INDRAPRASTHA COLLEGE FOR WOMEN

UNIVERSITY OF DELHI

COURSE: BSC. (HONS.) COMPUTER SCIENCE

PRACTICAL: COMPUTER GRAPHICS

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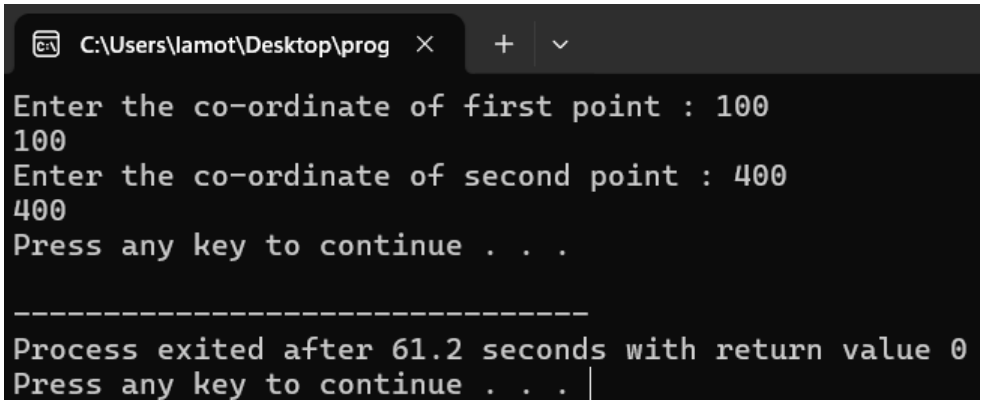
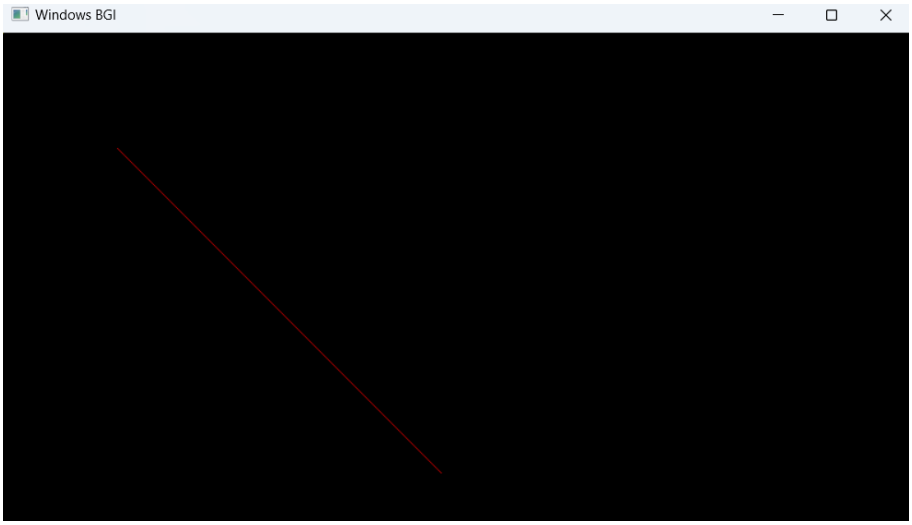
ROLL NO.:21/CS/54

Question 1: Write a program to implement DDA and Bresenham's line drawing algorithm.

```
#include<iostream>
#include<graphics.h>
using namespace std;
void drawline(int x0, int x1, int y0, int y1)
	{
		int dy,dx,x,y,dE,dNE,d;
		dx=x1-x0;
		dy=y1-y0;
		x=x0;
		y=y0;
		d=2*dy-dx;
		dE=2*dy;
		dNE=2*(dy-dx);
		while(x<x1){
			if(d<=0){
				putpixel(x,y,7);
				x=x+1;
				d=d+dE;
				delay(100);
			}
			else{
				putpixel(x,y,RED);
				x=x+1;
				y=y+1;
```

```
                    d=d+dNE;
                    delay(100);
                }
            }
        }

int main(){
    int x0,y0,x1,y1;
    int window1 = initwindow(800,800);
    cout<<"Enter the co-ordinate of first point : ";
    cin>>x0>>y0;
    cout<<"Enter the co-ordinate of second point : ";
    cin>>x1>>y1;
    drawline(x0,x1,y0,y1);
    system("pause");
    return 0;
}
```



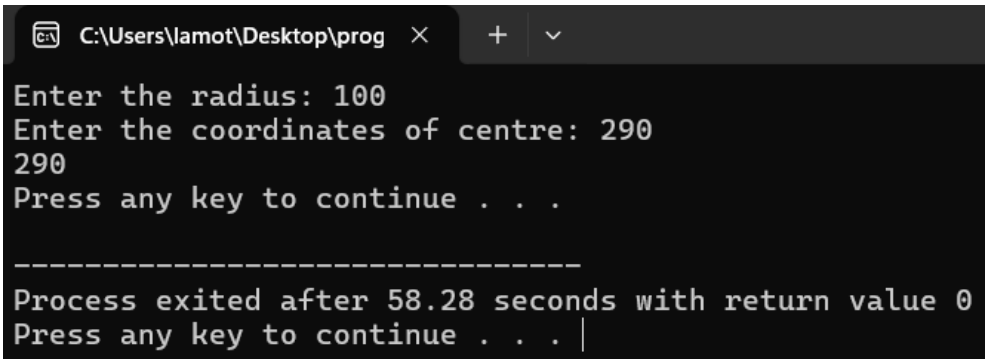


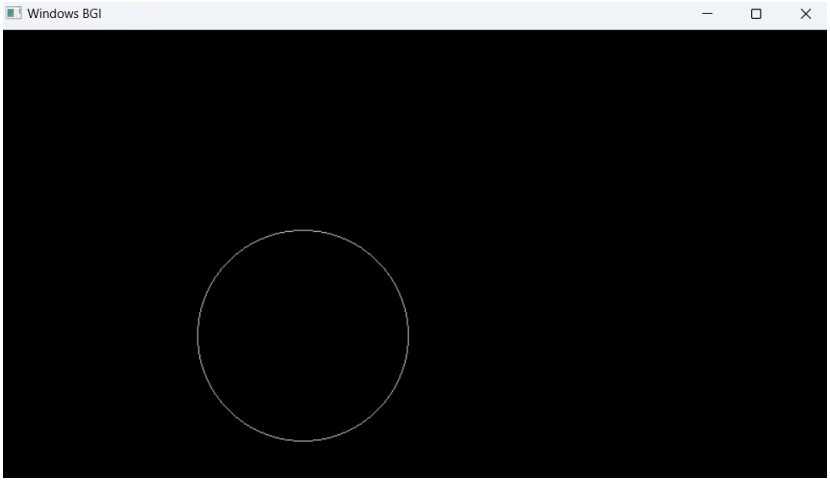
Question 2: Write a program to implement mid-point circle drawing algorithm.

```
#include<graphics.h>
using namespace std;
void drawline(int rad,int c1,int c2)
{
	int x,y,dE,dNE,d;
	x=0;
	y=rad;
	d=1-rad;
	while(y>x){
		if(d<0){
			putpixel(x+c1,y+c2,7);
			putpixel(-x+c1,y+c2,7);
			putpixel(x+c1,-y+c2,7);
			putpixel(-x+c1,-y+c2,7);
			putpixel(y+c1,x+c2,7);
			putpixel(y+c1,-x+c2,7);
			putpixel(-y+c1,x+c2,7);
```

```
                putpixel(-y+c1,-x+c2,7);
                d=d+2*x+3;
                x=x+1;
                delay(100);
        }
        else{
                putpixel(x+c1,y+c2,7);
                putpixel(-x+c1,y+c2,7);
                putpixel(x+c1,-y+c2,7);
                putpixel(-x+c1,-y+c2,7);
                putpixel(y+c1,x+c2,7);
                putpixel(y+c1,-x+c2,7);
                putpixel(-y+c1,x+c2,7);
                putpixel(-y+c1,-x+c2,7);
                d=d+2*(x-y)+5;
                x=x+1;
                y=y-1;
                delay(100);
        }
    }
}
int main(){
    int radius,c1,c2;
    int window1 = initwindow(800,800);
    cout<<"Enter the radius: ";
    cin>>radius;
    cout<<"Enter the coordinates of centre: ";
```

```
    cin>>c1>>c2;
    drawline(radius,c1,c2);
    closegraph(window1);
    return 0;
}
```





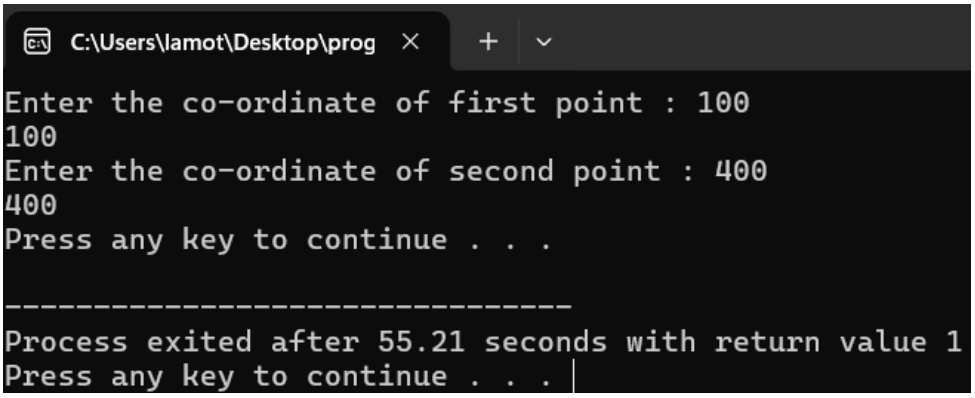
Question 3: Write a program to clip a line using Cohen and Sutherland line clipping algorithm.

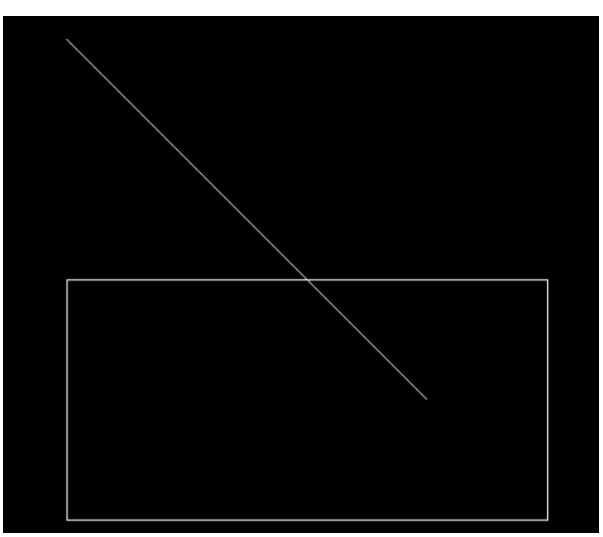
```
#include<iostream>
#include<graphics.h>
using namespace std;
int xmin=100, ymin=300, xmax=500, ymax=500; const int Left =1;
const int Right = 2;
const int Top =8;
```

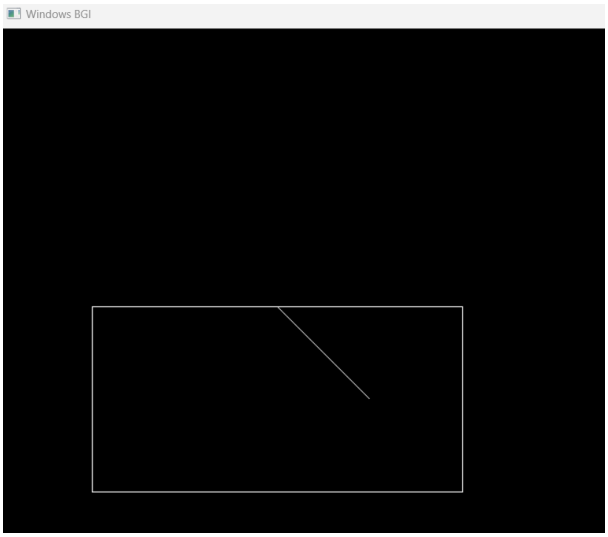
```
const int Bottom =4;
int computecode(int x, int y){
	int code=0;
	if(x<xmin)
		code|= Left;
	else if(y<ymin)
		code|= Bottom;
	if(x>xmax)
		code|= Right;
	else if(y>ymax)
		code|= Top;
	return code;
}

void clip(int x0,int x1,int y0,int y1){
	int code1,code2,outc1;
	int accept, flag=0;
	code1 = computecode(x0,y0);
	code2 = computecode(x1,y1);
	double m= (y1-y0)/(x1-x0);
	if(code1&code2){
		accept=false;
	}
	else{
		do{
			if(code1==code2){
				accept=true;
```

```
            flag=1;
        }
        else{
            int x,y;
            outc1=code1?code1:code2;
            if(outc1&Top){
                x=x0+(1/m)*(ymax-y0);
                y=ymax;
            }
            else if(outc1 & Bottom){
                x=x0+(1/m)*(ymin-y0);
                y=ymin;
            }
            else if(outc1 & Left){
                y=y0+m*(xmin-x0);
                x=xmin;
            }
            else if(outc1 & Right){
                y=y0+m*(xmax-x0);
                x=xmax;
            }
            if(outc1==code1){
                x0=x; y0=y;
                code1= computecode(x0,y0);
            }
            else{
                x1=x; y1=y;
```

```
                                        code2= computecode(x1,y1);
                                        }
                        }
                } while(!flag); // do-while end
        }
        if(accept){
                cleardevice();
                line(x0,y0,x1,y1);
                rectangle(xmin,ymin,xmax,ymax);
        }
}

int main(){
        int window1 = initwindow(800,800);
        int x0,x1,y0,y1;
        cout<<"Enter the co-ordinate of first point : ";
        cin>>x0>>y0;
        cout<<"Enter the co-ordinate of second point : ";
        cin>>x1>>y1;
        line(x0,y0,x1,y1);
        rectangle(xmin,ymin,xmax
        ,ymax); delay(7000);
        clip(x0,x1,y0,y1);
        system("pause");
        return 1;
}
```







Question 4: Write a program to clip a polygon using Sutherland Hodgeman algorithm.

```
#include<iostream>
#include<graphics.h>
#define round(a)((int)(a+0.5))
using namespace std;
int xmin=100,xmax=500,ymin=100,ymax=500,arr[20], m;
int k;
void clipleft(int x1,int y1,int x2,int y2){
        if(x2-x1)
                m=(y2-y1)/(x2-
```

```
                x1);
        else
                m=10000;

        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 cliptop(int x1,int y1,int x2,int y2){
        if(y2-y1)
                m=(x2-x1)/(y2-y1);
```

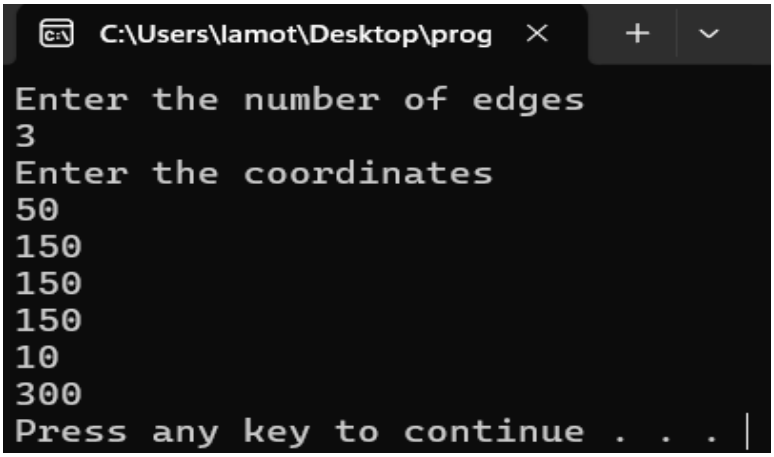
```
        else
                m=10000;
        if(y1<=ymax &&
                y2<=ymax){
                arr[k]=x2;
                arr[k+1]=y2;
                k+=2;
        }
        if(y1>ymax &&         y2<=ymax){
                arr[k]=x1+m*(ymax-y1);
                arr[k+1]=ymax;
                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 clipright(int x1,int y1,int x2,int y2){
        if(x2-x1)
                m=(y2-y1)/(x2-x1);
        else
                m=10000;
```

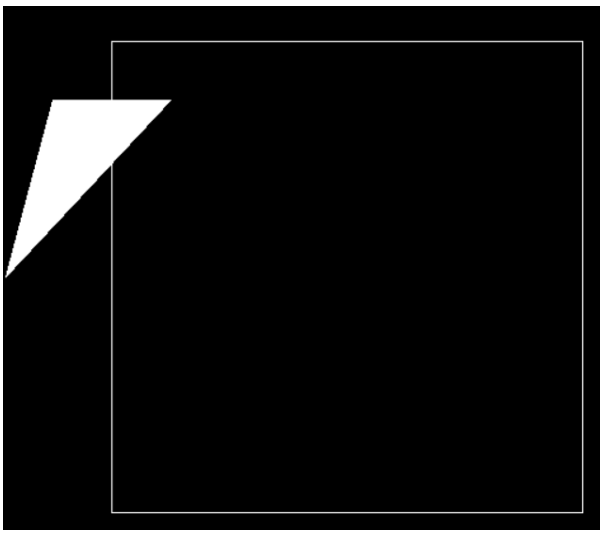
```
        if(x1<=xmax && x2<=xmax){
                arr[k]=x2;

                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 clipbottom(int x1,int y1,int x2,int y2){

        if(y2-y1)
                m=(x2-x1)/(y2-y1);
        else
                m=10000;
```

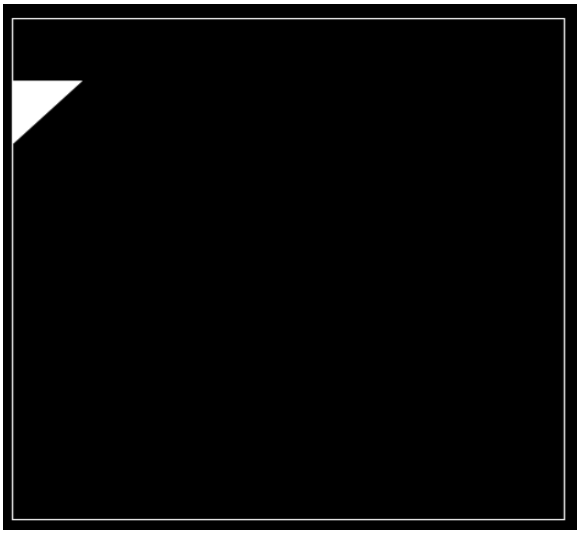
```
        if(y1>=ymin && y2>=ymin){
                arr[k]=x2;
                arr[k+1]=y2; k+=2;
        }
        if(y1<ymin && y2>=ymin){

                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;
        }
}

int main(){
        int polyy[20];
        int window1 = initwindow(800,800);
        int n,i;
        cout<<"Enter the number of edges"<<endl;
        cin>>n;
        cout<<"Enter the coordinates"<<endl;
```

```
for(i=0; i<2*n;i++)
cin>>polyy[i];
polyy[i]=polyy[0];
polyy[i+1]=polyy[1];

rectangle(xmin,ymax,xmax,ymin);
fillpoly(n,polyy);
delay(7000);
cleardevice();
k=0;
for(i=0;i<2*n;i+=2)
        clipleft(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)
        cliptop(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)
            clipright(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)
            clipbottom(polyy[i],polyy[i+1],polyy[i+2],polyy[i+3]);


        for(i=0;i<k;i++)
            polyy[i]=arr[i];
            rectangle(xmin,ymax,xmax,ymin);
        if(k)
            fillpoly(k/2,polyy);
        system("pause");
        return 1;
}
```





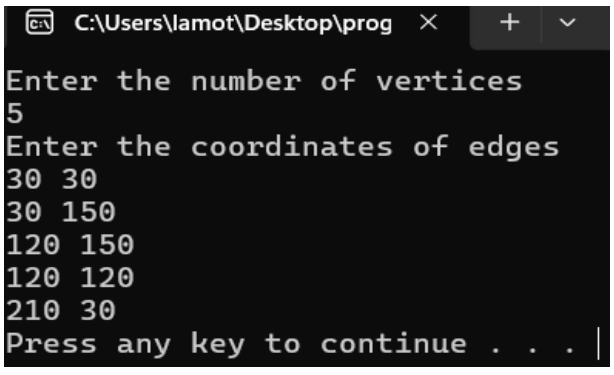


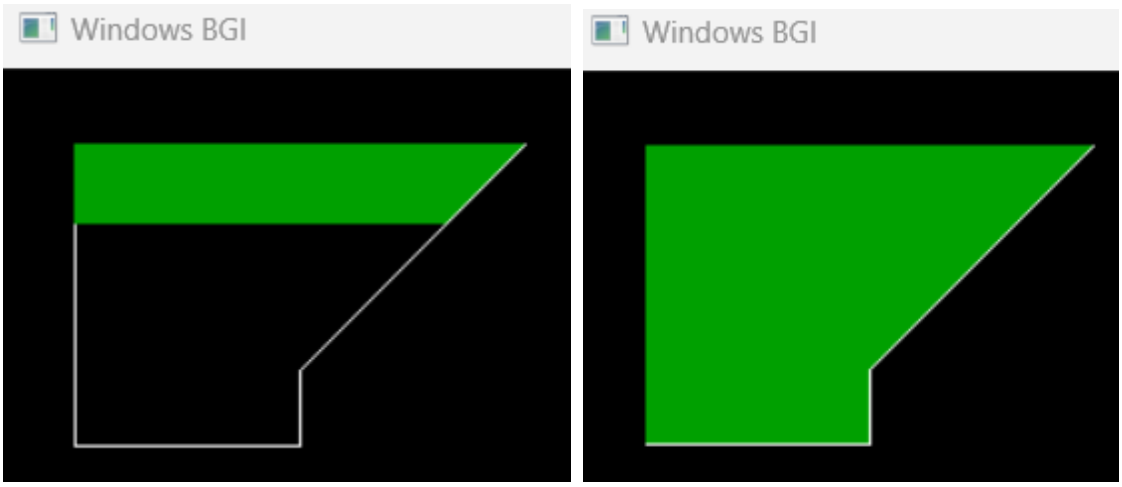
Question 5: Write a program to fill a polygon using Scan line fill algorithm.

```
#include<iostream>
#include<graphics.h>
using namespace std;
int main(){
                int i,j,n,k,x[20],y[20],ymin=10000,ymax=0,dy,dx,in_x[100],temp;
                float slope[100];
                int window1 = initwindow(800,800);
                cout<<"Enter the number of vertices"<<endl;

                cin>>n;
                cout<<"Enter the coordinates of edges"<<endl;
                for(i=0;i<n;i++){
                        cin>>x[i]>>y[i];
            if(y[i]>ymax)
                        ymax=y[i];
```

```
    if(y[i]<ymin)
            ymin=y[i];
}
x[n]=x[0];y[n]=y[0];
for(i=0;i<n;i++)
    line(x[i],y[i],x[i+1],y[i+1]);
    delay(4000);
for(i=0;i<n;i++){
    dy=y[i+1]-y[i]; dx=x[i+1]-x[i];
    if(dy==0)
            slope[i]=1.0;
    if(dx==0)
            slope[i]=0.0;
    if(dy!=0 &&   dx!=0)
            slope[i]=(float)dx/dy;
}
for(i=ymin;i<=ymax;i++){
    k=0;
    for(j=0;j<n;j++){
            if((y[j]<=i && y[j+1]>i) || (y[j]>i && y[j+1]<=i)){
                    in_x[k]=(int)(x[j]+ slope[j]*(i-y[j]));
                    k++;
            }
    }

    for(int m=0;m<k-1;m++){
            for(int l=0;l<k-1;l++){
```

```
                    if(in_x[l]>in_x[l+1]){
                        temp=in_x[l];
                        in_x[l]=in_x[l+1];
                        in_x[l+1]=temp;
                    }
                }
            }

            setcolor(2);
            for(int p=0;p<k;p+=2){
                line(in_x[p],i,
                in_x[p+1],i);
                delay(100);
            }
        }
        system("pause");
        return 1;
}
```





Question 6: Write a program to apply various 2D transformations on a 2D object (usehomogenous Coordinates).

```
#include <iostream>
#include<graphics.h>
#include<cmath>
using namespace std;
int main(){
        int tx=2,ty=5;
        int window1 = initwindow(800,800);
        int i,j,k;
        float P[2][3];
        cout<<"Enter the coordinates of line"<<endl;
        for(i=0;i<2;i++){
                for(j=0;j<2;j++)
                        cin>>P[i][j];
                        P[i][j]=1;
        }
```

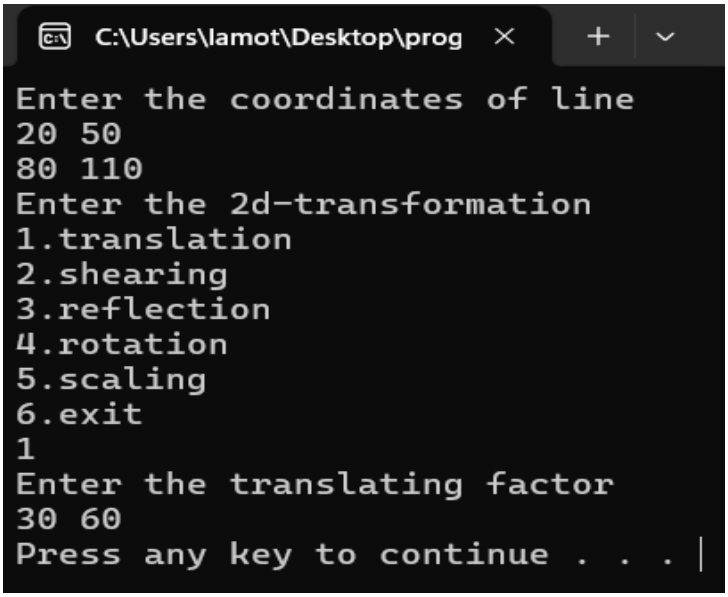
```
line(P[0][0], P[0][1], P[1][0], P[1][1]);
delay(7000);
float pp[2][3]={0};
int ch;
cout<<"Enter the 2d-transformation"<<endl;
cout<<"1.translation \n2.shearing \n3.reflection \n4.rotation \n5.scaling \n6.exit"<<endl;
cin>>ch;
switch(ch){
        case 1: {
                cout<<"Enter the translating factor"<<endl;
                cin>>tx>>ty;
                int T[3][3] = {{1,0,0},{0,1,0},{tx,ty,1}};

                for(i=0;i<2;i++){
                        for(j=0;j<3;j++)
                        for(k=0;k<3;k++)

                        pp[i][j]+=P[i][k]*T[k][j];
                }

                line(pp[0][0], pp[0][1], pp[1][0],pp[1][1]);
                system("pause");
                break;
        }
        case 2:{
                int sh;
```

```
char ax;
cout<<"Enter the shearing axis"<<endl;
cin>>ax;
cout<<"Enter the shearing factor"<<endl;
if(ax=='x'){
        cin>>sh;
        int T[3][3]={{1,0,0},{sh,1,0},{0,0,1}};
        for(i=0;i<2;i++){
                for(j=0;j<3;j++)
                for(k=0;k<3;k++)

                pp[i][j]+=P[i][k]*T[k][j];
        }
        line(pp[0][0], pp[0][1], pp[1][0], pp[1][1]);
        system("pause");
}
if(ax=='y'){
        cin>>sh;

        int T[3][3]={{1,sh,0},{0,1,0},{0,0,1}};
        for(i=0;i<2;i++){
                for(j=0;j<3;j++)
                for(k=0;k<3;k++)

                pp[i][j]+=P[i][k]*T[k][j];
        }
line(pp[0][0], pp[0][1], pp[1][0], pp[1][1]);
```

```
        system("pause");
        }
        break;
}
case 3:{
        int midx,midy,xn1,yn1,xn2,yn2;
        char ax;
        midx=getmaxx() / 2;
        midy=getmaxy() / 2;
        line(0,midy,midx*2,midy);
        line(midx,0,midx,midy*2);
        cout<<"Enter the axis for reflection"<<endl; cin>>ax;

        if(ax=='y'){
                xn1=(midx-P[1][0])+midx;
                yn1=P[0][1];
                xn2=(midx-P[0][0])+midx;
                yn2=P[1][1];
        }
        if(ax=='x'){
                yn1=(midy-P[1][1])+midy;
                xn1=P[0][0];
                yn2=(midy-P[0][1])+midy;
                xn2=P[1][0];

                cout<<xn1<<" "<<yn1<<" "<<xn2<<" "<<yn2<<endl;
        }
```

```
            line(xn1,yn1,xn2,yn2);
            system("pause");
            break;
    }
    case 4:{
            float theta;
            cout<<"Enter the theta for rotation"<<endl;
            cin>>theta;
            float rx;
            rx=(theta*3.14)/180;
            float T[3][3]={{cos(rx),sin(rx),0},{-sin(rx),cos(rx),0},{0,0,1}};
            for(i=0;i<2;i++){
                    for(j=0;j<3;j++)
                    for(k=0;k<3;k++)
                    pp[i][j]+=P[i][k]*T[k][j];
            }
            line(pp[0][0], pp[0][1], pp[1][0], pp[1][1]);
            system("pause");
            break;
    }

    case 5:{
            int Sx,Sy;
            cout<<"Enter the scaling factor for x-axis"<<endl;
            cin>>Sx;
            cout<<"Enter the scaling factor for y -axis"<<endl;
            cin>>Sy;
```

```
                int T[3][3]={{Sx,0,1},{0,Sy,1},{0,0,1}};
                for(i=0;i<2;i++){
                        for(j=0;j<3;j++)
                        for(k=0;k<3;k++)
                        pp[i][j]+=P[i][k]*T[k][j];
                }
                line(pp[0][0], pp[0][1], pp[1][0], pp[1][1]);
                system("pause");
                break;
        }
    }
    return 0;
}
```

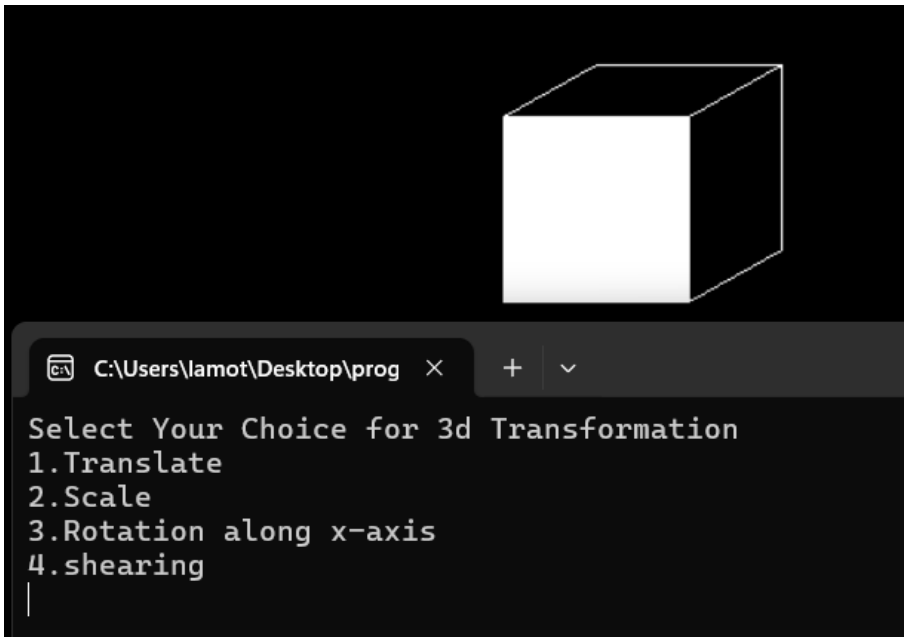


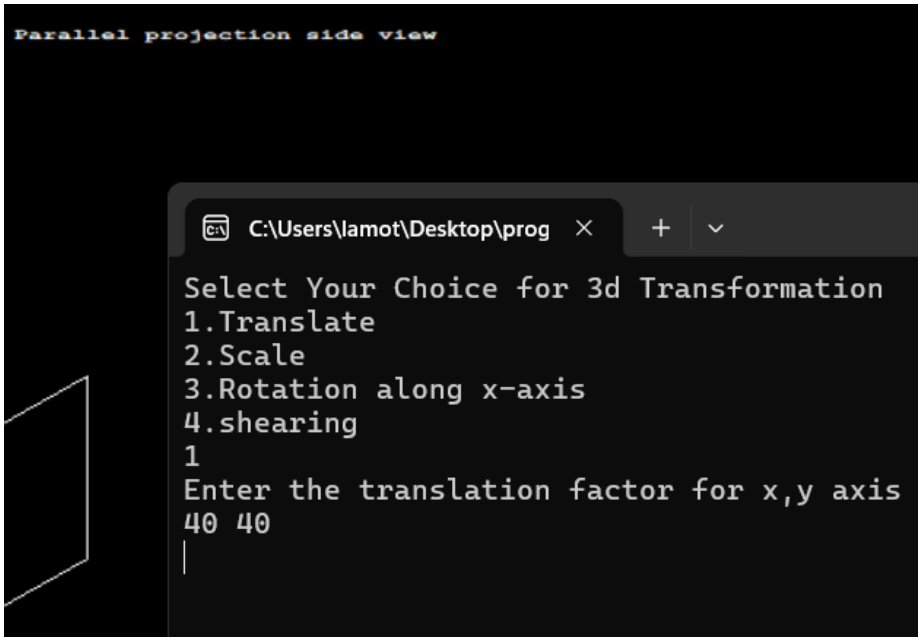
Question 7: Write a program to apply various 3D transformations on a 3D object and then apply parallel and perspective projection on it.

```
#include<iostream>
#include<graphics.h>
#include<cmath>
using namespace std;
int maxx,maxy,midx, midy;
int main(){
        int window1 =
        initwindow(800,800);
        bar3d(270,200,370,300,50,5);
        int ch,i,j,k; int pp[4][4];
        cout<<"Select Your Choice for 3d Transformation\n";

        cout<<"1.Translate\n2.Scale\n3.Rotation along x-axis\n4.shearing\n";
        cin>>ch; cleardevice();
        switch(ch){
```

```
case 1:{
        int tx,ty;
        cout<<"Enter the translation factor for x,y axis"<<endl;
        cin>>tx>>ty;
        bar3d(270+tx,200+ty,370+tx,300+ty,50,5);
        delay(7000);
        cleardevice();
        outtextxy(10,20,"Parallel projection side view");
        bar3d(0,200+ty,0,300+ty,50,5);
        delay(7000);
        delay(7000);
        break;
}
case 2:{
        int sx,sy;
        cout<<"Enter the scaling factor for x,y axis"<<endl;
        cin>>sx>>sy;
        bar3d(270*sx,200*sy,370*sx,300*sy,50,5);
        delay(7000);
        cleardevice();
        outtextxy(10,20,"Parallel projection side view");
        bar3d(0,200*sy,0,300*sy,50,5);
        delay(7000);
        break;
}
case 4:{
        int shx,shy;
```

```
                cout<<"Enter the shearing factor for x,y axis"<<endl;
                cin>>shx>>shy;
                bar3d(270,200+(shy*270),370,300+(shy*50),50+(270*shx),5);
                delay(7000);
                break;
            }
            case 3:{
                int ang;
                cout<<"Enter the rotation angle"<<endl;
                cin>>ang;
                ang=(ang*3.14)/180;
                int x1= 200*cos(ang)-50*sin(ang);
                int y1=50*cos(ang)+200*sin(ang); int
                x2=300*cos(ang)-500*sin(ang);
                int y2= 50*cos(ang)+300*sin(ang);
                bar3d(x1,y1,x2,y2,50,5);
                delay(7000);
                break;
            }
        }
        return 0;
}
```



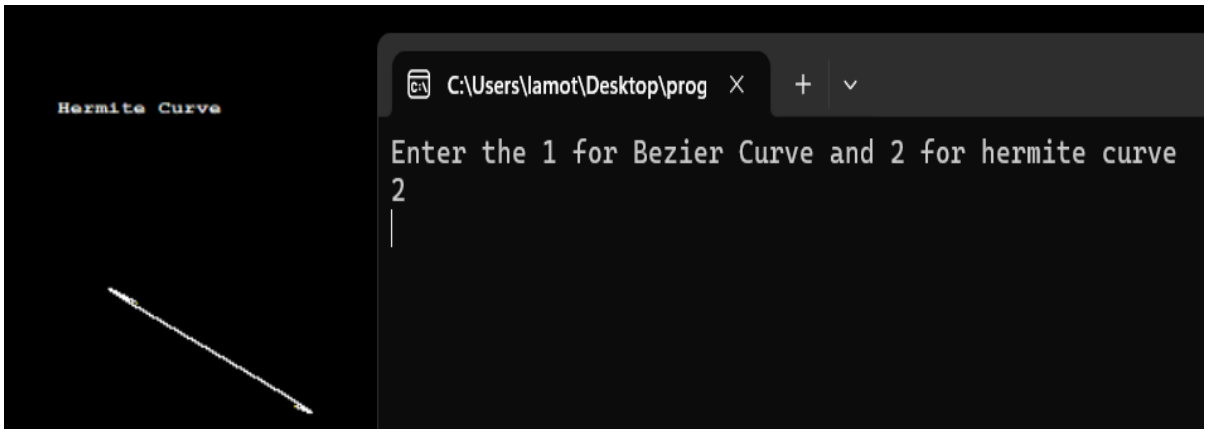


Question 8: Write a program to draw Hermite /Bezier curve.

```
#include <iostream>

#include<graphics.h>

#include<cmath>

using namespace std;

int main(){
```

```
int i;
double t,xt,yt;
int window1 = initwindow(800,800);
int ch;
cout<<"Enter the 1 for Bezier Curve and 2 for hermite curve"<<endl; cin>>ch;
switch(ch){
        case 1:{
                int x[4]={400,300,400,450};
                int y[4]={400,350,275,300};
                outtextxy(50,50,"Bezier Curve");
                for(t=0;t<=1;t=t+0.0005){

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];
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,WHITE);
                }
                for (i=0; i<4; i++){
                        putpixel (x[i], y[i], YELLOW);
                        delay(4000);
                }
                break;
        }
        case 2:{
                int x1[4]={200,100,200,250};

                int y1[4]={200,150,75,100};

                outtextxy(50,50,"Hermite Curve");
```

```
                    for(t=0;t<=1;t=t+0.00001){

        xt=x1[0]*(2*pow(t,3)-(3*t*t)+1)+x1[1]*(-2*pow(t,3)+(3*t*t))+x1[2]*(pow(t,3)-(2*t*t)+t)+x1[3]*(
pow(t,3)-(t*t));

        yt=y1[0]*(2*pow(t,3)-(3*t*t)+1)+y1[1]*(-2*pow(t,3)+(3*t*t))+y1[2]*(pow(t,3)-(2*t*t)+t)+y1[3]*(
pow(t,3)-(t*t));
                            putpixel (xt, yt,WHITE);
                            }
                    for(i=0;i<4;i++)
                    {
                            putpixel (x1[i],y1[i], YELLOW);
                            delay(9000);
                    }
                    break;
                }
        }
        return 4;
}
```


Hermite Curve
C:\Users\lamot\Desktop\prog
Enter the 1 for Bezier Curve and 2 for hermite curve
2