**IT6311 – PROGRAMMING AND DATA STRUCTURES II LAB**

**LAB MANUAL**

Prepared by,

**Ms. P. SUGANYA., M.E**

Assistant Professor

Department of Information Technology

EGSPEC, NAGAPATTINAM

**IT6311 PROGRAMMING AND DATA STRUCTURE LABORATORY II L T P C**

**0 0 3 2**

**OBJECTIVES:**

**The student should be made to:**

1. Be familiarized with good programming design methods, particularly Top- Down design.
2. Getting exposure in implementing the different data structures using C++
3. Appreciate recursive algorithms.

**LIST OF EXPERIMENTS:**

**IMPLEMENTATION IN THE FOLLOWING TOPICS**:

1. Constructors & Destructors, Copy Constructor.

2. Friend Function & Friend Class.

3. Inheritance.

4. Polymorphism & Function Overloading.

5. Virtual Functions.

6. Overload Unary & Binary Operators Both as Member Function & Non Member Function.

7. Class Templates & Function Templates.

8. Exception Handling Mechanism.

9. Standard Template Library concept.

10. File Stream classes.

11. Applications of Stack and Queue

12. Binary Search Tree

13. Tree traversal Techniques

14. Minimum Spanning Trees

15. Shortest Path Algorithms

**TOTAL: 45 PERIODS**

 **REFERENCE:**

spoken-tutorial.org.

**OUTCOMES:**

**At the end of the course, the student should be able to:**

1. Design and implement C++ programs for manipulating stacks, queues, linked lists, trees, and graphs.
2. Apply good programming design methods for program development.
3. Apply the different data structures for implementing solutions to practical problems.
4. Develop recursive programs using trees and graphs.

**LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:**

Standalone desktops with C++ compiler 30 Nos.

(or)

 Server with C++ compiler supporting 30 terminals or more.

**Ex. No. 1 Constructors & Destructors, Copy Constructor.**

**AIM**

To write a c++ program to verify the given number is Prime or Not

**ALGORITHM:**

STEP 1:  Start the program.

STEP 2:  Declare the class as Prime with data members,

                  Member functions.

STEP 3:  Consider the argument constructor Prime() with integer

                  Argument.

STEP 4:  To cal the function calculate() and do the following steps.

STEP 5:  For i=2 to a/2 do

STEP 6:  Check if a%i==0 then set k=0 and break.

STEP 7:  Else set k value as 1.

STEP 8:  Increment the value i as 1.

STEP 9:  Check whether the k value is 1 or 0.

STEP 10:If it is 1 then display the value is a prime number.

STEP 11:Else display the value is not prime.

STEP 12:Stop the program.

**PROGRAM**

#include<iostream.h>

#include<conio.h>

class prime

{

                int a,k,i;

              public:

              prime(int x)

              {

                            a=x;

              }

              void calculate()

              {

                 k=1;

                {

                     for(i=2;i<=a/2;i++)

       if(a%i==0)

                     {

                              k=0;

                              break;

                     }

                     else

                    {

                            k=1;

                  }

                }

              }

void show()

              {

                if(k==1)

                  cout<< “\n\tA is prime Number. ";

                else

                  cout<<"\n\tA is Not prime.";

              }

};

void main()

{

    clrscr();

    int a;

    cout<<"\n\tEnter the Number:";

    cin>>a;

    prime obj(a);

    obj.calculate();

    obj.show();

    getch();

}

**Sample Output:**

Enter the number: 7

Given number is Prime Number

**RESULT:-**

 The given program is implemented, executed, tested and verified successfully

**Ex.No 1b Implementation of Copy Constructor**

**AIM**

To calculate factorial of a given number using copy constructor.

**ALGORITHM:**

STEP 1:  Start the program.

STEP 2:  Declare the class name as Copy with data members and member functions.

STEP 3:  The constructor Copy() with argument to assign the value.

STEP 4:  To cal the function calculate() do the following steps.

STEP 5:   For i=1 to var do

STEP 6:   Calculate fact\*i to assign to fact.

STEP 7:   Increment the value as 1.

STEP 8:   Return the value fact.

STEP 9:   Print the result.

STEP 10: Stop the program.

**PROGRAM:**

#include<iostream.h>

#include<conio.h>

class copy

{

           int var,fact;

              public:

                copy(int temp)

                {

                 var = temp;

                }

                double calculate()

                {

                            fact=1;

                            for(int i=1;i<=var;i++)

                            {

                            fact = fact \* i;

                            }

                            return fact;

                }

};

void main()

{

    clrscr();

    int n;

    cout<<"\n\tEnter the Number : ";

    cin>>n;

    copy obj(n);

    copy cpy=obj;

    cout<<"\n\t"<<n<<" Factorial is:"<<obj.calculate();

    cout<<"\n\t"<<n<<" Factorial is:"<<cpy.calculate();

    getch();

}

**Output**

Enter the number: 5

Factorial is 120

**RESULT:-**

 The given program is implemented, executed, tested and verified successfully

**Ex. No:2 Implementation of Friend Function & Friend Class.**

**Aim:**

To write a c++ program for friend function.

**Algorithm:**

1.        Create the class and declare the data member as private.

2.        Declare the friend function using the keyword friend.

3.        Perform the operation of adding two private variables in the friend function.

4.        Display the result.

**Program:**

#include <iostream.h>

using namespace std;

class myclass {

int a, b;

public:

friend int sum(myclass x);

void set\_ab(int i, int j);

};

void myclass::set\_ab(int i, int j)

{

a = i;

b = j;

}

// Note: sum() is not a member function of any class.

int sum(myclass x)

{

/\* Because sum() is a friend of myclass, it can

directly access a and b. \*/

return x.a + x.b;

}

int main()

{

myclass n;

n.set\_ab(3, 4);

cout << sum(n);

return 0;

}

**Output:**

7

**RESULT:-**

 The given program is implemented, executed, tested and verified successfully

**Ex.No:3a Single Inheritance**

**AIM:**

To write a program to find out the payroll system using single inheritance.

**ALGORITHM:**

Step 1: Start the program.

Step 2: Declare the base class emp.

Step 3: Define and declare the function get() to get the employee details.

Step 4: Declare the derived class salary.

Step 5: Declare and define the function get1() to get the salary details.

Step 6: Define the function calculate() to find the net pay.

Step 7: Define the function display().

Step 8: Create the derived class object.

Step 9: Read the number of employees.

Step 10: Call the function get(),get1() and calculate() to each employees.

Step 11: Call the display().

Step 12: Stop the program.

**PROGRAM:**

#include<iostream.h>

#include<conio.h>

 class emp

{

   public:

     int eno;

     char name[20],des[20];

     void get()

     {

              cout<<"Enter the employee number:";

              cin>>eno;

              cout<<"Enter the employee name:";

              cin>>name;

              cout<<"Enter the designation:";

              cin>>des;

     }

};

class salary:public emp

{

     float bp,hra,da,pf,np;

   public:

     void get1()

     {

              cout<<"Enter the basic pay:";

              cin>>bp;

              cout<<"Enter the Humen Resource Allowance:";

              cin>>hra;

              cout<<"Enter the Dearness Allowance :";

              cin>>da;

              cout<<"Enter the Profitablity Fund:";

              cin>>pf;

     }

void calculate()

     {

              np=bp+hra+da-pf;

     }

     void display()

     {

              cout<<eno<<"\t"<<name<<"\t"<<des<<"\t"<<bp<<"\t"<<hra<<"\t"<<da<<"\t"<<pf<<"\t"<<np<<"\n";

     }

};

 void main()

{

    int i,n;

    char ch;

    salary s[10];

    clrscr();

    cout<<"Enter the number of employee:";

    cin>>n;

    for(i=0;i<n;i++)

    {

              s[i].get();

              s[i].get1();

              s[i].calculate();

    }

    cout<<"\ne\_no \t e\_name\t des \t bp \t hra \t da \t pf \t np \n";

    for(i=0;i<n;i++)

    {

              s[i].display();

    }

    getch();

}

**Output:**

Enter the Number of employee:1

Enter the employee No: 150

Enter the employee Name: ram

Enter the designation: Manager

Enter the basic pay: 5000

Enter the HR allowance: 1000

Enter the Dearness allowance: 500

Enter the profitability Fund: 300

E.No   E.name   des      BP    HRA   DA   PF     NP

150    ram      Manager  5000  1000  500  300    6200

**RESULT:-**

 The given program is implemented, executed, tested and verified successfully

**Ex.No:3b Multiple Inheritance**

**AIM:**

To find out the student details using multiple inheritance.

**ALGORITHM:**

Step 1: Start the program.

Step 2: Declare the base class student.

Step 3: Declare and define the function get() to get the student details.

Step 4: Declare the other class sports.

Step 5: Declare and define the function getsm() to read the sports mark.

Step 6: Create the class statement derived from student and sports.

Step 7: Declare and define the function display() to find out the total and average.

Step 8: Declare the derived class object,call the functions get(),getsm() and display().

Step 9: Stop the program.

**PROGRAM:**

#include<iostream.h>

#include<conio.h>

class student

{

    protected:

       int rno,m1,m2;

    public:

                void get()

              {

                            cout<<"Enter the Roll no :";

                            cin>>rno;

                            cout<<"Enter the two marks   :";

                            cin>>m1>>m2;

              }

};

class sports

{

    protected:

       int sm;                   // sm = Sports mark

    public:

                void getsm()

              {

                 cout<<"\nEnter the sports mark :";

                 cin>>sm;

              }

};

class statement:public student,public sports

{

    int tot,avg;

    public:

    void display()

              {

                 tot=(m1+m2+sm);

                 avg=tot/3;

                 cout<<"\n\n\tRoll No    : "<<rno<<"\n\tTotal      : "<<tot;

               cout<<"\n\tAverage    : "<<avg;

              }

};

void main()

{

   clrscr();

   statement obj;

   obj.get();

   obj.getsm();

   obj.display();

   getch();

}

Output:

              Enter the Roll no: 100

              Enter two marks

              90

              80

              Enter the Sports Mark: 90

              Roll No: 100

              Total    : 260

              Average: 86.66

**RESULT:-**

 The given program is implemented, executed, tested and verified successfully

**Ex.No :4a Implementation of Polymorphism & Function Overloading**

**AIM:**

To calculate the area of  circle, rectangle and  triangle using Polymorphism

**ALGORITHM:**

STEP 1:  Start the program.

STEP 2:  Declare the class name as polygon with data members and member functions.

STEP 3:  write the inheritance classes rectancle and triangle.

STEP 5:  Create objects for above classes

STEP 6:  calculate the area respectively for the above classes

STEP 7:  The function area() to find area of rectangle with two integer argument.

STEP 8:  Exit from program

**PROGRAM:**

*#include <iostream>*

*using* *namespace* std;

*class* Polygon {

 *protected*:

 *int* width, height;

 *public*:

 *void* set\_values (*int* a, *int* b)

 { width=a; height=b; }

};

*class* Rectangle: *public* Polygon {

 *public*:

 *int* area()

 { *return* width\*height; }

};

*class* Triangle: *public* Polygon {

 *public*:

 *int* area()

 { *return* width\*height/2; }

};

*int* main () {

 Rectangle rect;

 Triangle trgl;

 Polygon \* ppoly1 = &rect;

 Polygon \* ppoly2 = &trgl;

 ppoly1->set\_values (4,5);

 ppoly2->set\_values (4,5);

 cout << rect.area() << '\n';

 cout << trgl.area() << '\n';

 *return* 0;

}

**Sample Output:**

20

10

**RESULT:-**

 The given program is implemented, executed, tested and verified successfully

**Ex.No :4b Implementation of Function Overloading**

**AIM:**

 To calculate the area of  circle, rectangle and  triangle using function overloading.

**PROGRAM:**

#include<iostream.h>

#include<stdlib.h>

#include<conio.h>

#define pi 3.14

class fn

{

      public:

        void area(int); //circle

        void area(int,int); //rectangle

        void area(float ,int,int);  //triangle

};

void fn::area(int a)

{

 cout<<"Area of Circle:"<<pi\*a\*a;

}

void fn::area(int a,int b)

{

      cout<<"Area of rectangle:"<<a\*b;

}

void fn::area(float t,int a,int b)

{

      cout<<"Area of triangle:"<<t\*a\*b;

}

void main()

{

     int ch;

     int a,b,r;

     clrscr();

     fn obj;

     cout<<"\n\t\tFunction Overloading";

     cout<<"\n1.Area of Circle\n2.Area of Rectangle\n3.Area of Triangle\n4.Exit\n:”;

     cout<<”Enter your Choice:";

     cin>>ch;

     switch(ch)

     {

              case 1:

                cout<<"Enter Radious of the Circle:";

                cin>>r;

                obj.area(r);

                break;

              case 2:

                cout<<"Enter Sides of the Rectangle:";

                cin>>a>>b;

                obj.area(a,b);

                break;

              case 3:

                cout<<"Enter Sides of the Triangle:";

                cin>>a>>b;

                obj.area(0.5,a,b);

                break;

              case 4:

                exit(0);

     }

getch();

}

**Output:**

              Function Overloading

              1. Area of Circle

              2. Area of Rectangle

              3. Area of Triangle

              4. Exit

              Enter Your Choice: 2

              Enter the Sides of the Rectangle: 5 5

              Area of Rectangle is: 25

              1. Area of Circle

              2. Area of Rectangle

              3. Area of Triangle

              4. Exit

              Enter Your Choice: 4

**RESULT:-**

 The given program is implemented, executed, tested and verified successfully

**Ex.No: 5 Implementation of Virtual Functions**

**AIM:**

To calculate the total mark of a student using the concept of virtual base class.

**ALGORITHM:**

Step 1: Start the program.

Step 2: Declare the base class base.

Step 3: Declare and define the virtual function show().

Step 4: Declare and define the function display().

Step 5: Create the derived class from the base class.

Step 6: Declare and define the functions display() and show().

Step 7: Create the base class object and pointer variable.

Step 8: Call the functions display() and show() using the base class object and pointer.

Step 9: Create the derived class object and call the functions display() and show() using the derived class object and pointer.

Step 10: Stop the program.

**PROGRAM:**

#include<iostream.h>

#include<conio.h>

class base

{

    public:

      virtual void show()

      {

                cout<<"\n  Base class show:";

      }

      void display()

      {

              cout<<"\n  Base class display:" ;

      }

};

class drive:public base

{

   public:

      void display()

      {

              cout<<"\n  Drive class display:";

      }

      void show()

      {

              cout<<"\n  Drive class show:";

      }

};

void main()

{

   clrscr();

   base obj1;

   base \*p;

   cout<<"\n\t P points to base:\n"  ;

   p=&obj1;

   p->display();

   p->show();

   cout<<"\n\n\t P points to drive:\n";

   drive obj2;

   p=&obj2;

   p->display();

   p->show();

   getch();

}

**Output:**

              P points to Base

              Base class display

              Base class show

              P points to Drive

              Base class Display

              Drive class Show

**RESULT:-**

 The given program is implemented, executed, tested and verified successfully

**Ex.No : 6a**

**Implementation of Overload Unary Operators Both as Member Function & Non Member Function.**

**AIM:**

kTo write a program to find the complex numbers using unary operator overloading.

**ALGORITHM:**

Step 1: Start the program.

Step 2: Declare the class.

Step 3: Declare the variables and its member function.

Step 4: Using the function getvalue() to get the two numbers.

Step 5: Define the function operator ++ to increment the values

Step 6: Define the function operator - -to decrement the values.

Step 7: Define the display function.

Step 8: Declare the class object.

Step 9: Call the function getvalue

Step 10: Call the function operator ++() by incrementing the class object and call the   function display.

Step 11: Call the function operator - -() by decrementing the class object and call the function display.

Step 12: Stop the program.

**PROGRAM:**

#include<iostream.h>

#include<conio.h>

class complex

{

     int a,b,c;

    public:

        complex(){}

        void getvalue()

       {

                 cout<<"Enter the Two Numbers:";

                 cin>>a>>b;

       }

  void operator++()

      {

                 a=++a;

                 b=++b;

       }

       void operator--()

       {

                 a=--a;

                 b=--b;

        }

        void display()

        {

                 cout<<a<<"+\t"<<b<<"i"<<endl;

         }

};

 void main()

{

     clrscr();

     complex obj;

     obj.getvalue();

     obj++;

     cout<<"Increment Complex Number\n";

     obj.display();

     obj--;

     cout<<"Decrement Complex Number\n";

     obj.display();

     getch();

}

**Output:**

Enter the two numbers: 3 6

Increment Complex Number

4 +               7i

Decrement Complex Number

3 +               6i

**RESULT:-**

 The given program is implemented, executed, tested and verified successfully

**Ex.No : 6b**

**Implementation of Overload Binary Operators Both as Member Function & Non Member Function.**

**AIM:**

***To write a program to add two complex numbers using binary operator overloading.***

**ALGORITHM:**

Step 1: Start the program.

Step 2: Declare the class.

Step 3: Declare the variables and its member function.

Step 4: Using the function getvalue() to get the two numbers.

Step 5: Define the function operator +() to add two complex numbers.

Step 6: Define the function operator –()to subtract two complex numbers.

Step 7: Define the display function.

Step 8: Declare the class objects obj1,obj2 and result.

Step 9: Call the function getvalue using obj1 and obj2

Step 10: Calculate the value for the object result by calling the function operator + and     operator -.

Step 11: Call the display function using obj1 and obj2 and result.

Step 12: Return the values.

Step 13: Stop the program.

**PROGRAM:**

#include<iostream.h>

#include<conio.h>

class complex

{

              int a,b;

    public:

              void getvalue()

              {

                 cout<<"Enter the value of Complex Numbers a,b:";

                 cin>>a>>b;

              }

              complex operator+(complex ob)

              {

                            complex t;

                            t.a=a+ob.a;

                            t.b=b+ob.b;

                            return(t);

              }

              complex operator-(complex ob)

              {

                            complex t;

                            t.a=a-ob.a;

                            t.b=b-ob.b;

                            return(t);

              }

              void display()

              {

                            cout<<a<<"+"<<b<<"i"<<"\n";

              }

};

void main()

{

   clrscr();

   complex obj1,obj2,result,result1;

   obj1.getvalue();

   obj2.getvalue();

   result = obj1+obj2;

   result1=obj1-obj2;

   cout<<"Input Values:\n";

   obj1.display();

   obj2.display();

   cout<<"Result:";

   result.display();

  result1.display();

   getch();

}

**Output:**

Enter the value of Complex Numbers a, b

4                  5

Enter the value of Complex Numbers a, b

2                  2

Input Values

4 + 5i

2 + 2i

Result

6 +   7i

2 +   3i

**RESULT:-**

 The given program is implemented, executed, tested and verified successfully

**Ex.No:7 Implementation of Class Templates & Function Templates**

**AIM:**

To swap the numbers using the concept of function template.

**ALGORITHM:**

STEP 1:  Start the program.

STEP 2:  Declare the template class.

STEP 3:  Declare and define the functions to swap the values.

STEP 4:  Declare and define the functions to get the values.

STEP 5:  Read the values and call the corresponding functions.

STEP6:   Display the results.

STEP 7:  Stop the program.

**PROGRAM:**

#include<iostream.h>

#include<conio.h>

template<class t>

void swap(t &x,t &y)

{

   t temp=x;

   x=y;

   y=temp;

}

void fun(int a,int b,float c,float d)

{

   cout<<"\na and b before swaping :"<<a<<"\t"<<b;

   swap(a,b);

   cout<<"\na and b after swaping  :"<<a<<"\t"<<b;

   cout<<"\n\nc and d before swaping :"<<c<<"\t"<<d;

   swap(c,d);

   cout<<"\nc and d after swaping  :"<<c<<"\t"<<d;

}

void main()

{

    int a,b;

    float c,d;

    clrscr();

    cout<<"Enter A,B values(integer):";

    cin>>a>>b;

    cout<<"Enter C,D values(float):";

    cin>>c>>d;

    fun(a,b,c,d);

    getch();

}

**Output:**

Enter A, B values (integer): 10  20

Enter C, D values (float):    2.50  10.80

A and B before swapping: 10 20

A and B after    swapping:  20 10

C and D before swapping: 2.50  10.80

C and D after               swapping: 10.80  2.50

**RESULT:-**

 The given program is implemented, executed, tested and verified successfully

**Ex No 8a Implementation of Exception Handling Mechanism**.

**AIM:**

To write a program to perform exception handling for Divide by zero Exception

**ALGORITHM:**

Step 1: Start the program.

Step 2: Declare the variables a,b,c.

Step 3: Read the values a,b,c,.

Step 4: Inside the try block check the condition.

            a. if(a-b!=0) then calculate the value of d and display.

            b. otherwise throw the exception.

Step 5: Catch the exception and display the appropriate message.

Step 6: Stop the program.

**PROGRAM:**

#include<iostream.h>

#include<conio.h>

void main()

{

   int a,b,c;

   float  d;

   clrscr();

   cout<<"Enter the value of a:";

   cin>>a;

   cout<<"Enter the value of b:";

   cin>>b;

   cout<<"Enter the value of c:";

   cin>>c;

   try

   {

              if((a-b)!=0)

              {

                 d=c/(a-b);

                 cout<<"Result is:"<<d;

              }

              else

              {

                 throw(a-b);

              }

   }

   catch(int i)

   {

              cout<<"Answer is infinite because a-b is:"<<i;

   }

   getch();

}

**Output:**

              Enter the value for a: 20

              Enter the value for b: 20

              Enter the value for c: 40

              Answer is infinite because a-b is: 0

**RESULT:-**

 The given program is implemented, executed, tested and verified successfully

**Ex No 8b Implementation of exception handling with multiple catch.**

**AIM:**

 Write a Program to perform exception handling with multiple catch.

**ALGORITHM:**

Step 1: Start the program.

Step 2: Declare and define the function test().

Step 3: Within the try block check whether the value is greater than zero or not.

a.    if  the value greater than zero throw the value and catch the corresponding exception.

b.    Otherwise throw the character and catch the corresponding exception.

Step 4: Read the integer and character values for the function test().

Step 5: Stop the program.

**PROGRAM:**

#include<iostream.h>

#include<conio.h>

void test(int x)

{

   try

   {

              if(x>0)

                 throw x;

        else

                 throw 'x';

   }

   catch(int x)

   {

              cout<<"Catch a integer and that integer is:"<<x;

   }

   catch(char x)

   {

              cout<<"Catch a character and that character is:"<<x;

   }

}

void main()

{

   clrscr();

   cout<<"Testing multiple catches\n:";

   test(10);

   test(0);

   getch();

}

**Output:**

Testing multiple catches

Catch a integer and that integer is: 10

Catch a character and that character is: x

**RESULT:-**

 The given program is implemented, executed, tested and verified successfully

EX NO: 18

STANDARD TEMPLATE LIBRARY

 AIM:

To implement a C++ program to illustrate the concept of standard template library.

ALGORITHM:

Step 1: Include the header files

Step 2: Create a vector to store int

 Step 3: Display the original size to store int

 Step 4: Push 5 values into the vector using for loop

Step 5: Display extended size of vec

 Step 6: Access 5 values from the vector

Step 7: Use iterator to access the values

**PROGRAM**

#include<iostream.h>

 #include<vector>

using namespace std;

 int main()

{

 vector vec;

 int i;

cout << "vector size = " << vec.size() << endl;

 for(i = 0; i < 5; i++)

{

vec.push\_back(i);

}

cout << "extended vector size = " << vec.size() << endl;

for(i = 0; i < 5; i++)

{

cout << "value of vec [" << i << "] = " << vec[i] << endl;

 }

vector::iterator v = vec.begin();

 while( v != vec.end())

{

 cout << "value of v = " << \*v << endl;

 v++;

}

return 0;

}

**OUTPUT:**

 vector size = 0

extended vector size = 5

value of vec [0] = 0

value of vec [1] = 1

value of vec [2] = 2

value of vec [3] = 3

value of vec [4] = 4

value of v = 0

value of v = 1

value of v = 2

value of v = 3

value of v = 4

RESULT: Thus a C++ program to illustrate the concept of standard template library is implemented successfully.

**Ex. No 10 Implement File Stream Classes**

**AIM:**

 Write a Program t**o Implement File Stream Classes**.

**ALGORITHM**

**Step1: Start the program**

**Step2: Declare the class**

**Step3: open a text files emp.dat and dept.dat for writing the contents using out function**

**Step4: close the files**

**Step5: Again open the same file using in function to read the contents**

**Step 6: close the file**

**Step 7: Stop the program**

**PROGRAM**

#include <iostream.h>

#include <fstream.h>

#include<conio.h>

#include<stdlib.h>

void main()

{

ofstream out\_obj;

out\_obj.open(“emp.dat”);

out\_obj<<”Rahul\n”;

out\_obj<<”Lakhana\n”;

out\_obj<<”Nandan\n”;

out\_obj<<”Archana\n”;

out\_obj<<”Yogesh\n”;

out\_obj.close();

out\_obj.open(“dept.dat”);

out\_obj<<”Accounts\n”;

out\_obj<<”Proof\n”;

out\_obj<<”Marketing\n”;

out\_obj<<”DTP\n”;

out\_obj<<”Graphics design\n”;

out\_obj.close();

char data[80];

ifstream in\_obj;

in\_obj.open(“emp.dat”);

cout<<”\n following are contents of emp.dat file…\n”;

while(in\_obj)

{

in\_obj.getline(data,80);

cout<<”\n”<<data;

}

in\_obj.close();

in-obj.open(“dept.dat”);

cout<<”\n following are contents of dept.dat file…\n”;

while(in\_obj)

{

in\_obj.getline(data,80);

cout<<”\n”<<data;

}

in\_obj.close();

getch();

}

**Sample Output:**

following are contents of emp.dat file…

Rahul

Lakhana

Nandan

Archana

Yogesh

following are contents of dept.dat file…

Accounts

Proof

Marketing

DTP

Graphics design

**RESULT:-**

 The given program is implemented, executed, tested and verified successfully

**Ex no 11a APPLICATION OF STACK**

 **(CONVERT INFIX TO POSTFIX EXPRESSION)**

**AIM:-**

 To write a ‘C’ program to implement stack and use it to convert infix to postfix expression.

**ALGORITHM:-**

1. Start the program
2. Scan the Infix string from left to right.
3. Initialize an empty stack.
4. If the scanned character is an operand, add it to the Postfix string. If the scanned character is an operator and if the stack is empty Push the character to stack.
* If the scanned character is an Operand and the stack is not empty, compare the precedence of the character with the element on top of the stack (topStack). If topStack has higher precedence over the scanned character Pop the stack else Push the scanned character to stack. Repeat this step as long as stack is not empty and topStack has precedence over the character.

Repeat this step till all the characters are scanned.

1. (After all characters are scanned, we have to add any character that the stack may have to the Postfix string.) If stack is not empty add topStack to Postfix string and Pop the stack. Repeat this step as long as stack is not empty.
2. Return the Postfix string.
3. Terminate the program.

**INFIX TO POSTFIX CONVERSION**

**PROGRAM**

#include<iostream.h>

#include<conio.h>

#define operand(x) (x>='a'&&x<='z'||x>='A'&&x<='Z')

int top=-1;

class stack

{

char infix[20],stack[20],postfix[20];

public:

void getexpression()

{

 cout<<"enter the expression";

 cin>>infix;

}

void displayexpression()

{

 cout<<postfix;

}

stack()

{

}

void infixtopostfix();

int priority(char);

void push(char);

char pop();

};

void main()

{

stack a,b;

clrscr();

 a.getexpression();

 a.infixtopostfix();

 a.displayexpression();

 b.infixtopostfix();

 b.displayexpression();

 getch();

}

void stack::infixtopostfix()

{

 int j,l=0;

 char x,y;

 for(j=0;(x=infix[j])!='\0';j++)

 {

 if(operand(x))

 postfix[l++]=x;

 else if(x=='(')

 push(x);

 else if(x==')')

 {

 while((y=pop())!='(')

 postfix[l++]=y;

 }

 else

 {

 while(priority(stack[top])>=priority(x)&&stack[top]!='(')

 postfix[l++]=pop();

 push(x);

 }

 }

 while(top>=0)

 postfix[l++]=pop();

}

void stack::push(char n)

{

 stack[++top]=n;

}

 int stack::priority(char x)

{

 int y;

 y=(x=='('?3:x=='\*'?2:x=='/'?2:x=='+'?1:x=='-'?1:-1);

 return y;

}

char stack::pop()

{

 char n;

 n=stack[top];

 top--;

 return(n);

}

**OUTPUT:**

**RESULT:-**

 The given program is implemented, executed, tested and verified successfully.

Expt.No: 11b

Date:

**IMPLEMENTATION OF CIRCULAR QUEUE**

**Aim:**

 To implement of Circular Queue.

**Algorithm:**

**Addition of an element**

Step 1: Get the item to be inserted in array

Step 2: Rear points to the last item and front are one position counter clockwise from the first item in queue.

Step 3: If front and rear are equal then queue is full and insertion is impossible.

Step 4: Now Advance rear clockwise

Step 5: Insert the new item in rear position

**Deletion of an element**

Step 1: If front and rear are equal then queue is empty.

Step 2: Now advance front clockwise.

Step 3: Return the deleted item

**Circular Queue**

# include <iostream.h>

# include <conio.h>

# include <stdlib.h>

class cq

{

 private:

 int rear,front,x,d,\*a,csize;

 public:

 int fullq();

 int emptyq();

 void enq();

 void deq();

 void display();

 cq()

 {

 rear=0;

 front=0;

 csize=0;

 cout<<"Enter the size"<<endl;

 cin>>x;

 a=new int[x];

 }

};

int cq::fullq()

{

 if(csize==x)

 return 1;

 else

 return 0;

}

int cq::emptyq()

{

 if(csize==0)

 return 1;

 else

 return 0;

}

void cq::enq()

{

 if(!fullq())

 {

 cout<<"Enter the value to be inserted"<<endl;

 cin>>d;

 a[rear]=d;

 rear=(rear+1)%x;

 csize++;

 }

 else

 cout<<"The queue is full"<<endl;

}

void cq::deq()

{

 if(!emptyq())

 {

 d=a[front];

 cout<<"The value retrieved is"<<d;

 front=(front+1)%x;

 csize--;

 }

 else

 cout<<"The queue is empty"<<endl;

}

void cq::display()

{

 int i,j;

 i=front;

 j=csize;

 if(j==0)

 {

 cout<<"queue is empty"<<endl;

 return;

 }

 cout<<"The value in queue is"<<endl;

 while(j)

 {

 cout<<a[i]<<" ";

 j--; i++;

 }

}

void main()

{

 clrscr();

 cq c1;

 int ch;

 while(1)

 {

 cout<<"\n1.enqueue operation\n2.dequeue operation\n3.display\n 4.exit\n"<<endl;

 cout<<"\nEnter your choice\n"<<endl;

 cin>>ch;

 switch(ch)

 {

 case 1:

 c1.enq();

 break;

 case 2:

 c1.deq();

 break;

 case 3:

 c1.display();

 break;

 case 4:

 exit(0);

 break;

 default:

 cout<<"Wrong choice"<<endl;

 }

 }

}

**Output:**

**Circular Queue**

Enter the size 4

1.enqueue operation

2.dequeue operation

3.display

4.exit

Enter your choice 1

Enter the value to be inserted

2 3 4

1.enqueue operation

2.dequeue operation

3.display

4.exit

Enter your choice 3

The value in queue is 2 3 4

1.enqueue operation

2.dequeue operation

3.display

4.exit

Enter your choice 3

The value in queue is 2 3 4

1.enqueue operation

2.dequeue operation

3.display

4.exit

Enter your choice 2

The value retrieved is 2 3 4

1.enqueue operation

2.dequeue operation

3.display

4.exit

Enter your choice 4

**Result:**

Thus the program to implement circular queue was written and executed.

**Ex no 12 IMPLEMENT BINARY SEARCH TREE**

**AIM:-**

 To write a ‘C’ program to implement binary search tree.

**ALGORITHM:-**

Step 1: Start the process.

Step 2: Initialize and declare variables.

Step 3: Construct the Tree

Step 4: Data values are given which we call a key and a binary search tree

Step 5: To search for the key in the given binary search tree, start with the root node and

 Compare the key with the data value of the root node. If they match, return the

 root pointer.

Step 6: If the key is less than the data value of the root node, repeat the process by using

the left subtree.

Step 7: Otherwise, repeat the same process with the right subtree until either a match is

found or the subtree under consideration becomes an empty tree.

Step 8: Terminate

IMPLEMENTATION OF BINARY SEARCH TREE

#include<stdio.h>

#include<conio.h>

typedef struct node \*tree;

tree findmin(tree);

tree findmax(tree);

tree insert(int,tree);

tree del(int,tree);

void disp(tree);

struct node

{

 int data;

 tree left,right;

}\*t=NULL;

void main()

{

 int ch,n;

 tree a;

 clrscr();

 printf("1.insert 2.delete 3.findmax 4.findmin 5.disp 6.exit");

 do

 {

 printf("enter choie");

 scanf("%d",&ch);

 switch(ch)

 {

 case 1:

 printf("enter no to insert");

 scanf("%d",&n);

 t=insert(n,t);

 break;

 case 2:

 printf("enter no to delete");

 scanf("%d",&n);

 t=del(n,t);

 break;

 case 3:

 a=findmax(t);

 printf("%d",a->data);

 break;

 case 4:

 a=findmin(t);

 printf("%d",a->data);

 break;

 case 5:

 disp(t);

 break;

 case 6:

 exit (0);

 break;

 default:

 printf("enter correct choice");

 }

 }while(ch!=6);

 getch();

}

tree insert(int n,tree t)

{

 if(t==NULL)

 {

 t=(tree)malloc(sizeof(struct node));

 t->data=n;

 t->left=t->right=NULL;

 }

 else if(n<t->data)

 t->left=insert(n,t->left);

 else if(n>t->data)

 t->right=insert(n,t->right);

 else

 printf("already exist");

 return t;

}

tree del(int n,tree t)

{

 tree p;

 if(t==NULL)

 printf("element not found");

 else if(n<t->data)

 t->left=del(n,t->left);

 else if(n>t->data)

 t->right=del(n,t->right);

 else if(t->left&&t->right)

 {

 p=findmin(t->right);

 t->data=p->data;

 t->right=del(t->data,t->right);

 }

 else

 {

 p=t;

 if(t->left==NULL)

 t=t->right;

 else

 t=t->left;

 free(p);

 }

 return t;

}

void disp(tree t)

{

 if(t!=NULL)

 {

 disp(t->left);

 printf("%d\n",t->data);

 disp(t->right);

 }

}

tree findmin(tree t)

{

 if(t==NULL)

 return NULL;

 else if(t->left==NULL)

 return t;

 else return findmin(t->left);

}

tree findmax(tree t)

{

 if(t==NULL)

 return NULL;

 else if(t->right==NULL)

 return t;

 else

 return findmax(t->right);

}

**OUTPUT:**

****

**RESULT:-**

 The given program is implemented, executed, tested and verified successfully.

**Ex no 13 IMPLEMENTATION OF TREE TRAVERSALS**

**AIM:-**

 To write a ‘C’ program to implement an expression tree. Produce its pre-order, in-order, and post-order traversals.

**ALGORITHM:-**

Step 1: Start the process.

Step 2: Initialize and declare variables.

Step 3: Enter the choice. Inorder / Preorder / Postorder.

Step 4: If choice is Inorder then

* + Traverse the left subtree in inorder.
	+ Process the root node.
	+ Traverse the right subtree in inorder.

Step 5: If choice is Preorder then

* + Process the root node.
	+ Traverse the left subtree in preorder.
	+ Traverse the right subtree in preorder.

Step 6: If choice is postorder then

* + Traverse the left subtree in postorder.
	+ Traverse the right subtree in postorder.
	+ Process the root node.

Step7: Print the Inorder / Preorder / Postorder traversal.

Step 8: Stop the process.

**EXPRESSION TREE**

#include<stdio.h>

#include<conio.h>

#define operand(x) (x>='a'&&x<='z'||x>='A'&&x<='Z')

typedef struct node \*tree;

void push(tree);

tree pop();

void conversion();

void postfix(tree);

void infix(tree);

void prefix(tree);

struct node

{

 char data;

 tree left,right;

}\*T=NULL;

char post[20];

tree stack[20];

int top=-1;

void main()

{

 clrscr();

 printf("enter postfix expression");

 scanf("%s",post);

 conversion();

 printf("\npostfix expression is ");

 postfix(T);

 printf("\ninfix expression is ");

 infix(T);

 printf("\nprefix expression is ");

 prefix(T);

 getch();

}

void conversion()

{

 int i;

 tree a,b,c;

 char x;

 for(i=0;(x=post[i])!='\0';i++)

 {

 if(operand(x))

 {

 a=(tree)malloc(sizeof(struct node));

 a->data=x;

 a->left=a->right=NULL;

 push(a);

 }

else

 {

 a=pop();

 b=pop();

 c=(tree)malloc(sizeof(struct node));

 c->data=x;

 c->right=a;

 c->left=b;

 push(c);

 }

 }

 T=stack[top];

}

void push(tree a)

{

 stack[++top]=a;

}

tree pop()

{

 tree a;

 a=stack[top];

 top--;

 return(a);

}

void postfix(tree a)

{

 if(a!=NULL)

 {

 postfix(a->left);

 postfix(a->right);

 printf("%c",a->data);

 }

}

void infix(tree a)

{

 if(a!=NULL)

 {

 infix(a->left);

 printf("%c",a->data);

 infix(a->right);

 }

}

void prefix(tree a)

{

 if(a!=NULL)

 {

 printf("%c",a->data);

 prefix(a->left);

 prefix(a->right);

 }

}

 **OUTPUT:**

**RESULT:-**

 The given program is implemented, executed, tested and verified successfully

.

Expt.No: 13

Date:

**IMPLEMENTATION OF PRIM’S ALGORITHM**

**Aim:**

 To implement Prim's Algorithm.

**Algorithm:**

Step 1: Initially, set T (a set of edges) empty.

 Set B (a set of vertices) empty.

Step 2: Select an arbitrary vertex in V, and add it to B.

 Look for the lowest weight edge e= (u, v) such that u is in B but v is not in B.

 Add v to B, and e to T.

Step 3: Repeat step 3 until B equals N (that is B contains all vertices).

**Prim’s Algorithm**

# include <iostream.h>

# include <conio.h>

class prim

{

 private:

 struct vertex

 {

 int visit;

 int cost;

 int par;

 };

 vertex v[10];

 int a[10][10],n,ver;

 public:

 prim();

 void read();

 void chose();

 void display();

};

prim::prim()

{

 cout<<"Enter the number of nodes"<<endl;

 cin>>n;

 for(int i=1;i<=n;i++)

 {

 v[i].visit=0;

 v[i].cost=0;

 v[i].par=0;

 for(int j=1;j<=n;j++)

 a[i][j]=0;

 }

 ver=0;

}

void prim::read()

{

 for(int i=1;i<=n;i++)

 {

 for(int j=i+1;j<=n;j++)

 {

 if(i!=j)

 {

 cout<<"Enter the values of"<<i<<","<<j<<endl;

 cin>>a[i][j];

 a[j][i]=a[i][j];

 } } } }

void prim::chose()

{

 int min=0;

 int k=0,loc,loc1;

 v[1].visit=1;

 v[1].cost=0;

 v[1].par=0;

 while(k!=n-1)

 {

 int flag=0;

 for(int i=1;i<=n;i++)

 {

 if(v[i].visit)

 {

 for(int j=1;j<=n;j++)

 {

 if(a[i][j] && !flag && !v[j].visit)

 {

 min=a[i][j];

 loc=i;

 loc1=j;

 ver++;

 flag++;

 }

 if(a[i][j] && min>=a[i][j] && !v[j].visit && flag)

 {

 min=a[i][j];

 loc=i;

 loc1=j;

 } } } }

 v[loc1].visit=1;

 v[loc1].cost=min;

 v[loc1].par=loc;

 a[loc][loc1]=0;

 a[loc1][loc]=0;

 k++;

 } }

void prim::display()

{

 int d=0;

 if(ver==n-1)

 {

 cout<<"Cost"<<" "<<"visit"<<" "<<"parent"<<" "<<"current node"<<endl;

 for(int i=1;i<=n;i++)

 {

 d=d+v[i].cost;

 cout<<v[i].cost<<" ";

 cout<<v[i].visit<<" ";

 cout<<v[i].par<<" "<<i<<endl;

 }

 cout<<"Minimum cost is"<<d<<endl;

 }

 else

 cout<<"No spanning tree exists"<<endl;

}

void main()

{

 clrscr();

 prim p1;

 p1.read();

 p1.chose();

 p1.display();

 getch();

}

**Output:**

Enter the number of nodes

3

Enter the values of1,2

67

Enter the values of1,3

87

Enter the values of2,3

97

Cost visit parent current node

0 1 0 1

67 1 1 2

87 1 1 3

Minimum cost is154

**Result:**

 Thus the program to implement Prim's Algorithm was written and executed.

Expt.No: 14

Date:

**IMPLEMENTATION OF KRUSKAL’S ALGORITHM**

**Aim:**

 To implement Kruskal's Algorithm.

**Algorithm:**

1. Initially, set T (a set of edges) empty.
2. Create a set of components C (a "forest" of trees) having each vertex in V as a single component.
3. Examine edges in E in order of increasing weight (that is shortest/

 cheapest first)

1. If an edge joins two disjoint components in C, add it to T, and merge

 the disjoint components in C.

 If an edge does not joint two disjoint components in C, reject it.

1. Repeat 3-4 until C contains only a single component.

**Kruskal's Algorithm**

# include <iostream.h>

# include <conio.h>

class krusk

{

 private:

 struct edge

 {

 int cost;

 int sou;

 int des;

 int select;

 };

 int ecount,a[10][10],\*par,n,flag;

 edge \*e;

 public:

 krusk();

 void read();

 void chose\_edge();

 void union1(int,int);

 int find(int);

 void display();

};

krusk::krusk()

{

 cout<<"Enter the number of nodes"<<endl;

 cin>>n;

 par=new int[n+1];

 for(int i=1;i<=n;i++)

 {

 par[i]=-1;

 for(int j=1;j<=n;j++)

 {

 a[i][j]=0; a[j][i]=0;

 }

 }

 ecount=0; flag=1;

}

void krusk::read()

{

 for(int i=1;i<=n;i++)

 {

 for(int j=i+1;j<=n;j++)

 {

 cout<<"Enter the values of"<<i<<","<<j<<endl; cin>>a[i][j];

 a[j][i]=a[i][j];

 if(a[i][j])

 ecount++;

 } }

 e=new edge[ecount];

}

void krusk::union1(int i,int j)

{

 int t=par[i]+par[j];

 if(par[i]>par[j])

 {

 par[i]=j;

 par[j]=t;

 }

 else

 {

 par[j]=i;

 par[i]=t;

 } }

int krusk::find(int i)

{

 int j=i;

 while(par[j]>0)

 j=par[j];

 int k=i; int temp;

 while(k!=j)

 {

 temp=par[k];

 par[k]=j;

 k=temp;

 }

 return j;

}

void krusk::chose\_edge()

{

 int k=1;

 for(int i=1;i<=n;i++)

 {

 for(int j=i+1;j<=n;j++)

 {

 if(a[i][j])

 {

 e[k].cost=a[i][j];

 e[k].sou=i;

 e[k].des=j;

 e[k].select=0;

 k++;

 }

 }

 }

 for(i=1;i<=ecount;i++)

 {

 for(int j=1;j<ecount;j++)

 {

 if(e[j].cost>e[j+1].cost)

 {

 int temp=e[j].cost;

 e[j].cost=e[j+1].cost;

 e[j+1].cost=temp;

 temp=e[j].sou;

 e[j].sou=e[j+1].sou;

 e[j+1].sou=temp;

 temp=e[j].des;

 e[j].des=e[j+1].des;

 e[j+1].des=temp;

 } } }

 int t=0;

 k=1;

 int ecount1=ecount;

 while(t<n-1 && ecount1!=0)

 {

 int u=e[k].sou;

 int v=e[k].des;

 ecount1--;

 if(find(u)!=find(v))

 {

 e[k].select=1;

 t++;

 union1(find(u),find(v));

 }

 k++;

 }

 if(t<n-1)

 {

 cout<<"No spanning tree exists"<<endl;

 flag--;

 } }

void krusk::display()

{

 int mincost=0;

 if(flag)

 {

 cout<<"cost "<<"source "<<"dest "<<endl;

 for(int i=1;i<=ecount;i++)

 {

 if(e[i].select!=0)

 {

 mincost=mincost+e[i].cost;

 cout<<e[i].cost<<" "<<e[i].sou<<" "<<e[i].des<<" ";

 } }

 cout<<"Cost of minimum spanning tree is"<<mincost<<endl;

 } }

void main()

{

 clrscr();

 krusk k1;

 k1.read();

 k1.chose\_edge();

 k1.display();

 getch();

}

**Output:**

Enter the number of nodes

3

Enter the values of1,2

34

Enter the values of1,3

56

Enter the values of2,3

78

cost source dest

34 1 2

56 1 3

Cost of minimum spanning tree is 90

**Result:**

Thus the program to implement Kruskal's Algorithm was written and executed.

Expt.No: 15

Date:

**IMPLEMENTATION OF DIJKSTRA’S ALGORITHM**

**Aim:**

 To implement Dijkstra’s Algorithm.

**Algorithm:**

Step 1: Make a heap of values (vertex, edge, distance)

Step 2: Initialize v, -, infinity for each vertex

Step 3: Let tree T be empty

Step 4: While T has fewer than n vertices

Step 5: Let v, e, d (v) have the smallest weight in the heap

Step 6: Remove v, e, d (v) from the heap

Step 7: Add v and e to T

Step 8: Set distance (s, v) to d(v)

Step 9: For each edge f(v, u)

Step 10: If u is not already in T

Step 11: Find value (u, g, d (u)) in heap

Step 12: If (d (v) +length (f) < d (g)

Step 13: Replace (u, g,d(g)) with (u, f, d(v) + length(f))

**Dijkstra’s Algorithm**

# include <iostream.h>

# include <conio.h>

class dij

{

 private:

 struct path

 {

 int dis;

 int par;

 int visit;

 };

 path \*p;

 int n,a[10][10],sou,des;

 public:

 dij();

 void read();

 void chose();

 void display();

 void print(int);

};

dij::dij()

{

 cout<<"Enter the number of nodes"<<" "; cin>>n;

 cout<<"Enter the source node"<<" "; cin>>sou;

 cout<<"Enter the destination node"<<" "; cin>>des;

 p=new path[n];

 for(int i=0;i<=n;i++)

 {

 p[i].dis=0;

 p[i].par=0;

 p[i].visit=0;

 for(int j=0;j<=n;j++)

 a[i][j]=0;

 }

}

void dij::read()

{

 for(int i=1;i<=n;i++)

 {

 for(int j=1;j<=n;j++)

 {

 if(i!=j)

 {

 cout<<"Enter the values of"<<i<<","<<j<<" ";

 cin>>a[i][j];

 }

 }

 }

}

void dij::chose()

{

 int flag,v=0;

 p[sou].dis=0;

 p[sou].par=0;

 p[sou].visit=1;

 while(v<=n-1)

 {

 for(int i=1;i<=n;i++)

 {

 if(p[i].visit)

 {

 for(int j=1;j<=n;j++)

 {

 if(a[i][j] && !p[j].visit && (p[j].dis > p[i].dis+a[i][j] || !p[j].dis))

 {

 p[j].dis=p[i].dis+a[i][j];

 p[j].par=i;

 }

 }

 }

 }

 int min=0,flag=0,loc;

 for(i=1;i<=n;i++)

 {

 if(p[i].dis && !flag && !p[i].visit)

 {

 min=p[i].dis;

 loc=i;

 flag++;

 }

 if(p[i].dis && min>p[i].dis && !p[i].visit)

 {

 min=p[i].dis;

 loc=i;

 }

 }

 p[loc].visit=1;

 v++;

 }

}

void dij::display()

{

 int i=des,flag=0;

 while(i<=n)

 {

 if(p[i].visit)

 {

 cout<<"shortest path from "<<sou<<"to "<<des<<"with distance "<<p[i].dis<<endl;

 print(i);

 cout<<i<<endl;

 break;

 }

 else

 flag++;

 i++;

 }

 if(flag)

 cout<<"The node "<<des<<" is not reachable"<<endl;

}

void dij::print(int i)

{

 if(i!=sou)

 {

 i=p[i].par;

 print(i);

 cout<<i<<"--->";

 }

 else

 return;

}

void main()

{

 clrscr();

 dij d1;

 d1.read();

 d1.chose();

 d1.display();

 getch();

}

**Output:**

Enter Number of Node: 5

Enter the source node 2

Enter the destination node 3

Enter the values of1,2 12

Enter the values of1,3 23

Enter the values of1,4 22

Enter the values of1,5 44

Enter the values of2,1 333

Enter the values of2,3 55

Enter the values of2,4 22

Enter the values of2,5 5

Enter the values of3,1 3

Enter the values of3,2 7

Enter the values of3,4 234

Enter the values of3,5 645

Enter the values of4,1 3423

Enter the values of4,2 678

Enter the values of4,3 234

Enter the values of4,5 768

Enter the values of5,1 5

Enter the values of5,2 76

Enter the values of5,3 646

Enter the values of5,4 4

Shortest path from 2to 3with distance 33

2--->5--->1--->3

**Result:**

Thus the program to implement Dijkstra’s Algorithm was written and executed.