**Computer Graphics PRACTICAL BACKUP**

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1. **Write a program to implement DDA and Bresenham’s line drawing algorithm.**

CODE:

DDA

#include<iostream.h>

#include<graphics.h>

#include<dos.h>

void main()

{

float x,y,x1,y1,x2,y2,dx,dy,m;

int i,gd=DETECT,gm;

initgraph(&gd,&gm,"C:\\TURBOC3\\BGI");

cout<<"Enter the value of x1 and y1: ";

cin>>x1>>y1;

cout<<"Enter the value of x2 and y2: ";

cin>>x2>>y2;

dx=x2-x1;

dy=y2-y1;

m=dy/dx;

setbkcolor(WHITE);

x=x1;

y=y1;

while(x<=x2)

{

putpixel(x,y,RED);

x=x+1;

y=y+m;

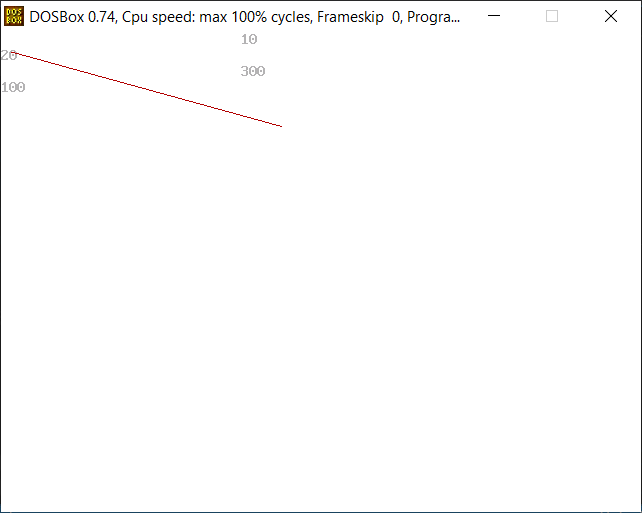
delay(100);

}

closegraph();

}

OUTPUT:



BRESENHAM:

#include<iostream.h>

#include<graphics.h>

#include<conio.h>

#include<dos.h>

void bresenhams(int x1,int y1,int x2, int y2 )

{

int dx=0,dy=0,a=0,b=0;

int s=0,p=0,x=0,y=0;

dy=y2-y1;

dx=x2-x1;

a=2\*dx;

b=2\*dy;

s=b-a;

p=b-dx;

x=x1;y=y1;

while(x<x2)

{

if(p<0)

{

putpixel(x,y1,RED);

x=x+1;

p=p+b;

}

else

{

putpixel(x,y,RED);

x=x+1;

y=y+1;

p=p+s;

}

delay(100);

}

}

void main()

{

int gd= DETECT,gm;

initgraph(&gd,&gm,"C:\\TurboC3\\BGI");

int x1,x2,y1,y2;

x1=x2=y1=y2=0;

cout<<"Enter the starting coordinate of the line : \nx : ";

cin>>x1;

cout<<"y : ";

cin>>y1;

cout<<"Enter the ending coordinates of the line : \nx : ";

cin>>x2;

cout<<"y : ";

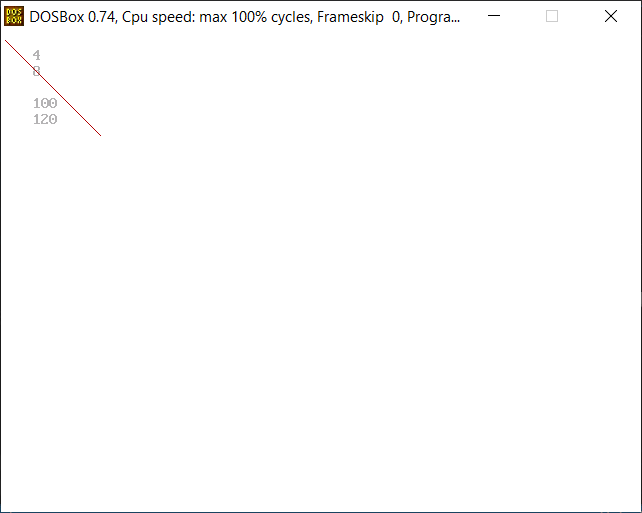
cin>>y2;

bresenhams(x1,y1,x2,y2);

getch();

}

OUTPUT:



1. **Write a program to implement mid-point circle drawing algorithm.**

CODE:

#include<iostream.h>

#include<graphics.h>

#include<dos.h>

#include<conio.h>

void circlePoints(int x,int y,int x\_centre,int y\_centre)

{

putpixel(x+x\_centre,y+y\_centre,RED);

delay(100);

putpixel(-x+x\_centre,y+y\_centre,RED);

delay(100);

putpixel(x+x\_centre,-y+y\_centre,RED);

delay(100);

putpixel(-x+x\_centre,-y+y\_centre,RED);

delay(100);

putpixel(y+y\_centre,x+x\_centre,RED);

delay(100);

putpixel(-y+y\_centre,x+x\_centre,RED);

delay(100);

putpixel(y+y\_centre,-x+x\_centre,RED);

delay(100);

putpixel(-y+y\_centre,-x+x\_centre,RED);

delay(100);

}

void midPointCircle(int r,int x\_centre,int y\_centre)

{

int x=0;

int y=r;

double d=3-2\*r;

while(y>x)

{

if(d<0)

d=d+4\*x+6.0;

else

{

d=d+4\*(x-y)+10.0;

y=y-1;

}

x++;

circlePoints(x,y,x\_centre,y\_centre);

}

return;

}

void main()

{

int i,gd=DETECT,gm;

int x,y,r;

initgraph(&gd,&gm,"C:\\TURBOC3\\BGI");

cout<<"Enter the centre coordinates:\n";

cout<<"x: ";

cin>>x;

cout<<"y: ";

cin>>y;

cout<<"Enter radius: ";

cin>>r;

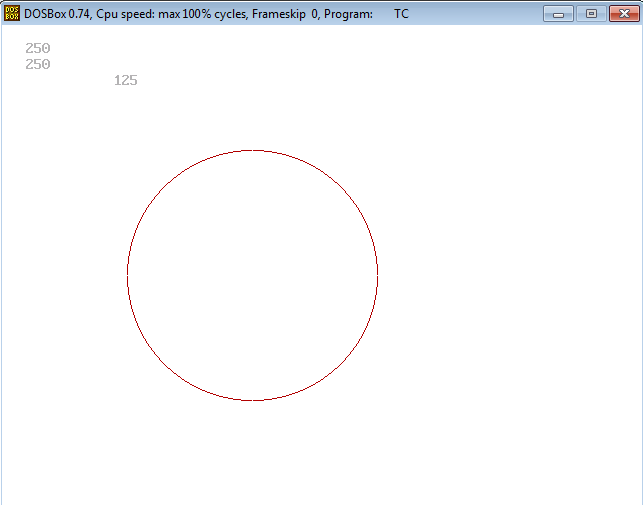
setbkcolor(WHITE);

midPointCircle(r,x,y);

getch();

}

OUTPUT:



1. **Write a program to clip a line using Cohen and Sutherland line clipping algorithm.**

CODE:

#include<iostream.h>

#include<graphics.h>

#include<conio.h>

/\*TOP=0001, LEFT=1000, RIGHT=0100, BOTTOM=0010\*/

int compOutCode(

double x,double y,

double xmin,double xmax,

double ymin,double ymax)

{

int code=0000;

if(y>ymax)

code+=0001;

else if(y<ymin)

code+=0010;

if(x>xmax)

code+=0100;

else if(x<xmin)

code+=1000;

return code;

}

void cohen(

double x0,double y0,

double x1, double y1,

double xmin,double xmax,

double ymin,double ymax)

{

cout<<"Applying Cohen-Sutherlan Algorithm";

int outcode0,outcode1,outcodeout;

int acc=0,done=0;

outcode0=compOutCode(x0,y0,xmin,xmax,ymin,ymax);

outcode1=compOutCode(x1,y1,xmin,xmax,ymin,ymax);

do

{

if(!(outcode0|outcode1))

{

acc=1;done=1;

}

else if(outcode0&outcode1)

{ done=1;

}

else{

double x,y;

outcodeout=outcode0?outcode0:outcode1;

if(outcodeout&0001)

{

x=x0+(x1-x0)\*(ymax-y0)/(y1-y0);

y=ymax;

cout<<"\nClipping Top!!!";

}

else if(outcodeout&0010)

{

x=x0+(x1-x0)\*(ymin-y0)/(y1-y0);

y=ymin;

cout<<"\nClipping Bottom!!!";

}

else if(outcodeout&0100)

{y=y0+(y1-y0)\*(xmax-x0)/(x1-x0);

x=xmax;

cout<<"\nClipping Right";

}

else

{y=y0+(y1-y0)\*(xmin-x0)/(x1-x0);

x=xmin;

cout<<"\nClipping Left";

}

if(outcodeout==outcode0)

{

x0=x;y0=y;outcode0=compOutCode(x0,y0,xmin,xmax,ymin,ymax);

}

else

{

x1=x;y1=y;outcode1=compOutCode(x1,y1,xmin,xmax,ymin,ymax);

}

}

}

while(done==0);

clrscr();

cout<<"After clipping window and line:";

rectangle(xmin,ymax,xmax,ymin);

line(x0,y0,x1,y1);

getch();

return;

}

void main()

{

int i,gd=DETECT,gm;

int l,r,b,t;

initgraph(&gd,&gm,"C:\\TURBOC3\\BGI");

cout<<"Enter the coordinates of clipping window:\n";

cout<<"left: ";

cin>>l;

cout<<"bottom: ";

cin>>b;

cout<<"right: ";

cin>>r;

cout<<"top: ";

cin>>t;

int x0,x1,y0,y1;

cout<<"Enter the coordinates of original line:\n";

cout<<"x0: ";

cin>>x0;

cout<<"y0: ";

cin>>y0;

cout<<"x1: ";

cin>>x1;

cout<<"y1: ";

cin>>y1;

clrscr();

cout<<"Before clipping window and line:";

rectangle(l,t,r,b);

line(x0,y0,x1,y1);

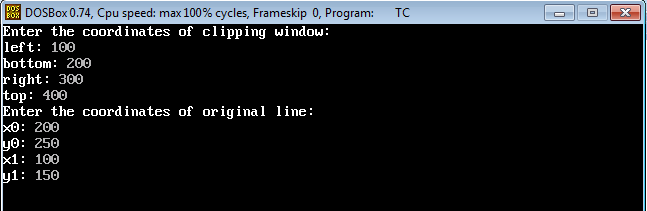
getch();

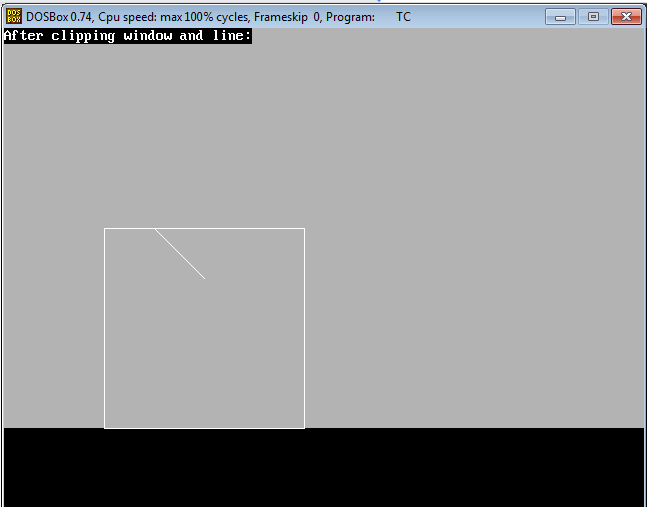
cohen(x0,y0,x1,y1,l,r,b,t);

return;

}

OUTPUT:



1. **Write a program to clip a polygon using Sutherland Hodgeman algorithm.**

CODE:

#include<iostream.h>

#include<conio.h>

#include<graphics.h>

int k,xmin,ymin,xmax,ymax,arr[20],m;

void clipl (int x1, int y1, int x2, int y2)

{

    if(x2-x1)

        m=(y2-y1)/(x2-x1);

    else

        m=100000;

    if(x1 >= xmin && x2 >= xmin)

    {

        arr[k]=x2;

        arr[k+1]=y2;

        k+=2;

    }

    if(x1 < xmin && x2 >= xmin)

    {

        arr[k]=xmin;

        arr[k+1]=y1+m\*(xmin-x1);

        arr[k+2]=x2;

        arr[k+3]=y2;

        k+=4;

    }

    if(x1 >= xmin  && x2 < xmin)

    {

        arr[k]=xmin;

        arr[k+1]=y1+m\*(xmin-x1);

        k+=2;

    }

}

void clipt(int x1, int y1, int x2, int y2)

{

    if(y2-y1)

        m=(x2-x1)/(y2-y1);

    else

        m=100000;

    if(y1 <= ymax && y2 <= ymax)

    {

        arr[k]=x2;

        arr[k+1]=y2;

        k+=2;

    }

    if(y1 > ymax && y2 <= ymax)

    {

        arr[k]=x1+m\*(ymax-y1);

        arr[k+1]=ymax;

        arr[k+2]=x2;

        arr[k+3]=y2;

        k+=4;

    }

    if(y1 <= ymax  && y2 > ymax)

    {

        arr[k]=x1+m\*(ymax-y1);

        arr[k+1]=ymax;

        k+=2;

    }

}

void clipr(int x1, int y1, int x2, int y2)

{

    if(x2-x1)

        m=(y2-y1)/(x2-x1);

    else

        m=100000;

    if(x1 <= xmax && x2 <= xmax)

    {

        arr[k]=x2;

        arr[k+1]=y2;

        k+=2;

    }

    if(x1 > xmax && x2 <= xmax)

    {

        arr[k]=xmax;

        arr[k+1]=y1+m\*(xmax-x1);

        arr[k+2]=x2;

        arr[k+3]=y2;

        k+=4;

    }

    if(x1 <= xmax  && x2 > xmax)

    {

        arr[k]=xmax;

        arr[k+1]=y1+m\*(xmax-x1);

        k+=2;

    }

}

void clipb(int x1, int y1, int x2, int y2)

{

    if(y2-y1)

        m=(x2-x1)/(y2-y1);

    else

        m=100000;

    if(y1 >= ymin && y2 >= ymin)

    {

        arr[k]=x2;

        arr[k+1]=y2;

        k+=2;

    }

    if(y1 < ymin && y2 >= ymin)

    {

        arr[k]=x1+m\*(ymin-y1);

        arr[k+1]=ymin;

        arr[k+2]=x2;

        arr[k+3]=y2;

        k+=4;

    }

    if(y1 >= ymin  && y2 < ymin)

    {

        arr[k]=x1+m\*(ymin-y1);

        arr[k+1]=ymin;

        k+=2;

    }

}

void main()

{

    int gd=DETECT,gm,n,poly[20];

    int xi,yi,xf,yf,polyy[20];

    initgraph(&gd,&gm,"C:\\TurboC3\\BGI");

    setcolor(WHITE);

    cout<<"Enter the Minimum Coordinates of visible window : x : ";

    cin>>xmin;

    cout<<"y : ";

    cin>>ymin;

    cout<<"Enter the Maximum Coordinates of visible window : x : ";

    cin>>xmax;

    cout<<"y : ";

    cin>>ymax;

    cout<<"Enter the number of side of Polygon to be clipped : ";

    cin>>n;

    cout<<"Enter the coordinates :";

    for(int i=0 ; i < 2\*n ; i++)

       cin>>polyy[i];

    polyy[i]=polyy[0];

    polyy[i+1]=polyy[1];

    for(i=0 ; i < 2\*n+2 ; i++)

poly[i]=polyy[i];

    clrscr();

    rectangle(xmin,ymax,xmax,ymin);

    cout<<"\tUNCLIPPED POLYGON";

    setcolor(WHITE);

    fillpoly(n,poly);

getch();

    clrscr();

    k=0;

    for(i=0;i < 2\*n;i+=2)

clipl(polyy[i],polyy[i+1],polyy[i+2],polyy[i+3]);

    n=k/2;

    for(i=0;i < k;i++)

polyy[i]=arr[i];

    polyy[i]=polyy[0];

    polyy[i+1]=polyy[1];

    k=0;

    for(i=0;i < 2\*n;i+=2)

clipt(polyy[i],polyy[i+1],polyy[i+2],polyy[i+3]);

    n=k/2;

    for(i=0;i < k;i++)

polyy[i]=arr[i];

    polyy[i]=polyy[0];

    polyy[i+1]=polyy[1];

    k=0;

    for(i=0;i < 2\*n;i+=2)

clipr(polyy[i],polyy[i+1],polyy[i+2],polyy[i+3]);

    n=k/2;

    for(i=0;i < k;i++)

polyy[i]=arr[i];

    polyy[i]=polyy[0];

    polyy[i+1]=polyy[1];

    k=0;

    for(i=0;i < 2\*n;i+=2)

clipb(polyy[i],polyy[i+1],polyy[i+2],polyy[i+3]);

    for(i=0;i < k;i++)

poly[i]=arr[i];

    if(k)

fillpoly(k/2,poly);

    setcolor(RED);

    rectangle(xmin,ymax,xmax,ymin);

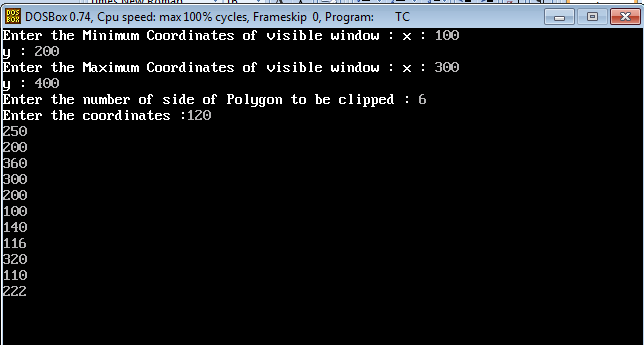
    cout<<"CLIPPED POLYGON";

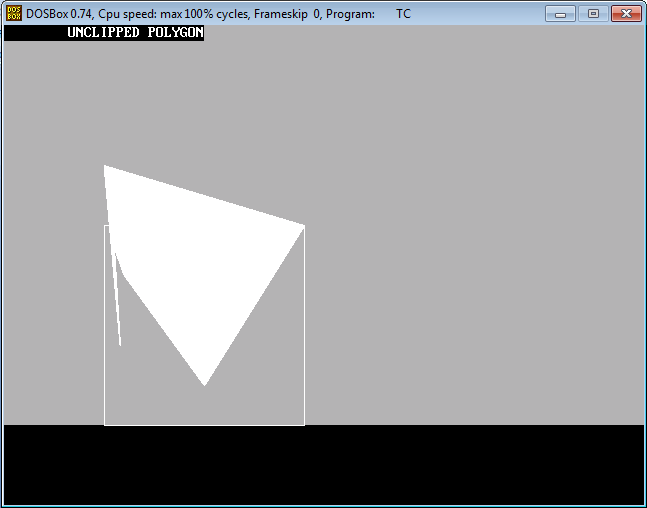
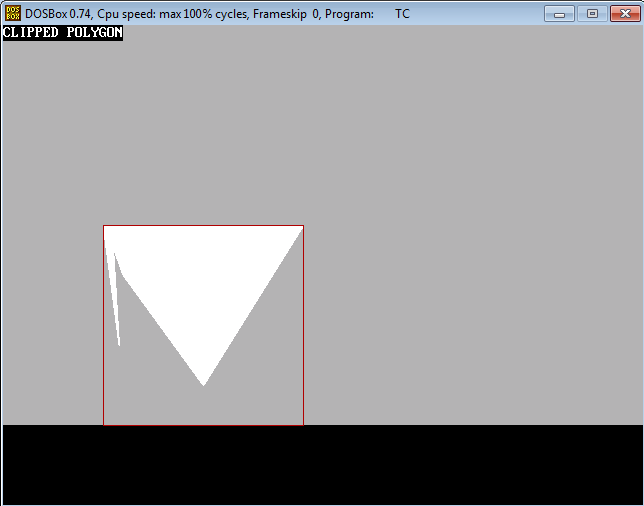
    getch();

    closegraph();

}

OUTPUT:



1. **Write a program to fill a polygon using Scan line fill algorithm.**

CODE:

#include <conio.h>

#include <iostream.h>

#include <graphics.h>

#include <stdlib.h>

#include <dos.h>

class point

{

    public:

    int x,y;

};

point p[20];

int inter[20],x,y;

int v,xmin,ymin,xmax,ymax;

int c;

void read()

{

 cout<<"SCAN\_FILL ALGORITHM";

 cout<<"\nEnter the no of vertices of polygon : ";

 cin>>v;

 cout<<"Enter the coordinates : \n "  ;

for(int i=0; i<v; i++) //ACCEPT THE VERTICES

{

    cout<<"x"<<(i+1)<<"=";

    cin>>p[i].x;

    cout<<"y"<<(i+1)<<"=";

    cin>>p[i].y;

}

p[i].x=p[0].x;

p[i].y=p[0].y;

xmin=xmax=p[0].x;

ymin=ymax=p[0].y;

}

void calcs()

{

    for(int i=0;i<v;i++)

    {

if(xmin>p[i].x)

xmin=p[i].x;

if(xmax<p[i].x)

xmax=p[i].x;

if(ymin>p[i].y)

ymin=p[i].y;

if(ymax<p[i].y)

ymax=p[i].y;

    }

}

void ints(float z) //DEFINE FUNCTION INTS

{

    int x1,x2,y1,y2,temp;

    c=0;

    for(int i=0;i<v;i++)

    {

x1=p[i].x;

y1=p[i].y;

x2=p[i+1].x;

y2=p[i+1].y;

if(y2<y1)

{

    temp=x1;

    x1=x2;

    x2=temp;

    temp=y1;

    y1=y2;

    y2=temp;

}

if(z<=y2&&z>=y1)

{

    if((y1-y2)==0)

    x=x1;

    else // used to make changes in x. so that we can fill our polygon after cerain distance

    {

x=((x2-x1)\*(z-y1))/(y2-y1);

x=x+x1;

    }

    if(x<=xmax && x>=xmin)

    inter[c++]=x;

}

    }

}

void sort(int z) //SORT FUNCTION

{

    int temp,j,i;

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

{

    line(p[i].x,p[i].y,p[i+1].x,p[i+1].y); // used to make hollow outlines of a polygon

}

delay(100);

for(i=0; i<c;i+=2)

{

  delay(100);

  line(inter[i],z,inter[i+1],z);  // Used to fill the polygon ....

}

}

void display()

{

    float s,s2;

    s=ymin+0.01;

    cleardevice();

    while(s<=ymax)

       {

ints(s);

sort(s);

s++;

       }

}

int main() //START OF MAIN

{

    int gd=DETECT,gm;

    initgraph(&gd,&gm,"C:\\TurboC3\\BGI");

    int cl;

    cout<<"\nEnter the colour u want:(0-15)->"; //Selecting colour

    cin>>cl;

    setcolor(cl);

    read();

    calcs();

    cleardevice();

    display();

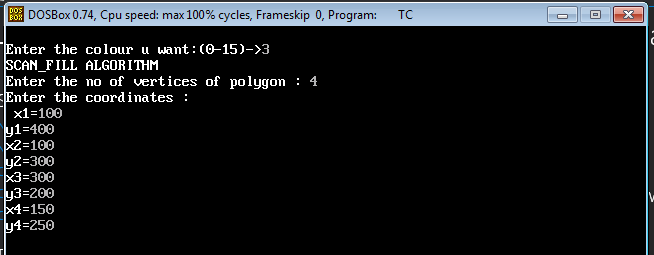
    closegraph();

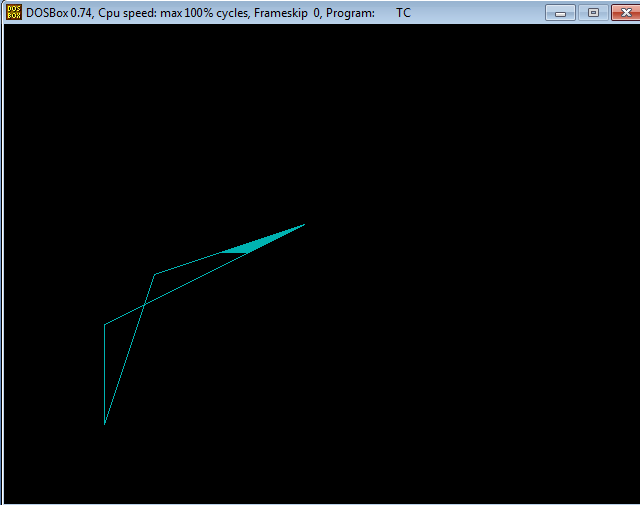
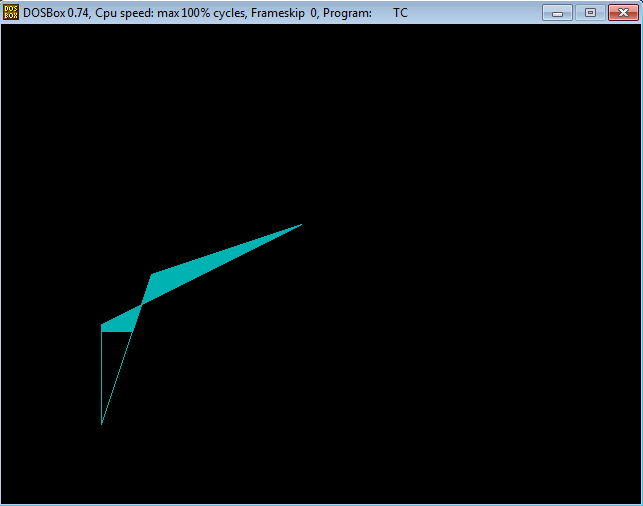
    getch();

    return 0;

}

OUTPUT:



1. **Write a program to apply various 2D transformations on a 2D object (use homogenous Coordinates).**

CODE:

#include<iostream.h>

#include<graphics.h>

#include<conio.h>

#include<dos.h>

#include<math.h>

#define pi 3.14285714

class transformations

{

double vertices[3][3];             //matrix contains vertices of the triangle

double t\_matrix[3][3];             //transformation matrix

double result[3][3];

public:

transformations(){};

void get\_vertices();

void display\_triangle();

void display\_triangle\_result();

void multiplication();

void copyback();

void rotation(double angle,double m,double n);

void reflection(double m,double c);

void scaling(double a,double d);

void shearing(double b,double c);

};

void transformations::get\_vertices()

{

int i=0;

for(i=0;i<3;i++)

     {

cout<<"\nEnter vertex "<<i+1<<"...";

cout<<"\nx1 : ";

cin>>vertices[i][0];

result[i][0]=vertices[i][0];

cout<<"y1 : ";

cin>>vertices[i][1];

result[i][1]=vertices[i][1];

vertices[i][2]=result[i][2]=1;

     }

}

void transformations::display\_triangle()

{

int i=0;

for(i=0;i<2;i++)

     line(vertices[i][0],vertices[i][1],vertices[i+1][0],vertices[i+1][1]);

     line(vertices[i][0],vertices[i][1],vertices[0][0],vertices[0][1]);

}

void transformations::display\_triangle\_result()

{

int i=0;

for(i=0;i<2;i++)

     line(result[i][0],result[i][1],result[i+1][0],result[i+1][1]);

     line(result[i][0],result[i][1],result[0][0],result[0][1]);

}

void transformations::copyback()

{

int i=0,j=0;

for(i=0;i<3;i++)

for(j=0;j<3;j++)

result[i][j]=vertices[i][j];

}

void transformations::multiplication()

{

double r[3][3];

int i=0,j=0,k=0;

for(i=0;i<3;i++)

{

for(j=0;j<3;j++)

    {

r[i][j]=0;

for(k=0;k<3;k++)

r[i][j]+=result[i][k]\*t\_matrix[k][j];

    }

}

for(i=0;i<3;i++)              //Copying back the result

for(j=0;j<3;j++)

result[i][j]=r[i][j];

}

//ROTATION:-

void transformations::rotation(double angle,double m,double n)

{

angle=((pi/180)\*angle);

copyback();

cleardevice();

setcolor(RED);

display\_triangle();

delay(20);

getch();

t\_matrix[0][0]=1;                     //Matrix for translating the triangle to origin

t\_matrix[0][1]=0;

t\_matrix[0][2]=0;

t\_matrix[1][0]=0;

t\_matrix[1][1]=1;

t\_matrix[1][2]=0;

t\_matrix[2][0]=(m\*(-1));

t\_matrix[2][1]=(n\*(-1));

t\_matrix[2][2]=1;

multiplication();

t\_matrix[0][0]=cos(angle);             //Matrix to perform rotation about origin

t\_matrix[0][1]=sin(angle);

t\_matrix[1][0]=(sin(angle)\*(-1));;

t\_matrix[1][1]=cos(angle);

t\_matrix[2][0]=0;

t\_matrix[2][1]=0;

multiplication();

t\_matrix[0][0]=1;                      //Matrix to translate back to original centre of rotation

t\_matrix[0][1]=0;

t\_matrix[1][0]=0;

t\_matrix[1][1]=1;

t\_matrix[2][0]=m;

t\_matrix[2][1]=n;

multiplication();

setcolor(GREEN);

display\_triangle\_result();

delay(20);

getch();

}

//REFLECTION:-

void transformations::reflection(double m,double c)

{

double angle=atan(m);                //tan inverse(slope)=angle

copyback();

cleardevice();

double x1=0,y1=c,x2=400,y2=(m\*x2)+c;

setcolor(YELLOW);

line(x1,y1,x2,y2);

delay(20);

getch();

setcolor(RED);

display\_triangle();

delay(20);

getch();

t\_matrix[0][0]=1;                     //translate (0,-c)

t\_matrix[0][1]=0;

t\_matrix[0][2]=0;

t\_matrix[1][0]=0;

t\_matrix[1][1]=1;

t\_matrix[1][2]=0;

t\_matrix[2][0]=0;

t\_matrix[2][1]=(c\*(-1));

t\_matrix[2][2]=1;

multiplication();

t\_matrix[0][0]=cos(-1\*angle);             //rotate the object about the x-axis by -angle

t\_matrix[0][1]=sin(-1\*angle);

t\_matrix[1][0]=(sin(-1\*angle)\*(-1));;

t\_matrix[1][1]=cos(-1\*angle);

t\_matrix[2][0]=0;

t\_matrix[2][1]=0;

multiplication();

t\_matrix[0][0]=1;                      //reflection about x-axis

t\_matrix[0][1]=0;

t\_matrix[1][0]=0;

t\_matrix[1][1]=-1;

t\_matrix[2][0]=0;

t\_matrix[2][1]=0;

multiplication();

t\_matrix[0][0]=cos(angle);             //rotate the object about the x-axis by -angle

t\_matrix[0][1]=sin(angle);

t\_matrix[1][0]=(sin(angle)\*(-1));;

t\_matrix[1][1]=cos(angle);

t\_matrix[2][0]=0;

t\_matrix[2][1]=0;

multiplication();

t\_matrix[0][0]=1;                       //translating back to original line of reflection

t\_matrix[0][1]=0;

t\_matrix[1][0]=0;

t\_matrix[1][1]=1;

t\_matrix[2][0]=0;

t\_matrix[2][1]=c;

multiplication();

setcolor(GREEN);

display\_triangle\_result();

delay(20);

getch();

}

//SCALING:-

void transformations::scaling(double a,double d)

{

copyback();

cleardevice();

setcolor(RED);

display\_triangle();

delay(20);

getch();

t\_matrix[0][0]=a;                     //Matrix for scaling the triangle

t\_matrix[0][1]=0;

t\_matrix[0][2]=0;

t\_matrix[1][0]=0;

t\_matrix[1][1]=d;

t\_matrix[1][2]=0;

t\_matrix[2][0]=0;

t\_matrix[2][1]=0;

t\_matrix[2][2]=1;

multiplication();

setcolor(GREEN);

display\_triangle\_result();

delay(20);

getch();

}

//SHEARING:-

void transformations::shearing(double b,double c)

{

copyback();

cleardevice();

setcolor(RED);

display\_triangle();

delay(20);

getch();

t\_matrix[0][0]=1;                     //Matrix for shearing the triangle

t\_matrix[0][1]=b;

t\_matrix[0][2]=0;

t\_matrix[1][0]=c;

t\_matrix[1][1]=1;

t\_matrix[1][2]=0;

t\_matrix[2][0]=0;

t\_matrix[2][1]=0;

t\_matrix[2][2]=1;

multiplication();

setcolor(GREEN);

display\_triangle\_result();

delay(20);

getch();

}

void main()

{

clrscr();

int gd=DETECT,gm,choice;

transformations t1;

char ch1,ch2;

double angle,m,n,slope,intercept,a,b,c,d;

do

    {

cout<<"\n\n\t   ........TWO DIMENSIONAL TRANSFORMATIONS........\n";

cout<<"\nEnter the details of a triangle(i.e. 2-D object).....";

       t1.get\_vertices();

do

  {

initgraph(&gd,&gm,"C:\\Turboc3\\BGI");

cout<<"\n.......MENU.......";

cout<<"\n1.Rotation.";

cout<<"\n2.Reflection.";

cout<<"\n3.Scaling.";

cout<<"\n4.Shearing.";

cout<<"\n..................";

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

cin>>choice;

switch(choice)

      {

case 1:cout<<"\n\nFOR ROTATION..........";

cout<<"\nEnter the angle of rotation :: ";

cin>>angle;

cout<<"\nNow,enter the point about which you wanna perform rotation :: ";

cout<<"\nx coordinate : ";

cin>>m;

cout<<"y coordinate : ";

cin>>n;

t1.rotation(angle,m,n);

break;

case 2:cout<<"\n\nFOR REFLECTION..........";

cout<<"\nTo enter the line in slope-intercept form(i.e. y=mx+c)....";

cout<<"\nEnter slope(m) : ";

cin>>slope;

cout<<"Then,enter y-intercept(c) : ";

cin>>intercept;

t1.reflection(slope,intercept);

break;

case 3:cout<<"\n\nFOR SCALING..........";

cout<<"\nEnter the factor of scaling...";

cout<<"\nAlong the x-axis : ";

cin>>a;

cout<<"And, along the y-axis : ";

cin>>d;

t1.scaling(a,d);

break;

case 4:cout<<"\n\nFOR SHEARING..........";

cout<<"\nEnter the factor of shearing...";

cout<<"\nAlong the x-axis : ";

cin>>c;

cout<<"And, along the y-axis : ";

cin>>b;

t1.shearing(b,c);

break;

default:cout<<"\n\n\t!!!INVALID CHOICE!!!";

getch();

      }

closegraph();

cout<<"\nWanna try another tarnsformation(y/n)...";

cin>>ch2;

}while(ch2=='y');

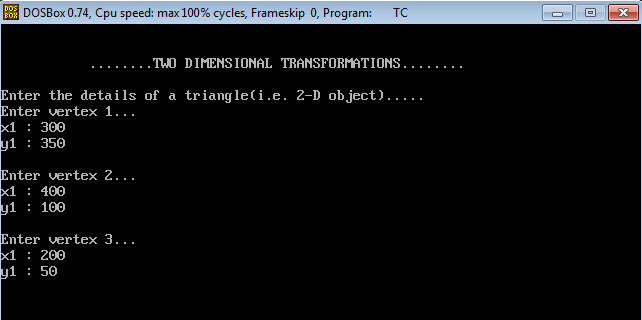
cout<<"\n\nWant to try with a triangle of different dimensions(y/n)? ";

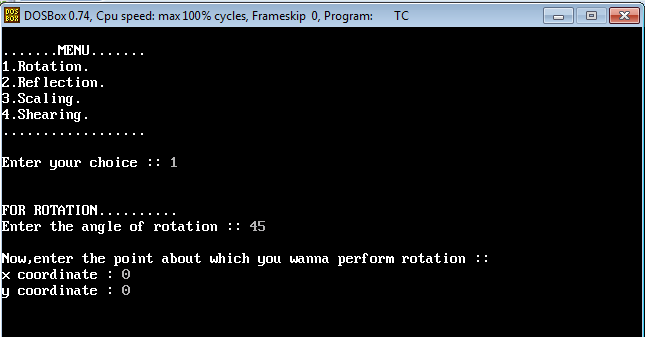
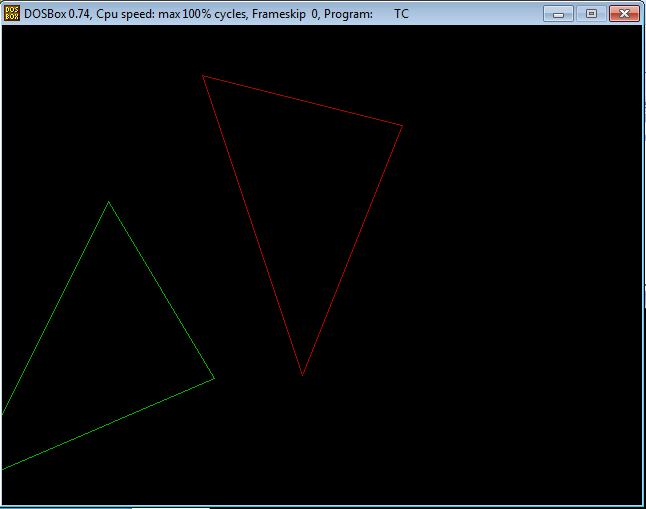
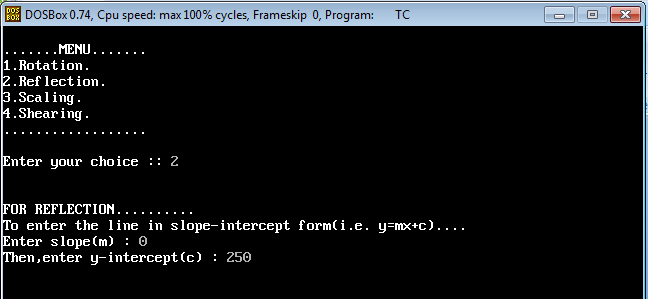
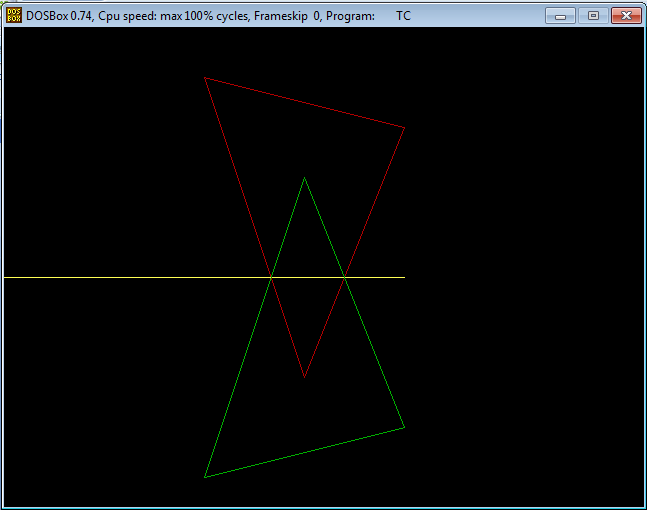
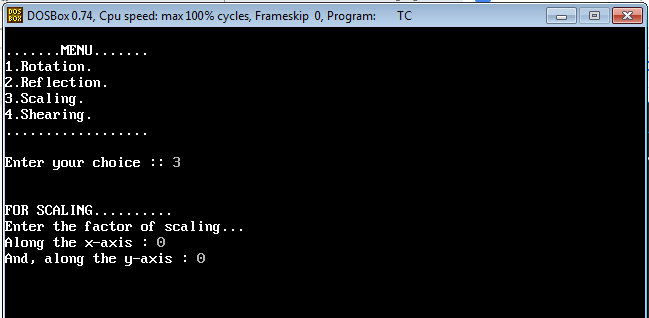
cin>>ch1;

}while(ch1=='y');

}

OUTPUT:



1. **Write a program to apply various 3D transformations on a 3D object and then apply parallel and perspective projection on it.**

CODE:

#include<iostream.h>

#include<graphics.h>

#include<conio.h>

#include<dos.h>

#include<math.h>

#define pi 3.14285714

class projections

{

      double vertices[8][4];               //matrix contains vertices of the triangle

      double t\_matrix[4][4];             //transformation matrix

      double result[8][4];

      public:

      projections(){};

      void get\_vertices();

      void display\_cube();

      void multiplication();

      void copyback();

      void orthographic();

      void axonometric(double angle\_x,double angle\_y);

      void cavalier(double angle);

      void cabinet(double angle);

      void single\_point(double r);

      void two\_point(double r);

      void three\_point(double r);

};

void projections::get\_vertices()

{

     for(int i=0;i<8;i++)

     {

cout<<"\nEnter vertex "<<i+1<<"...";

cout<<"\nx : ";

cin>>vertices[i][0];

result[i][0]=vertices[i][0];

cout<<"y : ";

cin>>vertices[i][1];

result[i][1]=vertices[i][1];

cout<<"z : ";

cin>>vertices[i][2];

result[i][2]=vertices[i][2];

vertices[i][3]=result[i][3]=1;

     }

}

void projections::display\_cube()

{

     int i=0;

     for(i=0;i<3;i++)

     line(result[i][0],result[i][1],result[i+1][0],result[i+1][1]);

     line(result[i][0],result[i][1],result[0][0],result[0][1]);

     for(i=4;i<7;i++)

     line(result[i][0],result[i][1],result[i+1][0],result[i+1][1]);

     line(result[i][0],result[i][1],result[4][0],result[4][1]);

     for(i=0;i<4;i++)

     line(result[i][0],result[i][1],result[i+4][0],result[i+4][1]);

}

void projections::copyback()

{

     int i=0,j=0;

     for(i=0;i<8;i++)

     for(j=0;j<4;j++)

     result[i][j]=vertices[i][j];

}

void projections::multiplication()

{

     double r[8][4];

     int i=0,j=0,k=0;

for(i=0;i<8;i++)

{

    for(j=0;j<4;j++)

    {

r[i][j]=0;

for(k=0;k<4;k++)

r[i][j]+=result[i][k]\*t\_matrix[k][j];

    }

}

     for(i=0;i<8;i++)              //Copying back the result

     for(j=0;j<4;j++)

     result[i][j]=r[i][j];

}

//ORTHOGRAPHIC PROJECTION....................................................................

void projections::orthographic()

{

     cleardevice();

     clearviewport();

     cout<<"\tORTHOGRAPHIC PROJECTION...........";

     copyback();

     t\_matrix[0][0]=1;              //[T] for parallel projection on plane z=0

     t\_matrix[0][1]=0;

     t\_matrix[0][2]=0;

     t\_matrix[0][3]=0;

     t\_matrix[1][0]=0;

     t\_matrix[1][1]=1;

     t\_matrix[1][2]=0;

     t\_matrix[1][3]=0;

     t\_matrix[2][0]=0;

     t\_matrix[2][1]=0;

     t\_matrix[2][2]=0;

     t\_matrix[2][3]=0;

     t\_matrix[3][0]=0;

     t\_matrix[3][1]=0;

     t\_matrix[3][2]=0;

     t\_matrix[3][3]=1;

      multiplication();

    setcolor(GREEN);

    display\_cube();

    delay(20);

    getch();

}

//AXONOMETRIC PROJECTION..................................................................

void projections::axonometric(double angle\_x,double angle\_y)

{

     angle\_x=((pi/180)\*angle\_x);                //tan inverse(slope)=angle

     angle\_y=((pi/180)\*angle\_y);

     cleardevice();

     clearviewport();

     cout<<"\tAXONOMETRIC PROJECTION...........";

     copyback();

     t\_matrix[0][0]=cos(angle\_y);              //[T] for parallel projection on plane z=0

     t\_matrix[0][1]=(sin(angle\_y))\*(sin(angle\_x));

     t\_matrix[0][2]=0;

     t\_matrix[0][3]=0;

     t\_matrix[1][0]=0;

     t\_matrix[1][1]=cos(angle\_x);

     t\_matrix[1][2]=0;

     t\_matrix[1][3]=0;

     t\_matrix[2][0]=sin(angle\_y);

     t\_matrix[2][1]=(-1)\*(cos(angle\_y)\*sin(angle\_x));

     t\_matrix[2][2]=0;

     t\_matrix[2][3]=0;

     t\_matrix[3][0]=0;

     t\_matrix[3][1]=0;

     t\_matrix[3][2]=0;

     t\_matrix[3][3]=1;

      multiplication();

    setcolor(GREEN);

    display\_cube();

    delay(20);

    getch();

}

//CAVALIER OBLIQUE PROJECTION..................................................................

void projections::cavalier(double angle)

{

     angle=((pi/180)\*angle);                //converting degrees into radian

     cleardevice();

     clearviewport();

     cout<<"\tCAVALIER PROJECTION...........";

     copyback();

     t\_matrix[0][0]=1;              //[T] for cavalier projection on plane z=0

     t\_matrix[0][1]=0;

     t\_matrix[0][2]=0;

     t\_matrix[0][3]=0;

     t\_matrix[1][0]=0;

     t\_matrix[1][1]=1;

     t\_matrix[1][2]=0;

     t\_matrix[1][3]=0;

     t\_matrix[2][0]=(-1)\*1\*cos(angle);

     t\_matrix[2][1]=(-1)\*1\*sin(angle);

     t\_matrix[2][2]=0;

     t\_matrix[2][3]=0;

     t\_matrix[3][0]=0;

     t\_matrix[3][1]=0;

     t\_matrix[3][2]=0;

     t\_matrix[3][3]=1;

      multiplication();

    setcolor(GREEN);

    display\_cube();

    delay(20);

    getch();

}

//CABINET OBLIQUE PROJECTION..................................................................

void projections::cabinet(double angle)

{

     angle=((pi/180)\*angle);        //converting degrees into radian

     cleardevice();

     clearviewport();

     cout<<"\tCABINET PROJECTION...........";

     copyback();

     t\_matrix[0][0]=1;              //[T] for cabinet projection on plane z=0

     t\_matrix[0][1]=0;

     t\_matrix[0][2]=0;

     t\_matrix[0][3]=0;

     t\_matrix[1][0]=0;

     t\_matrix[1][1]=1;

     t\_matrix[1][2]=0;

     t\_matrix[1][3]=0;

     t\_matrix[2][0]=(-1)\*0.5\*cos(angle);

     t\_matrix[2][1]=(-1)\*0.5\*sin(angle);

     t\_matrix[2][2]=0;

     t\_matrix[2][3]=0;

     t\_matrix[3][0]=0;

     t\_matrix[3][1]=0;

     t\_matrix[3][2]=0;

     t\_matrix[3][3]=1;

      multiplication();

    setcolor(GREEN);

    display\_cube();

    delay(20);

    getch();

}

//SINGLE POINT PRESPECTIVE PROJECTION..................................................................

void projections::single\_point(double r)

{

     double l=10,m=10,n=10;            //Translation factors along x, y and z axis

     cleardevice();

     clearviewport();

     cout<<"\tSINGLE POINT PRESPECTIVE PROJECTION...........";

     r=(-1/r);

     copyback();

     t\_matrix[0][0]=1;              //[T] for single point prespective projection on plane z=0

     t\_matrix[0][1]=0;

     t\_matrix[0][2]=0;

     t\_matrix[0][3]=0;

     t\_matrix[1][0]=0;

     t\_matrix[1][1]=1;

     t\_matrix[1][2]=0;

     t\_matrix[1][3]=0;

     t\_matrix[2][0]=0;

     t\_matrix[2][1]=0;

     t\_matrix[2][2]=0;

     t\_matrix[2][3]=r;

     t\_matrix[3][0]=l;

     t\_matrix[3][1]=m;

     t\_matrix[3][2]=0;

     t\_matrix[3][3]=r\*n+1;

     multiplication();

     setcolor(GREEN);

     display\_cube();

     delay(20);

     getch();

}

//TWO-POINT PRESPECTIVE PROJECTION..................................................................

void projections::two\_point(double r)

{

     double angle=45;

     angle=(pi/180)\*angle;

     cleardevice();

     clearviewport();

     cout<<"\tTWO POINT PRESPECTIVE PROJECTION...........";

     copyback();

     r=(-1/r);

     t\_matrix[0][0]=cos(angle);              //[T] for two point prespective projection on plane z=0

     t\_matrix[0][1]=0;

     t\_matrix[0][2]=(-1\*sin(angle));

     t\_matrix[0][3]=sin(angle)/r;

     t\_matrix[1][0]=0;

     t\_matrix[1][1]=1;

     t\_matrix[1][2]=0;

     t\_matrix[1][3]=0;

     t\_matrix[2][0]=sin(angle);

     t\_matrix[2][1]=0;

     t\_matrix[2][2]=cos(angle);

     t\_matrix[2][3]=(-1\*cos(angle))/r;

     t\_matrix[3][0]=0;

     t\_matrix[3][1]=0;

     t\_matrix[3][2]=0;

     t\_matrix[3][3]=1;

                    multiplication();

     setcolor(GREEN);

     display\_cube();

     delay(20);

     getch();

}

//THREE POINT PRESPECTIVE PROJECTION..........................................

void projections::three\_point(double r)

{

     double angle\_y=45,angle\_x=45;

     angle\_y=(pi/180)\*angle\_y;

     angle\_x=(pi/180)\*angle\_x;

     cleardevice();

     clearviewport();

     cout<<"\tTHREE POINT PRESPECTIVE PROJECTION...........";

     copyback();

     r=(-1/r);

     t\_matrix[0][0]=cos(angle\_y);              //[T] for three point prespective projection on plane z=0

     t\_matrix[0][1]=sin(angle\_y)\*sin(angle\_x);

     t\_matrix[0][2]=0;

     t\_matrix[0][3]=(sin(angle\_y)\*cos(angle\_x))/r;

     t\_matrix[1][0]=0;

     t\_matrix[1][1]=cos(angle\_x);

     t\_matrix[1][2]=0;

     t\_matrix[1][3]=(-1\*sin(angle\_x))/r;

     t\_matrix[2][0]=(sin(angle\_y));

     t\_matrix[2][1]=(-1\*cos(angle\_y)\*sin(angle\_x));

     t\_matrix[2][2]=0;

     t\_matrix[2][3]=(-1\*cos(angle\_y)\*cos(angle\_x))/r;

     t\_matrix[3][0]=0;

     t\_matrix[3][1]=0;

     t\_matrix[3][2]=0;

     t\_matrix[3][3]=1;

     multiplication();

     setcolor(GREEN);

     display\_cube();

     delay(20);

     getch();

}

void main()

{

    clrscr();

    int gd=DETECT,gm,choice;

    projections t1;

    char ch1,ch2,axis,axis1,axis2;

    double angle\_x,angle\_y,angle,ratio,ratio1,ratio2,ratio3;

    do

    {

       cout<<"\n\n\t   ........PROJECTIONS OF 3D OBJECTS........\n";

       cout<<"\nEnter the details of a cube(i.e. 3D object).....";

       t1.get\_vertices();

  do

  {

      initgraph(&gd,&gm,"C:\\Turboc3\\BGI");

      cout<<"\n\n...........MENU...........";

      cout<<"\n1.Orthographic.";

      cout<<"\n2.Axonometric.";

      cout<<"\n3.Cavalier (Oblique type 1).";

      cout<<"\n4.Cabinet (Oblique type 2)";

      cout<<"\n5.Single-Point presepective.";

      cout<<"\n6.Two-Point presepective.";

      cout<<"\n7.Three-Point presepective.";

      cout<<"\n............................";

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

      cin>>choice;

      switch(choice)

      {

    case 1:t1.orthographic();

    break;

    case 2:cout<<"\n\nFOR AXONOMETRIC PROJECTION..........";

    cout<<"\nEnter the angle of rotation about :-";

    cout<<"\nx-axis : ";

    cin>>angle\_x;

    cout<<"And, y-axis : ";

    cin>>angle\_y;

    t1.axonometric(angle\_x,angle\_y);

    break;

    case 3:cout<<"\n\nFOR CAVALIER PROJECTION..........";

    cout<<"\nEnter the angle of inclination : ";

    cin>>angle;

    t1.cavalier(angle);

    break;

    case 4:cout<<"\n\nFOR CABINET PROJECTION..........";

    cout<<"\nEnter the angle of inclination : ";

    cin>>angle;

    t1.cabinet(angle);

    break;

    case 5:cout<<"\n\nFOR SINGLE POINT PRESPECTIVE PROJECTION..........";

    cout<<"\nAssuming that the VP lies on the z-axis....";

    cout<<"Enter the prespective ratio for z-axis :: ";

    cin>>ratio;

    t1.single\_point(ratio);

    break;

    case 6:cout<<"\n\nFOR TWO POINT PRESPECTIVE PROJECTION..........";

    cout<<"\nAssuming that the VP lies on the z-axis....";

    cout<<"Enter the prespective ratio for z-axis :: ";

    cin>>ratio;

    t1.two\_point(ratio);

    break;

    case 7:cout<<"\n\nFOR THREE POINT PRESPECTIVE PROJECTION..........";

    cout<<"\nAssuming that the VP lies on the z-axis....";

    cout<<"Enter the prespective ratio for z-axis :: ";

    cin>>ratio;

    t1.three\_point(ratio);

                               break;

    default:cout<<"\n\n\t!!!INVALID CHOICE!!!";

                                getch();

      }

      closegraph();

      cout<<"\nWanna try another projection(y/n)...";

      cin>>ch2;

  }while(ch2=='y');

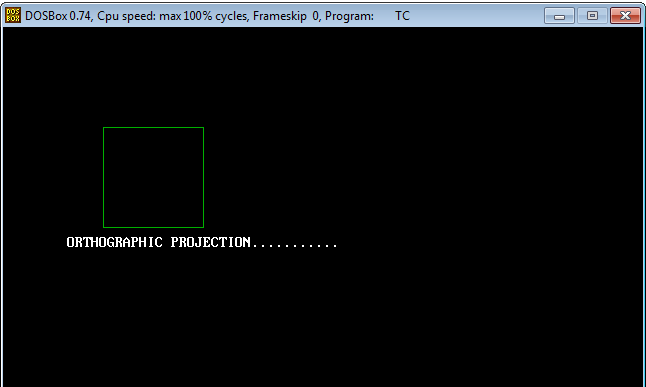
       cout<<"\nWanna try with a cube of different dimensions(y/n)... ";

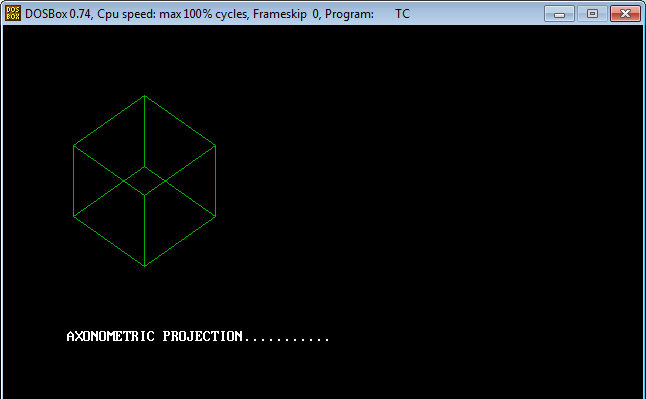
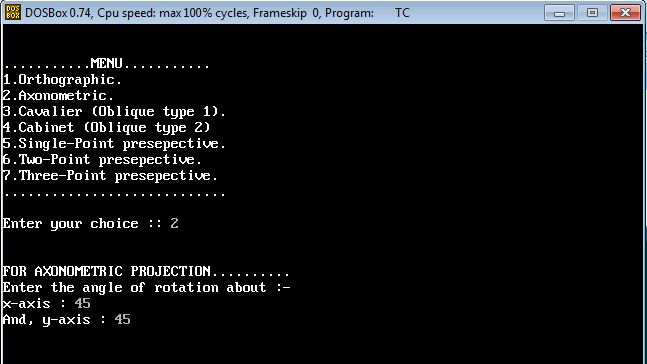
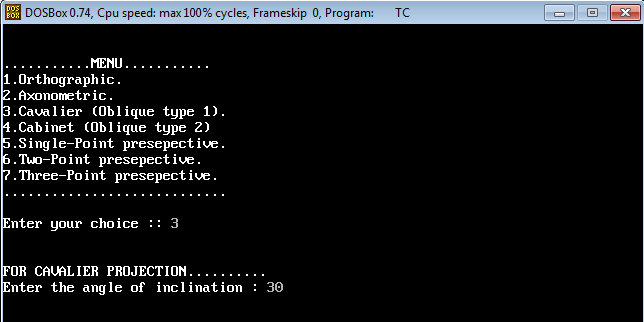
       cin>>ch1;

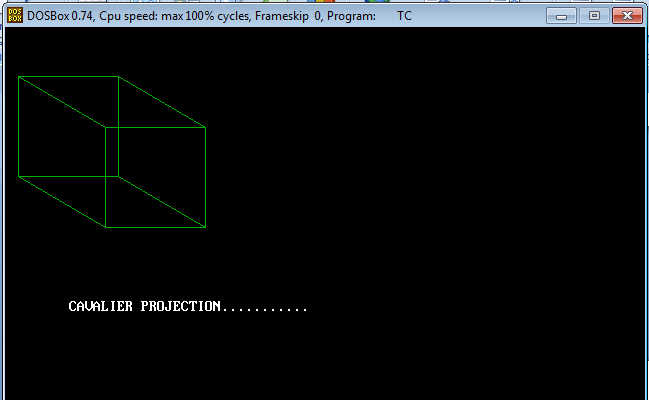
    }while(ch1=='y');

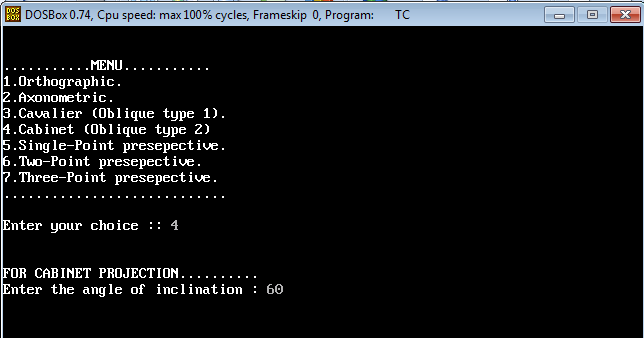
}

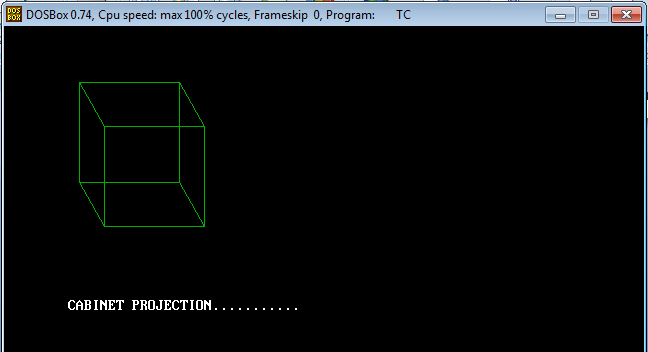
OUTPUT:

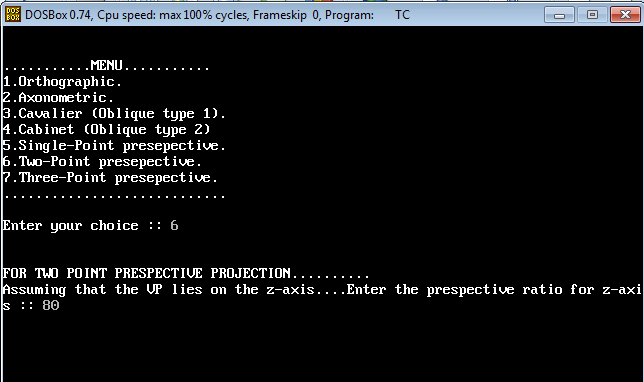


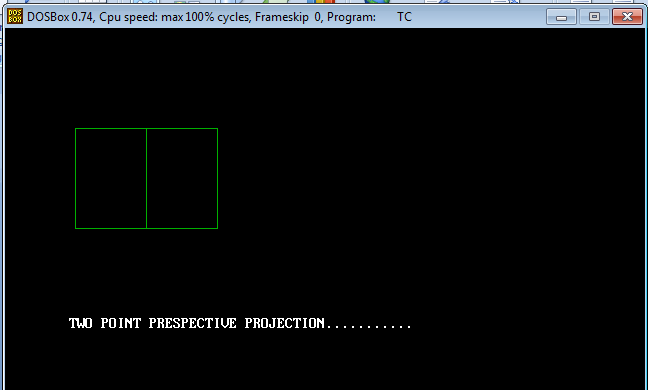
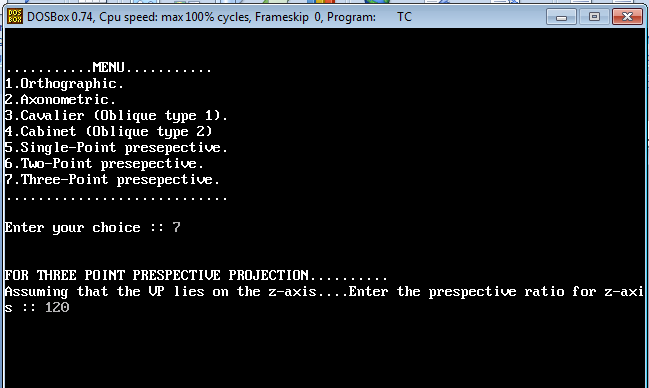
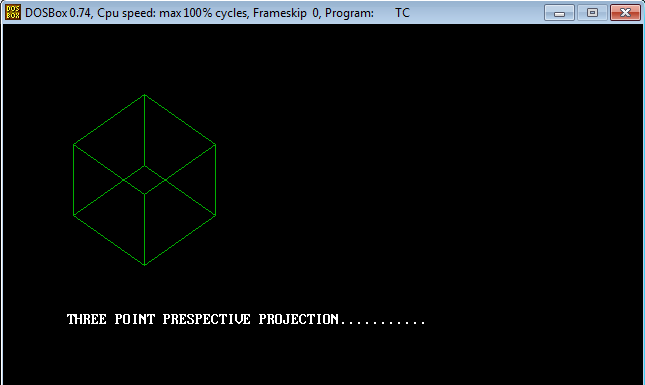
 









1. **Write a program to draw Hermite /Bezier curve.**

CODE:

#include<stdio.h>

    #include<graphics.h>

    #include<iostream.h>

    #include<conio.h>

    #include<stdlib.h>

    #include<math.h>

    void bezier(int x[4], int y[4])

    {

        double t;

        for(t=0.0;t < 1.0;t+=0.0005)

        {

            double xt=pow(1-t,3)\*x[0]+3\*t\*pow(1-t,2)\*x[1]+3\*pow(t,2)\*(1-t)\*x[2]+pow(t,3)\*x[3];

            double yt=pow(1-t,3)\*y[0]+3\*t\*pow(1-t,2)\*y[1]+3\*pow(t,2)\*(1-t)\*y[2]+pow(t,3)\*y[3];

    putpixel(xt,yt,RED);

        }

        for(int i=0;i < 4;i++)

        putpixel(x[i],y[i],YELLOW);

        getch();

        closegraph();

        return;

    }

    void main()

    {

        /\* request auto detection \*/

        int gdriver = DETECT, gmode, errorcode;

        /\* initialize graphics and local variables \*/

        initgraph(&gdriver, &gmode, "..\\bgi");

        /\* read result of initialization \*/

        errorcode = graphresult();

        /\* an error occurred \*/

        if (errorcode != grOk)

        {

            printf("Graphics error: %s\n", grapherrormsg(errorcode));

            printf("Press any key to halt:");

            getch();

            exit(1);

        }

        int x[4],y[4];

        int i;

cout<<"Enter x and y coordinates"<<endl;

for(i=0;i < 4;i++)

{

    cin>>x[i];

    cout<<endl;

    cin>>y[i];

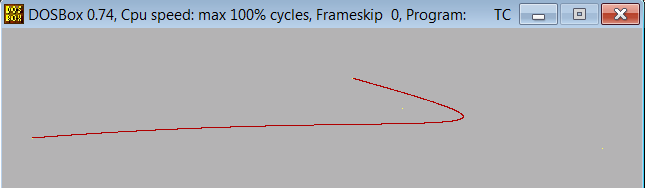
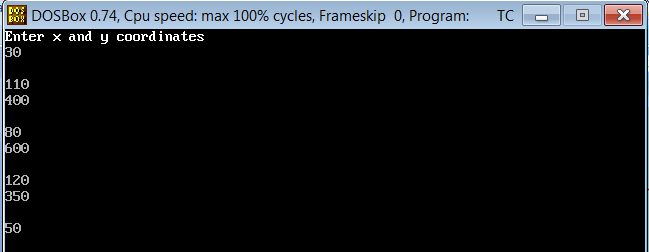
}

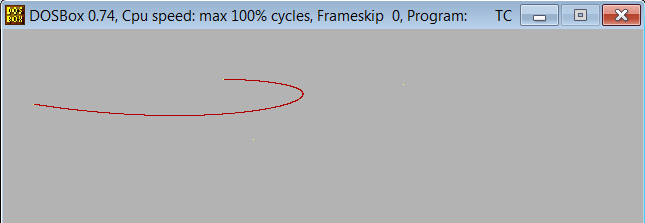
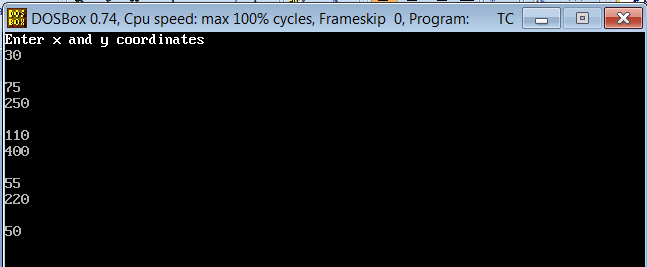
clrscr();

bezier(x,y);

}

OUTPUT:





Q6) Write a program to apply various 2D transformations on a 2D object (use homogenous Coordinates).

**CODE-**

#include<iostream.h>

#include<graphics.h>

#include<conio.h>

#include<dos.h>

#include<math.h>

#define pi 3.14285714

class transformations

{

double vertices[3][3];

double t\_matrix[3][3];

double result[3][3];

public:

transformations(){};

void get\_vertices();

void display\_triangle();

void display\_triangle\_result();

void multiplication();

void copyback();

void rotation(double angle,double m,double n);

void reflection(double m,double c);

void scaling(double a,double d);

void shearing(double b,double c);

};

void transformations::get\_vertices()

{

int i=0;

for(i=0;i<3;i++)

     {

cout<<"\nEnter vertex "<<i+1<<":";

cout<<"\nx1 : ";

cin>>vertices[i][0];

result[i][0]=vertices[i][0];

cout<<"y1 : ";

cin>>vertices[i][1];

result[i][1]=vertices[i][1];

vertices[i][2]=result[i][2]=1;

     }

}

void transformations::display\_triangle()

{

int i=0;

for(i=0;i<2;i++)

     line(vertices[i][0],vertices[i][1],vertices[i+1][0],vertices[i+1][1]);

     line(vertices[i][0],vertices[i][1],vertices[0][0],vertices[0][1]);

}

void transformations::display\_triangle\_result()

{

int i=0;

for(i=0;i<2;i++)

     line(result[i][0],result[i][1],result[i+1][0],result[i+1][1]);

     line(result[i][0],result[i][1],result[0][0],result[0][1]);

}

void transformations::copyback()

{

int i=0,j=0;

for(i=0;i<3;i++)

for(j=0;j<3;j++)

result[i][j]=vertices[i][j];

}

void transformations::multiplication()

{

double r[3][3];

int i=0,j=0,k=0;

for(i=0;i<3;i++)

{

for(j=0;j<3;j++)

    {

r[i][j]=0;

for(k=0;k<3;k++)

r[i][j]+=result[i][k]\*t\_matrix[k][j];

    }

}

for(i=0;i<3;i++)

for(j=0;j<3;j++)

result[i][j]=r[i][j];

}

void transformations::rotation(double angle,double m,double n)

{

angle=((pi/180)\*angle);

copyback();

cleardevice();

setcolor(RED);

display\_triangle();

delay(20);

getch();

t\_matrix[0][0]=1;

t\_matrix[0][1]=0;

t\_matrix[0][2]=0;

t\_matrix[1][0]=0;

t\_matrix[1][1]=1;

t\_matrix[1][2]=0;

t\_matrix[2][0]=(m\*(-1));

t\_matrix[2][1]=(n\*(-1));

t\_matrix[2][2]=1;

multiplication();

t\_matrix[0][0]=cos(angle);

t\_matrix[0][1]=sin(angle);

t\_matrix[1][0]=(sin(angle)\*(-1));;

t\_matrix[1][1]=cos(angle);

t\_matrix[2][0]=0;

t\_matrix[2][1]=0;

multiplication();

t\_matrix[0][0]=1;

t\_matrix[0][1]=0;

t\_matrix[1][0]=0;

t\_matrix[1][1]=1;

t\_matrix[2][0]=m;

t\_matrix[2][1]=n;

multiplication();

setcolor(YELLOW);

display\_triangle\_result();

delay(20);

getch();

}

void transformations::reflection(double m,double c)

{

double angle=atan(m);

copyback();

cleardevice();

double x1=0,y1=c,x2=400,y2=(m\*x2)+c;

setcolor(YELLOW);

line(x1,y1,x2,y2);

delay(20);

getch();

setcolor(RED);

display\_triangle();

delay(20);

getch();

t\_matrix[0][0]=1;

t\_matrix[0][1]=0;

t\_matrix[0][2]=0;

t\_matrix[1][0]=0;

t\_matrix[1][1]=1;

t\_matrix[1][2]=0;

t\_matrix[2][0]=0;

t\_matrix[2][1]=(c\*(-1));

t\_matrix[2][2]=1;

multiplication();

t\_matrix[0][0]=cos(-1\*angle);

t\_matrix[0][1]=sin(-1\*angle);

t\_matrix[1][0]=(sin(-1\*angle)\*(-1));;

t\_matrix[1][1]=cos(-1\*angle);

t\_matrix[2][0]=0;

t\_matrix[2][1]=0;

multiplication();

t\_matrix[0][0]=1;

t\_matrix[0][1]=0;

t\_matrix[1][0]=0;

t\_matrix[1][1]=-1;

t\_matrix[2][0]=0;

t\_matrix[2][1]=0;

multiplication();

t\_matrix[0][0]=cos(angle);

t\_matrix[0][1]=sin(angle);

t\_matrix[1][0]=(sin(angle)\*(-1));;

t\_matrix[1][1]=cos(angle);

t\_matrix[2][0]=0;

t\_matrix[2][1]=0;

multiplication();

t\_matrix[0][0]=1;

t\_matrix[0][1]=0;

t\_matrix[1][0]=0;

t\_matrix[1][1]=1;

t\_matrix[2][0]=0;

t\_matrix[2][1]=c;

multiplication();

setcolor(YELLOW);

display\_triangle\_result();

delay(20);

getch();

}

void transformations::scaling(double a,double d)

{

copyback();

cleardevice();

setcolor(RED);

display\_triangle();

delay(20);

getch();

t\_matrix[0][0]=a;

t\_matrix[0][1]=0;

t\_matrix[0][2]=0;

t\_matrix[1][0]=0;

t\_matrix[1][1]=d;

t\_matrix[1][2]=0;

t\_matrix[2][0]=0;

t\_matrix[2][1]=0;

t\_matrix[2][2]=1;

multiplication();

setcolor(YELLOW);

display\_triangle\_result();

delay(20);

getch();

}

void transformations::shearing(double b,double c)

{

copyback();

cleardevice();

setcolor(RED);

display\_triangle();

delay(20);

getch();

t\_matrix[0][0]=1;

t\_matrix[0][1]=b;

t\_matrix[0][2]=0;

t\_matrix[1][0]=c;

t\_matrix[1][1]=1;

t\_matrix[1][2]=0;

t\_matrix[2][0]=0;

t\_matrix[2][1]=0;

t\_matrix[2][2]=1;

multiplication();

setcolor(YELLOW);

display\_triangle\_result();

delay(20);

getch();

}

void main()

{

clrscr();

int gd=DETECT,gm,choice;

transformations t1;

char ch1,ch2;

double angle,m,n,slope,intercept,a,b,c,d;

do

    {

cout<<"\n\n\tTWO DIMENSIONAL TRANSFORMATIONS\n";

cout<<"\nEnter the details of a triangle(i.e. 2-D object)";

       t1.get\_vertices();

do

  {

initgraph(&gd,&gm,"C:\\Turboc3\\BGI");

cout<<"\n.......MENU.......";

cout<<"\n1.Rotation.";

cout<<"\n2.Reflection.";

cout<<"\n3.Scaling.";

cout<<"\n4.Shearing.";

cout<<"\n..................";

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

cin>>choice;

switch(choice)

      {

case 1:cout<<"\n\nFOR ROTATION..........";

cout<<"\nEnter the angle of rotation :: ";

cin>>angle;

cout<<"\nEnter the point about which rotation is performed :: ";

cout<<"\nx coordinate : ";

cin>>m;

cout<<"y coordinate : ";

cin>>n;

t1.rotation(angle,m,n);

break;

case 2:cout<<"\n\nFOR REFLECTION..........";

cout<<"\nTo enter the line in slope-intercept form(i.e. y=mx+b)....";

cout<<"\nEnter slope(m) : ";

cin>>slope;

cout<<"Enter y-intercept(b) : ";

cin>>intercept;

t1.reflection(slope,intercept);

break;

case 3:cout<<"\n\nFOR SCALING..........";

cout<<"\nEnter the factor of scaling...";

cout<<"\nAlong the x-axis : ";

cin>>a;

cout<<"Along the y-axis : ";

cin>>d;

t1.scaling(a,d);

break;

case 4:cout<<"\n\nFOR SHEARING..........";

cout<<"\nEnter the factor of shearing...";

cout<<"\nAlong the x-axis : ";

cin>>c;

cout<<"Along the y-axis : ";

cin>>b;

t1.shearing(b,c);

break;

default:cout<<"\n\n\t!!!INVALID CHOICE!!!";

getch();

      }

closegraph();

cout<<"\nDo you want to try another transformation?(Y/N)...";

cin>>ch2;

}while(ch2=='y'|| ch2=='Y');

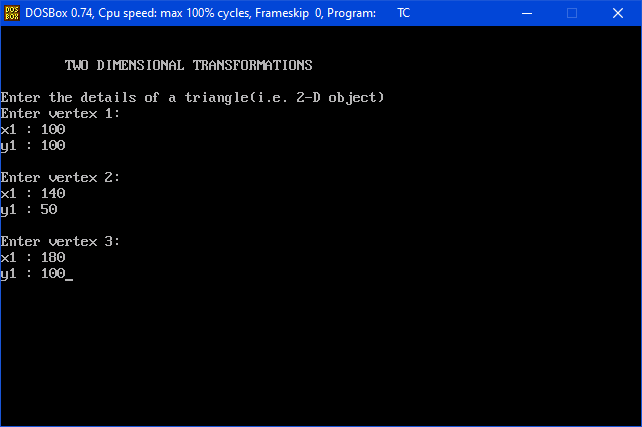
cout<<"\n\nDo you want to try with a triangle with different dimensions(Y/N)? ";

cin>>ch1;

}while(ch1=='y' || ch1=='Y');

}

**OUTPUT-**

****

