative containers that store elements in a mapped fashion. Each element has a key va lue and a mapped value. No two mapped values can have same key values.

map::operator[]

This operator is used to reference the element present at position given inside the operator. It is similar to the at() function, t e only difference is that the at() function throws an out-of-range exception when the position is not in the bounds of the size of map, while this operator causes undefined behaviour.

Syntax :

***mapname*[*key*]**

Parameters :

Key value mapped to the element to be fetched.

Returns :

Direct reference to the element at the given key value.

Examples:

Input : map mymap;

mymap['a'] = 1;

mymap['a'];

Output : 1

Input : map mymap;

mymap["abcd"] = 7;

mymap["abcd"];

Output : 7

//Program

```
#include <map>
#include <iostream>
#include<string>
usingnamespacestd;
```

```
intmain()
{
   // map declaration
   map<int,string>mymap;

   // mapping integers to strings
   mymap[1] = "Hi";
   mymap[2] = "This";
   mymap[3] = "is";
   mymap[4] = "SPCOE";

   // using operator[] to print string
   // mapped to integer 4
   cout<<mymap[4];
   return0;
}
```

Output:

```
SPCOE
```

Facilities:

Linux Operating Systems, G++

Algorithm:

1. Start.
2. Give a header file to map associative container.
3. Insert states name so that we get values as population of that state.
4. Use populationMap.insert().
5. Display the population of states**.**
6. End.

Input:

Information such as state name to map associative container.

Output:

Size of population Map: 5

Brasil: 193 million

China: 1339 million

India: 1187 million

Indonesia: 234 million

Pakistan: 170 million

Indonesia's populations is 234 million

Conclusion:

Hence, we have successfully studied the concept of map associative container

Questions:

1. What is an associative container in C++?
2. What is map in C++?
3. How to do declare a map?
4. Explain Associative mapping with example?

Thank You!