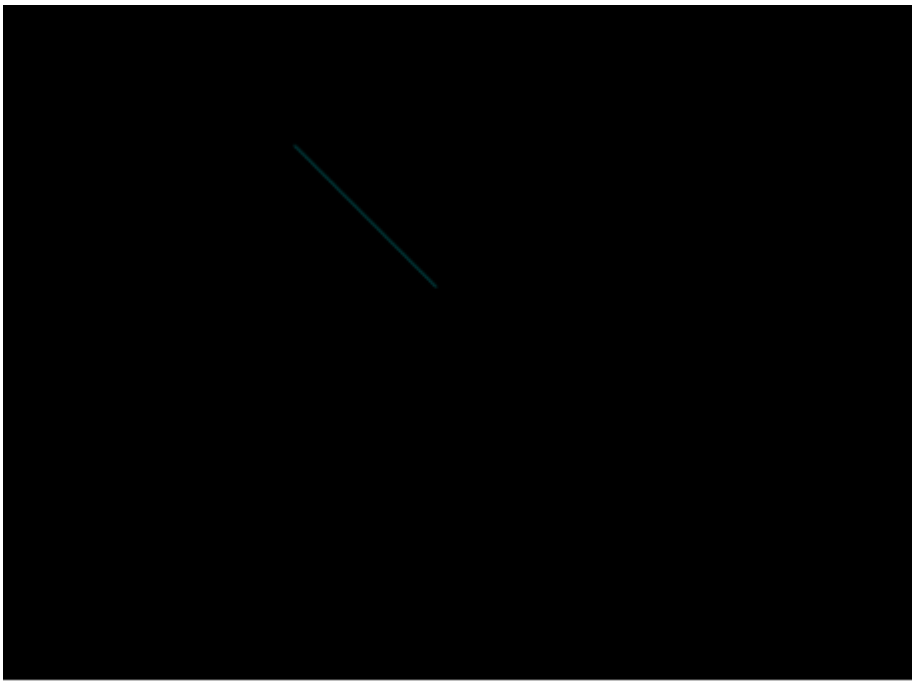
RAMANUJAN COLLEGE
KALKAJI, NEW DELHI -110019

Name-Harpreet kumari
Roll no-2019/1460
Examination Rollno-19075570010
Semester-6
Bsc (Hons) computer science
Computer Graphics
Practical Assessment
Submitted To:Sheetal Mam

1. **Write a program to implement Bresenhams line drawing algorithm.**

```
#include<stdio.h>
#include<graphics.h>
void midpointline(int x0,int y0,int x1,int y1,int value)
{
double dy=y1-y0;
double dx=x1-x0;
int d=2*dy-dx;
int incrE=2*dy;
int increNE=2*(dy-dx);
int x=x0;
int y=y0;
putpixel(x,y,value);
while(x<x1)
{                       //choose E
if(d<0)
{
d+=incrE;
x++;
}
else
{
d+=increNE;
x++;
y++;
}
putpixel(x,y,value);
}
}
main()
{
int gd=DETECT,gm;
int i,j,k;
initgraph(&gd,&gm,"c:\\turboc3\\bgi");
midpointline(100,100,200,200,3);
getch();
closegraph();
return 0;
```

Output:



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

```
#include<graphics.h>
   #include<conio.h>
   #include<dos.h>
   void circlepoints(int x1,int y1,int x, int y,int val)
   {
 putpixel(x1+x,y1+y,val);
 putpixel(x1+y,y1+x,val);
 putpixel(x1+y,y1-x,val);
 putpixel(x1+x,y1-y,val);
 putpixel(x1-x,y1-y,val);
 putpixel(x1-y,y1-x,val);
 putpixel(x1-x,y1+y,val);
 putpixel(x1-y,y1+x,val);
   }
 void midpointcircle(int x1,int y1,int r,int value)
   {
 int x=0,y=r,p;
 p=1-r;
 circlepoints(x1,y1,x,y,value);
 while(x<y)
 {
    if(p<0)
    {
  p=p+2.0*x+3.0;
    }
    else
```

```
    {
  p=p+2.0*(x-y)+5.0;
y=y-1;
    }
    x=x+1;
    circlepoints(x1,y1,x,y,value);
 }
   }

   void main()
   {
 int gd =DETECT,a,gm;
 initgraph(&gd,&gm,"C:\\TURBOC3\\BGI");
 printf("enter radius");
 scanf("%d",&a);
 midpointcircle(100,100,a,5);
 getch();
 closegraph();
   }
```

Output:

3.Write a program to clip a line using Cohen and Sutherland line Clipping algorithm.

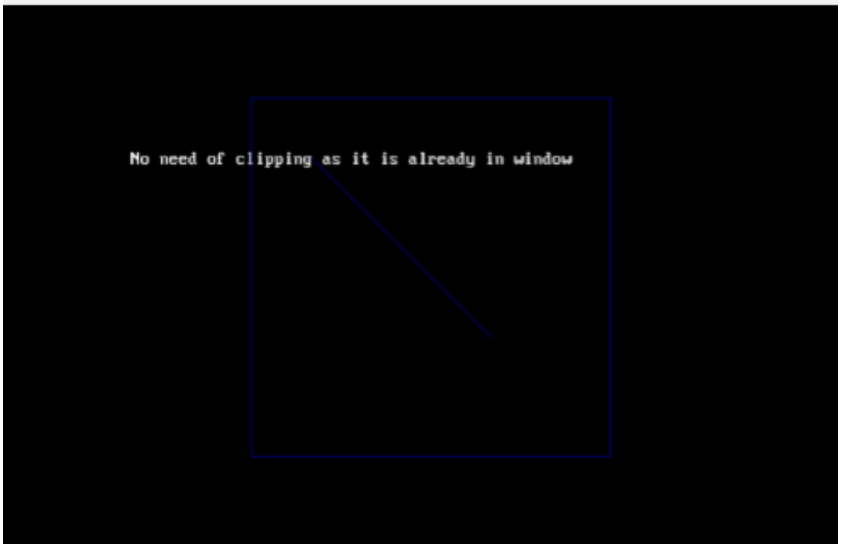
```
#include<graphics.h>
#include<conio.h>
```

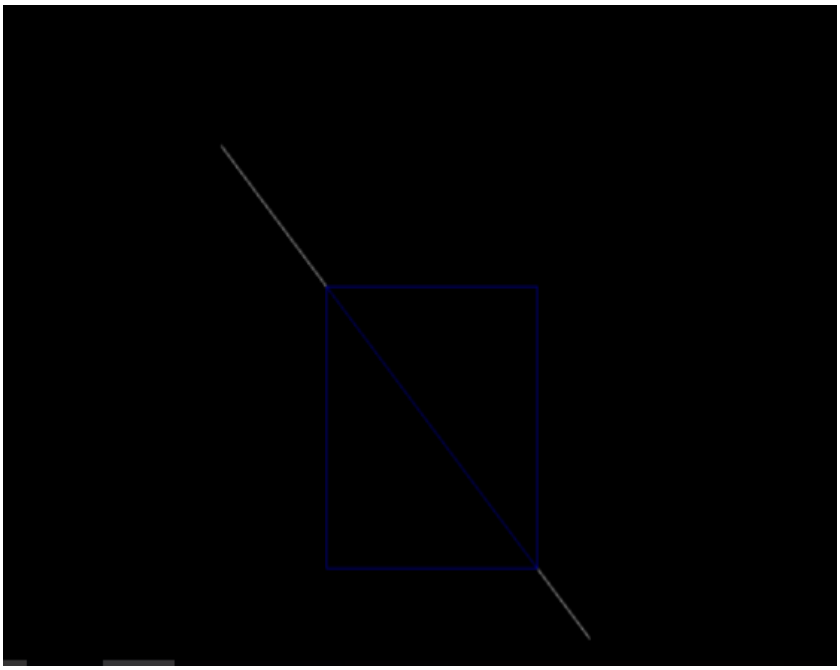
```
#include<stdio.h>
#include<math.h>
void main()
{
int rcode_begin[4]={0,0,0,0},rcode_end[4]={0,0,0,0},region_code[4];
int W_xmax,W_ymax,W_xmin,W_ymin,flag=0;
float slope;
int x,y,x1,y1,i;
int gm=DETECT,gd;
initgraph(&gm,&gd,"c:\\turboc3\\bgi");
printf("\n****** Cohen Sutherlsnd Line Clipping algorithm ***********");
printf("\n Now, enter XMin, YMin =");
scanf("%d %d",&W_xmin,&W_ymin);
printf("\n First enter XMax, YMax =");
scanf("%d %d",&W_xmax,&W_ymax);
printf("\n Please enter intial point x and y= ");
scanf("%d %d",&x,&y);
printf("\n Now, enter final point x1 and y1= ");
scanf("%d %d",&x1,&y1);cleardevice();
rectangle(W_xmin,W_ymin,W_xmax,W_ymax);
line(x,y,x1,y1);
if(y>W_ymax)  {
rcode_begin[0]=1;    // Top
flag=1 ;
}
if(y<W_ymin) {
rcode_begin[1]=1;         // Bottom

flag=1;
}
if(x>W_xmax)  {
rcode_begin[2]=1;         // Right
flag=1;
}
if(x<W_xmin)   {
rcode_begin[3]=1;         //Left
flag=1;
}

//end point of Line
if(y1>W_ymax){
rcode_end[0]=1;         // Top
flag=1;
}
if(y1<W_ymin) {
rcode_end[1]=1;         // Bottom
flag=1;
}
```

```
if(x1>W_xmax){
rcode_end[2]=1;          // Right
flag=1;
}
if(x1<W_xmin){
rcode_end[3]=1;          //Left
flag=1;
 }
if(flag==0)
{
printf("No need of clipping as it is already in window");
}
flag=1;
for(i=0;i<4;i++){
region_code[i]= rcode_begin[i] && rcode_end[i] ;
if(region_code[i]==1)
 flag=0;
}
if(flag==0)
{
printf("\n Line is completely outside the window");
}
else{
slope=(float)(y1-y)/(x1-x);
if(rcode_begin[2]==0 && rcode_begin[3]==1)   //left
{
y=y+(float) (W_xmin-x)*slope ;
x=W_xmin;

}
if(rcode_begin[2]==1 && rcode_begin[3]==0)       // right
{
y=y+(float) (W_xmax-x)*slope ;
x=W_xmax;

}
if(rcode_begin[0]==1 && rcode_begin[1]==0)      // top
{
x=x+(float) (W_ymax-y)/slope ;
y=W_ymax;

}
if(rcode_begin[0]==0 && rcode_begin[1]==1)     // bottom
{
x=x+(float) (W_ymin-y)/slope ;
y=W_ymin;

}
```

```
// end points
if(rcode_end[2]==0 && rcode_end[3]==1)   //left
{
y1=y1+(float) (W_xmin-x1)*slope ;
x1=W_xmin;

}
if(rcode_end[2]==1 && rcode_end[3]==0)      // right
{
y1=y1+(float) (W_xmax-x1)*slope ;
x1=W_xmax;

}
if(rcode_end[0]==1 && rcode_end[1]==0)     // top
{
x1=x1+(float) (W_ymax-y1)/slope ;
y1=W_ymax;

}
if(rcode_end[0]==0 && rcode_end[1]==1)     // bottom
{
x1=x1+(float) (W_ymin-y1)/slope ;
y1=W_ymin;

}
}
setcolor(BLUE);
rectangle(W_xmin,W_ymin,W_xmax,W_ymax);line(x,y,x1,y1);
getch();
closegraph();
}
```

Output:





4. Write a program to clip a Polygon using Sutherland Hodgeman algorithm.

```
 #include<graphics.h>
#include<stdlib.h>
#include<conio.h>
#include<math.h>

int *x1,*y1,*x2,*y2,*x,*y,*ymax,*ymin,i,j,nin,nout,*pintersect;
float *dx,*xa;

 int sign(long int a)
{
 if (a<0) return(-1);
```

```
 else if (a==0) return(0);
   else return(1);
}
 void clip_polygon(void)
{
 int s1,s2,f1,f2,spcross,svisible;
 int visible(int a,int b,int c,int d,int e,int f);
 void output(int a,int b,int *c,int *d,int *e);
 int cross(int a,int b,int c,int d,int e,int f,int g,int h);
 int *intersect(int a,int b,int c,int d,int e,int f,int g,int h);
 pintersect=(int *)malloc(sizeof(int)*2);
 for (i=1;i<=4;i++)
 {
nout=0;
    for (j=0;j<nin;j++)
      *(x2+j)=*(y2+j)=0;
    for (j=1;j<=nin;j++)
     {
       if (j!=1) {}
        else
        {
    f1=*(x1+j-1);
    f2=*(y1+j-1);
    s1=*(x1+j-1);
    s2=*(y1+j-1);
    svisible=visible(s1,s2,*(x+i-1),*(y+i-1),*(x+i),*(y+i));
    if (svisible>=0) output(s1,s2,&nout,x2,y2);
     continue;
       }
       spcross=cross(s1,s2,*(x1+j-1),*(y1+j-1),*(x+i-1),*(y+i-1),*(x+i),*(y+i));
       if (!spcross) {}
        else
   {
    pintersect=intersect(s1,s2,*(x1+j-1),*(y1+j-1),*(x+i-1),*(y+i1),*(x+i),*(y+i));
    output(*pintersect,*(pintersect+1),&nout,x2,y2);
  }
       s1=*(x1+j-1);
       s2=*(y1+j-1);
       svisible=visible(s1,s2,*(x+i-1),*(y+i-1),*(x+i),*(y+i));
       if (svisible>=0) output(s1,s2,&nout,x2,y2);
     }
    if (!nout) continue;
    spcross=cross(s1,s2,f1,f2,*(x+i-1),*(y+i-1),*(x+i),*(y+i));
if (!spcross) {}
     else
      {
        pintersect=intersect(s1,s2,f1,f2,*(x+i-1),*(y+i-1),*(x+i),*(y+i));
        output(*pintersect,*(pintersect+1),&nout,x2,y2);
```

```
      }
     for (j=0;j<nout;j++)
      {
        *(x1+j)=*(x2+j);
        *(y1+j)=*(y2+j);
      }
     nin=nout;
 }
   *(x2+nout)=*x2;
   *(y2+nout)=*y2;
}

int cross(int s1,int s2,int p1,int p2,int wx1,int wy1,int wx2,int wy2)
{
 int pvisible1,pvisible2;
   int visible(int a,int b,int c,int d,int e,int f);
   pvisible1=visible(s1,s2,wx1,wy1,wx2,wy2);
   pvisible2=visible(p1,p2,wx1,wy1,wx2,wy2);
   if (pvisible1==-pvisible2)
     return 1;
    else return 0;
}

int visible(int sx1,int sx2,int px1,int py1,int px2,int py2)
{
 long int temp1,temp2,temp3;
int pvisible;
   temp1=(long)(sx1-px1)*(long)(py2-py1);
   temp2=(long)(sx2-py1)*(long)(px2-px1);
 temp3=temp2-temp1;
   pvisible=sign(temp3);
   return (pvisible);
}

int *intersect(int px1,int py1,int px2,int py2,int wx1,int wy1,int wx2,int wy2)
{
 float parameter[2][1],coeff[2][2],temp1,temp2;
 int right[2][1];
   coeff[0][0]=px2-px1;
   coeff[0][1]=wx1-wx2;
   coeff[1][0]=py2-py1;
   coeff[1][1]=wy1-wy2;
   right[0][0]=wx1-px1;
   right[1][0]=wy1-py1;
   temp1=(coeff[0][0]*coeff[1][1])-(coeff[0][1]*coeff[1][0]);
   temp2=coeff[0][0];
   coeff[0][0]=(coeff[1][1])/temp1;
   coeff[1][1]=temp2/temp1;
```

```
   coeff[0][1]=-(coeff[0][1])/temp1;
   coeff[1][0]=-(coeff[1][0])/temp1;
   parameter[0][0]=(coeff[0][0]*right[0][0])+(coeff[0][1]*right[1][0]);
   parameter[1][0]=(coeff[1][0]*right[0][0])+(coeff[1][1]*right[1][0]);
 *pintersect=px1+(px2-px1)*parameter[0][0];
   *(pintersect+1)=py1+(py2-py1)*parameter[0][0];
   return(pintersect);
 }
void output(int vertex1,int vertex2,int *n,int *x2,int *y2)
{
 (*n)++;
   *(x2+(*n)-1)=vertex1;
   *(y2+(*n)-1)=vertex2;
}

void include(int *end_edge,int final_edge,int scan)
{
 while((*end_edge<=final_edge)&&(*(ymax+*end_edge)>=scan))
    (*end_edge)++;
}

void fillscan(int end_edge,int start_edge,int scan)
{
 int nx,j,k;
   nx=(end_edge-start_edge)/2;
   j=start_edge;
 for (k=1;k<=nx;k++)
 {
     line(*(xa+j),scan,*(xa+j+1),scan);
     j+=2;
    }
}

void update_xvalues(int last_edge,int *start_edge,int scan)
{
 int k1,k2;
   k2=last_edge;
   for (k1=last_edge;k1>=*start_edge;k1--)
    {
if (*(ymin+k1)<scan)
      {
        *(xa+k2)=*(xa+k1)+*(dx+k1);
        if (k1!=k2)
         {
     *(ymin+k2)=*(ymin+k1);
     *(dx+k2)=*(dx+k1);
         }
        k2--;
```

```
     }
    }
   *start_edge=k2+1;
}

void xsort(int start_edge,int last_edge)
{
 int k,l;
   float t;
   for (k=start_edge;k<=last_edge;k++)
 {
     l=k;
     while((l>start_edge)&&(*(xa+l)<*(xa+l-1)))
      {
        t=*(ymin+l);
        *(ymin+l)=*(ymin+l-1);
        *(ymin+l-1)=t;
        t=*(xa+l);
      *(xa+l)=*(xa+l-1);
        *(xa+l-1)=t;
        t=*(dx+l);
        *(dx+l)=*(dx+l-1);
*(dx+l-1)=t;
        l--;
      }
   }
}

void poly_insert(int j,int xc1,int yc1,int xc2,int yc2)
{
 int j1,ym;
   j1=j;
   if (yc1>yc2) ym=yc1;
 else ym=yc2;
   while((j1!=0)&&(*(ymax+j1-1)<ym))
    {
     *(ymax+j1)=*(ymax+j1-1);
     *(ymin+j1)=*(ymin+j1-1);
     *(xa+j1)=*(xa+j1-1);
     *(dx+j1)=*(dx+j1-1);
     j1--;
    }
   *(ymax+j1)=ym;
   *(dx+j1)=-(float)(xc2-xc1)/(yc2-yc1);
   if (yc1>yc2)
    {
     *(ymin+j1)=yc2;
     *(xa+j1)=xc1;
```

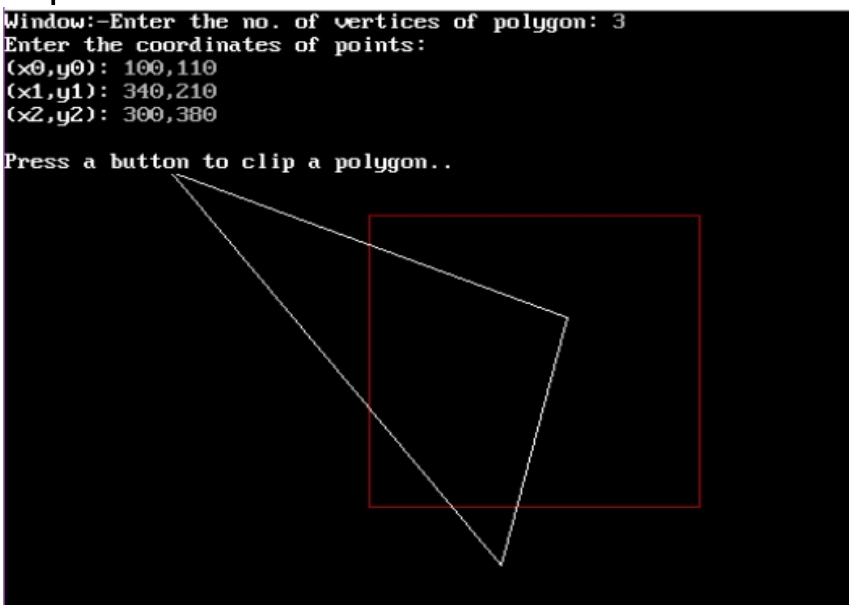
```
    }
    else
    {
     *(ymin+j1)=yc1;
      *(xa+j1)=xc2;
   }
}

void getpoint(int i,int *xtemp,int *ytemp)
{
 *xtemp=*(x2+i);
   *ytemp=*(y2+i);
}

void loadpolygon(int i,int *edges)
{
 int xc1,xc2,yc1,yc2,i1,k;
   getpoint(i,&xc1,&yc1);
   i1=i+1;
   *edges=0;
   for(k=1;k<=nin;k++)
 {
     getpoint(i1,&xc2,&yc2);
     if (yc1==yc2)
      xc1=xc2;
     else
       {
         poly_insert(*edges,xc1,yc1,xc2,yc2);
   (*edges)++;
         yc1=yc2;
         xc1=xc2;
       }
     i1++;
    }
   (*edges)--;
}
void fillpolygon(int index)
{
 int edges,scan,start_edge,end_edge;
 loadpolygon(index,&edges);
   if (edges<1) return;
   scan=*ymax;
   start_edge=0;
   end_edge=0;
   include(&end_edge,edges,scan);
   while(end_edge!=start_edge)
 {
     xsort(start_edge,end_edge-1);
```

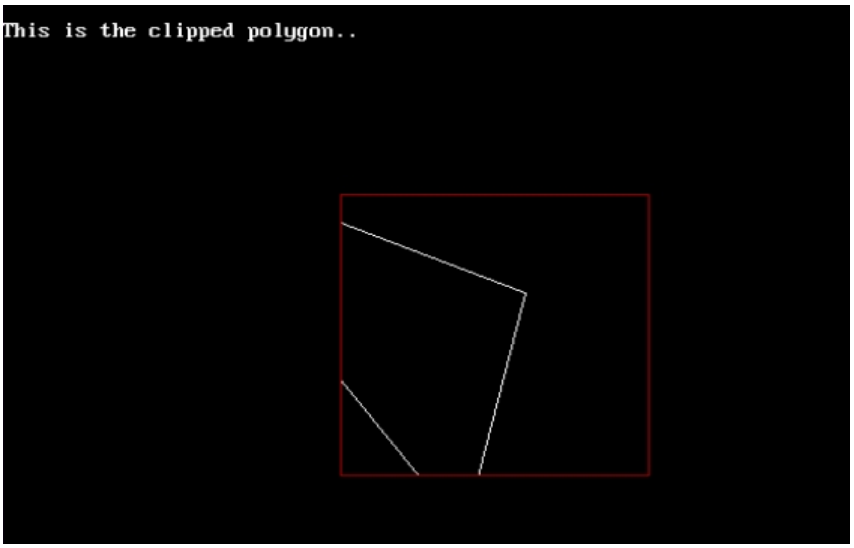
```
    fillscan(end_edge,start_edge,scan);
    scan--;
    update_xvalues(end_edge-1,&start_edge,scan);
    include(&end_edge,edges,scan);
   }
}

void main()
{
 int gd=DETECT,gm;
   int gdriver = DETECT,gmode,errorcode;
   clrscr();
 /*  //Request autodetection
  int gdriver = DETECT,gmode,errorcode;
  //int xmax,ymax,x1,y1,x2,y2,l;
 //Initialize graphics and local variables
  initgraph(&gdriver,&gmode,"C:\\TURBOC3\\BGI");
 //Read result of initialization
errorcode=graphresult();
  if(errorcode!=grOk) //Error occured
  {
   printf("Graphics error : %s\n",grapherrormsg(errorcode));
   printf("Press any key to halt.");
   getch();
   exit(1);
 }*/

 x=(int *)malloc(sizeof(int)*5);
   y=(int *)malloc(sizeof(int)*5);
   printf("Enter number of sides in polygon : ");
   scanf("%d",&nin);
   x1=(int *)malloc(sizeof(int)*2*nin);
   y1=(int *)malloc(sizeof(int)*2*nin);
   x2=(int *)malloc(sizeof(int)*2*nin);
   y2=(int *)malloc(sizeof(int)*2*nin);
   ymax=(int *)malloc(sizeof(int)*2*nin);
   ymin=(int *)malloc(sizeof(int)*2*nin);
   xa=(float *)malloc(sizeof(float)*2*nin);
 dx=(float *)malloc(sizeof(float)*2*nin);
   printf("Enter the coordinates of the polygon vertices (x y) :\n");
   for (i=0;i<nin;i++)
 {
    printf("%d",(i+1));
    printf(":");
    scanf("%d%d",&*(x1+i),&*(y1+i));
   }
   *(x1+nin)=*x1;
   *(y1+nin)=*y1;
```

```
   printf("\n\nEnter the coordinates of the window vertices :\n");
for (i=0;i<4;i++)
    {
     printf("%d",(i+1));
     printf(":");
     scanf("%d%d",&*(x+i),&*(y+i));
    }
   *(x+4)=*x;
   *(y+4)=*y;
  // registerbgidriver(EGAVGA_driver);
  initgraph(&gdriver,&gmode,"C:\\TURBOC3\\BGI");
  errorcode = graphresult();
 // initgraph(&gd,&gm,"");
  printf("Before clipping");
   outtextxy(*x1+10,*y1-10,"Polygon");
   outtextxy(*(x+1)+10,*(y+1)-10,"Clipping Window");
   for (i=0;i<4;i++)
     line(*(x+i),*(y+i),*(x+i+1),*(y+i+1));
   for (i=0;i<nin;i++)
     line(*(x1+i),*(y1+i),*(x1+i+1),*(y1+i+1));
   getch();
   clearviewport();
   printf("After clipping");
   //rectangle(200,200,400,400);
   for (i=0;i<4;i++)
  line(*(x+i),*(y+i),*(x+i+1),*(y+i+1));
   clip_polygon();
   for (i=0;i<nin;i++)
    {
     if(*(y2+i)<*(y2+i+1))
     {
       *(ymax+i)=*(y2+i+1);
*(ymin+i)=*(y2+i);
       *(xa+i)=*(x2+i+1);
      }
      else
       {
        *(ymax+i)=*(y2+i);
        *(ymin+i)=*(y2+i+1);
        *(xa+i)=*(x2+i);
       }
     *(dx+i)=*(y2+i)-*(y2+i+1);
     if (*(dx+i))
       *(dx+i)=(float)(*(x2+i)-*(x2+i+1))/(*(dx+i));
     line(*(x2+i),*(y2+i),*(x2+i+1),*(y2+i+1));
    }
 fillpolygon(0);
   getch();
```

```
  closegraph();
}
```

Output:





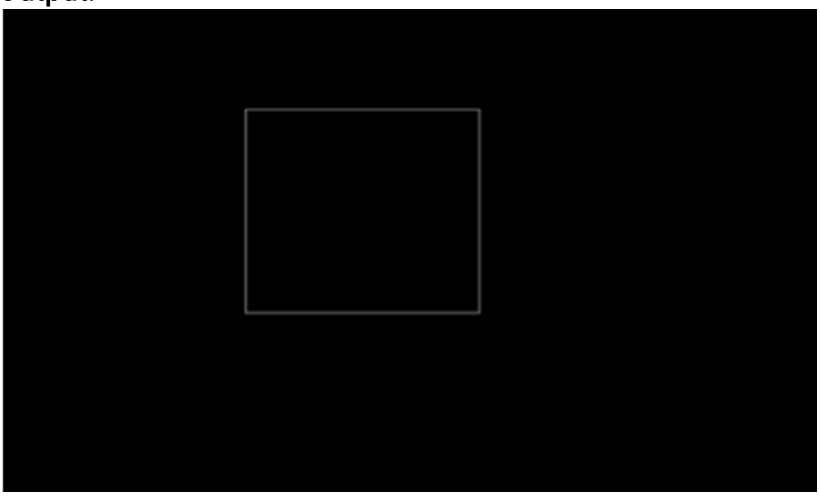
5. Write a program to fill a polygon using Scan line fill algorithm.

```
#include <stdio.h>
#include <conio.h>
#include <graphics.h>

main()
{

int n,i,j,k,gd,gm,dy,dx;
int x,y,temp;
int a[20][2],xi[20];
float slope[20];
```

```
clrscr();
printf("\n\n\tEnter the no. of edges of polygon : ");
scanf("%d",&n);
printf("\n\n\tEnter the cordinates of polygon :\n\n\n ");

for(i=0;i<n;i++)
{
printf("\tX%d Y%d : ",i,i);
scanf("%d %d",&a[i][0],&a[i][1]);
}

a[n][0]=a[0][0];
a[n][1]=a[0][1];


detectgraph(&gd,&gm);
initgraph(&gd,&gm,"c:\\turboc3\\bgi");
/*- draw polygon -*/

for(i=0;i<n;i++)
{
line(a[i][0],a[i][1],a[i+1][0],a[i+1][1]);
}

getch();
 for(i=0;i<n;i++)
{
dy=a[i+1][1]-a[i][1];
dx=a[i+1][0]-a[i][0];
 if(dy==0) slope[i]=1.0;
if(dx==0) slope[i]=0.0;

if((dy!=0)&&(dx!=0)) /*- calculate inverse slope -*/
{
slope[i]=(float) dx/dy;
}
}
 for(y=0;y< 480;y++)
{
k=0;
for(i=0;i<n;i++)
{
if( ((a[i][1]<=y)&&(a[i+1][1]>y))||
((a[i][1]>y)&&(a[i+1][1]<=y)))
{
xi[k]=(int)(a[i][0]+slope[i]*(y-a[i][1]));
```

```
k++;
}
}
 for(j=0;j<k-1;j++) /*- Arrange x-intersections in order -*/
for(i=0;i<k-1;i++)
{
if(xi[i]>xi[i+1])
{
temp=xi[i];
xi[i]=xi[i+1];
xi[i+1]=temp;
}
}
setcolor(35);
for(i=0;i<k;i+=2)
{
line(xi[i],y,xi[i+1]+1,y);
getch();
}
}
}
```

Output:



6. Write a program to apply various 2D transformations on a 2D object(use homogeneous coordinates).

```
#include<stdio.h>
#include<graphics.h>
#include<math.h>
#define pi (22/7)
#define sz 3
double x[3][3],res[3][3],tm[3][3];
int t2[3][2];

void prod(double a[sz][sz],double b[sz][sz],double c[sz][sz],int r1,int c1,int c2)
{ int i,j,k;
 for(i=0;i<r1;i++)
```

```
 {
  for(j=0;j<c2;j++)
  {
   for(k=0;k<c1;k++)
   {
    c[i][j] += a[i][k]*b[k][j];
   }
  }
 }
}
void drawtriangle(int t[3][2])
{ int i;
 for(i=0;i<3;i++)
 {
  line(t[i][0]+100,100-t[i][1],t[(i+1)%3][0]+100,100-t[(i+1)%3][1]);
 }
 line(0,100,400,100);
 line(100,0,100,400);
}
void translation(int t1[3][2])
{
 int i,j,val;
 for(i=0;i<3;i++)
 {
  for(j=0;j<2;j++)
  {
   x[i][j] = t1[i][j];
   t2[i][j] = 0;
   res[i][j] = 0;
   if(i == j)
    tm[i][j] = 1;
   else
    tm[i][j] = 0;
  }
  x[i][j] = 1;
  res[i][j] = 0;
  if(i == j)
   tm[i][j] = 1;
  else
   tm[i][j] = 0;
 }
 printf("\n Shift in x-axis : ");
 scanf("%d",&val);
 tm[2][0] = val;
 printf("\n Shift in y-axis : ");
 scanf("%d",&val);
 tm[2][1] = val;
 prod(x,tm,res,3,3,3);
```

```
 for(i=0;i<3;i++)
{
  for(j=0;j<2;j++)
  {
   t2[i][j] = (int)res[i][j];
  }
 }
 settextstyle(2,0,5);
 outtextxy(10,405,"Press any key to continue...");
 getch();
 clrscr();
 outtextxy(10,10,"\n Triangle after transformation ");
 drawtriangle(t2);
 outtextxy(10,405,"Press any key to continue...");
 getch();
}
void rotation(int t1[3][2])
{
 int i,j,ang;
 double sinx[] = {0,0.5,0.7,0.8,1,0,-1,0};
 double cosx[] = {1,0.8,0.7,0.5,0,-1,0,1};
 for(i=0;i<3;i++)
 {
  for(j=0;j<2;j++)
  {
   x[i][j] = t1[i][j];
   t2[i][j] = 0;
   res[i][j] = 0;
   if(i == j)
    tm[i][j] = 1;
   else
    tm[i][j] = 0;
}
  x[i][j] = 1;
  res[i][j] = 0;
  if(i == j)
   tm[i][j] = 1;
  else
   tm[i][j] = 0;
 }
 printf("\n Choose the angle of rotation : ");
 printf("\n\t 1. 0 degree\n\t 2. 30 degree\n\t 3. 45 degree\n\t 4. 60 degree\n\t 5. 90 degree");
 printf("\n\t 6. 180 degree\n\t 7. 270 degree\n\t 8. 360 degree\n Enter your choice : ");
 scanf("%d",&ang);
 if(ang > 0 && ang < 9)
 {
  tm[0][0] = tm[1][1] = cosx[ang-1];
  tm[0][1] = tm[1][0] = sinx[ang-1];
```

```
 }
 else
 {
  tm[0][0] = tm[1][1] = cosx[0];
  tm[0][1] = tm[1][0] = sinx[0];
 }
 tm[1][0] *= (-1);
 prod(x,tm,res,3,3,3);
 for(i=0;i<3;i++)
 {
  for(j=0;j<2;j++)
  {
   t2[i][j] = (int)res[i][j];
  }
}
 settextstyle(2,0,5);
 outtextxy(10,405,"Press any key to continue...");
 getch();
 clrscr();
 outtextxy(10,10,"\n Triangle after transformation ");
 drawtriangle(t2);
 outtextxy(10,405,"Press any key to continue...");
 getch();
}
void scaling(int t1[3][2])
{
 int i,j;
 for(i=0;i<3;i++)
 {
  for(j=0;j<2;j++)
  {
   x[i][j] = t1[i][j];
   t2[i][j] = 0;
   res[i][j] = 0;
   if(i == j)
    tm[i][j] = 1;
   else
    tm[i][j] = 0;
  }
  x[i][j] = 1;
  res[i][j] = 0;
  if(i == j)
   tm[i][j] = 1;
  else
   tm[i][j] = 0;
}
 printf("\n Enter the Scaling value : ");
 scanf("%lf",&tm[0][0]);
```

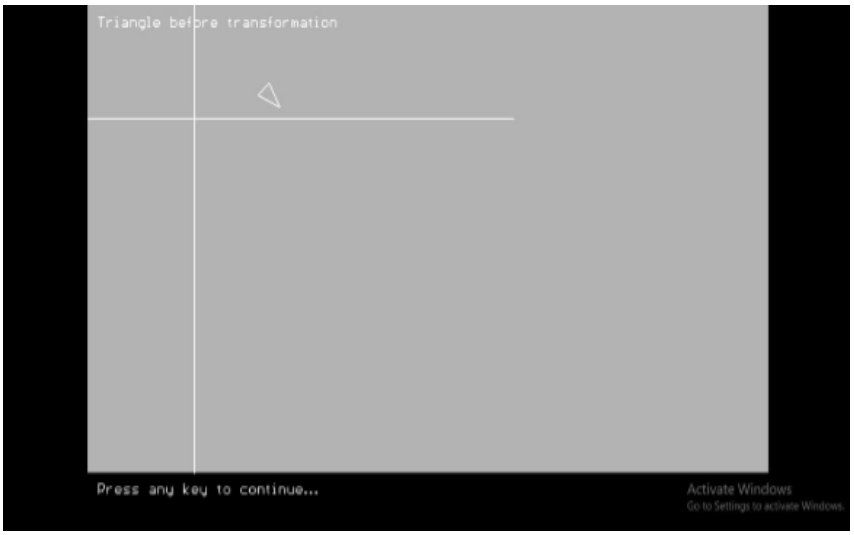
```
 tm[1][1] = tm[0][0];
 prod(x,tm,res,3,3,3);
 for(i=0;i<3;i++)
 {
  for(j=0;j<2;j++)
  {
   t2[i][j] = (int)res[i][j];
  }
 }
 settextstyle(2,0,5);
 outtextxy(10,405,"Press any key to continue...");
 getch();
 clrscr();
 outtextxy(10,10,"\n Triangle after transformation ");
 drawtriangle(t2);
 outtextxy(10,405,"Press any key to continue...");
 getch();
}
void reflection(int t1[3][2])
{
 int i,j,ch;
 for(i=0;i<3;i++)
 {
  for(j=0;j<2;j++)
  {
   x[i][j] = t1[i][j];
   t2[i][j] = 0;
   res[i][j] = 0;
if(i == j)
    tm[i][j] = 1;
   else
    tm[i][j] = 0;
  }
  x[i][j] = 1;
  res[i][j] = 0;
  if(i == j)
   tm[i][j] = 1;
  else
   tm[i][j] = 0;
 }
 printf("\n Type of Reflection : ");
 printf("\n\t 1. Along x-axis ; y = 0\n\t 2. Along y-axis ; x = 0\n\t 3. Along y = x\n\t 4. Along y = -x
");
 printf("\n Enter your choice : ");
 scanf("%d",&ch);
 if(ch > 0 && ch < 4)
 {                    if(ch < 3)
  {
```

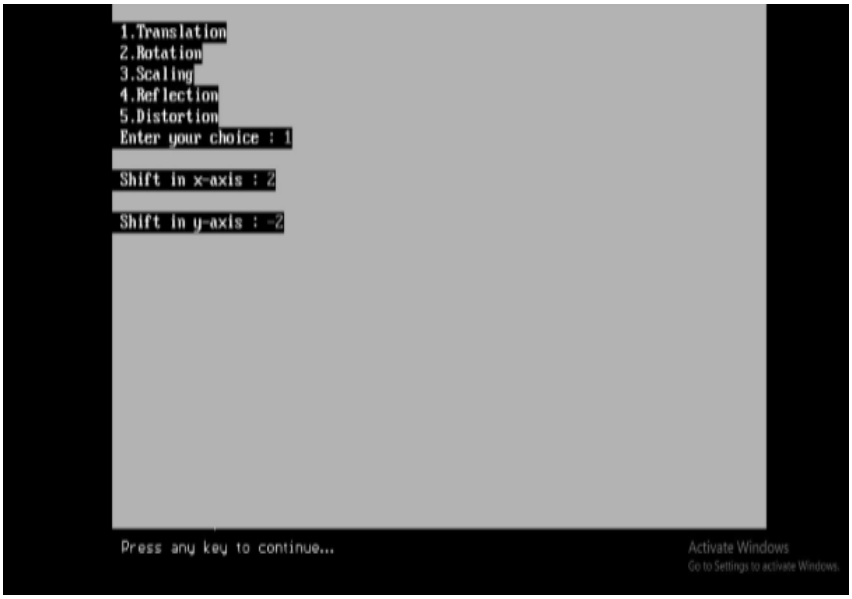
```
   tm[0][1] = tm[1][0] = 0;
   if(ch == 1)
    tm[1][1] = -1;
   else
    tm[0][0] = -1;
  }
  else
  {
   tm[0][0] = tm[1][1] = 0;
   if(ch == 3)
    tm[0][1] = tm[1][0] = 1;
else
    tm[0][1] = tm[1][0] = -1;
  }
 }
 else    // taking the case of reflection along y = 0
 {
  tm[0][1] = tm[1][0] = 0;
  tm[1][1] = -1;
 }
 prod(x,tm,res,3,3,3);
 for(i=0;i<3;i++)
 {
  for(j=0;j<2;j++)
  {
   t2[i][j] = (int)res[i][j];
  }
 }
 settextstyle(2,0,5);
 outtextxy(10,405,"Press any key to continue...");
 getch();
 clrscr();
 outtextxy(10,10,"\n Triangle after transformation ");
 drawtriangle(t2);
 outtextxy(10,405,"Press any key to continue...");
 getch();
}
void distortion(int t1[3][2])
{
 int i,j;
 for(i=0;i<3;i++)
 {
for(j=0;j<2;j++)
  {
   x[i][j] = t1[i][j];
   t2[i][j] = 0;
   res[i][j] = 0;
   if(i == j)
```

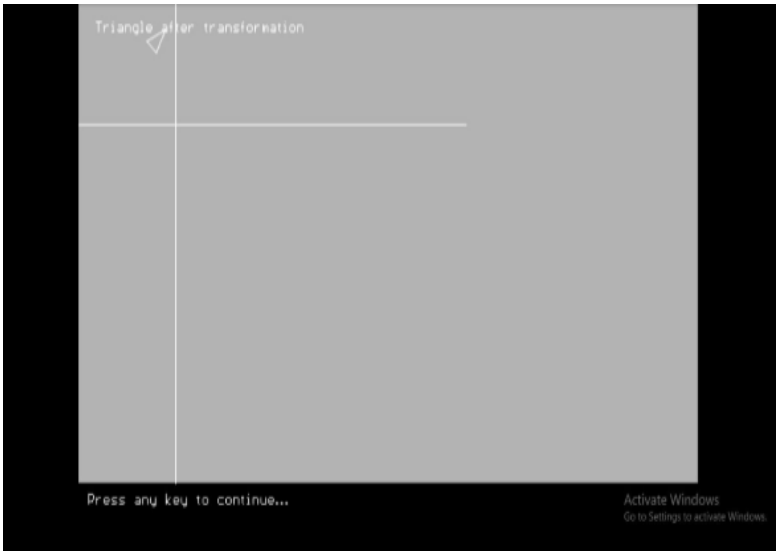
```
   tm[i][j] = 1;
  else
   tm[i][j] = 0;
 }
 x[i][j] = 1;
 res[i][j] = 0;
 if(i == j)
  tm[i][j] = 1;
 else
  tm[i][j] = 0;
}
 printf("\n Enter the Scaling value for x-axis : ");
 scanf("%lf",&tm[0][0]);
 printf("\n Enter the Scaling value for y-axis : ");
 scanf("%lf",&tm[1][1]);
 prod(x,tm,res,3,3,3);
 for(i=0;i<3;i++)
 {
  for(j=0;j<2;j++)
  {
   t2[i][j] = (int)res[i][j];
  }
 }
 settextstyle(2,0,5);
 outtextxy(10,405,"Press any key to continue...");
getch();
 clrscr();
 outtextxy(10,10,"\n Triangle after transformation ");
 drawtriangle(t2);
 outtextxy(10,405,"Press any key to continue...");
 getch();
}
void main()
{
 int gd = DETECT,gm,i,ch;
 int t1[3][2];
 initgraph(&gd,&gm,"C:\\TURBOC3\\bgi");
 clrscr();
 for(i=0;i<3;i++)
 {
  printf("\n Enter the value of x%d : ",i+1);
  scanf("%d",&t1[i][0]);
  printf("\n Enter the value of y%d : ",i+1);
  scanf("%d",&t1[i][1]);
 }
 settextstyle(2,0,5);
 outtextxy(10,405,"Press any key to continue...");
 getch();
```

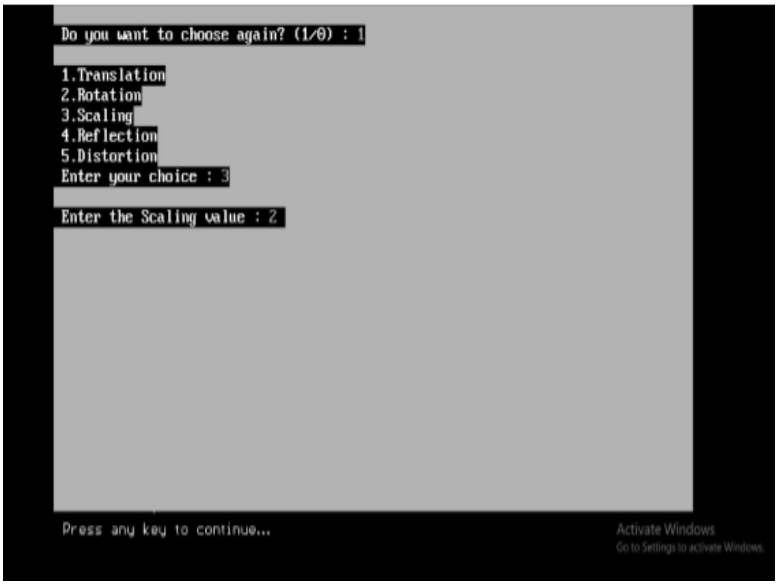
```
 clrscr();
 outtextxy(10,10,"Triangle before transformation ");
 drawtriangle(t1);
 outtextxy(10,405,"Press any key to continue...");
 getch();
 clrscr();
 do
 {
printf("\n 1.Translation\n 2.Rotation\n 3.Scaling\n 4.Reflection\n 5.Distortion\n Enter your
choice : ");
  scanf("%d",&ch);
  switch(ch)
  {
   case 1:
    translation(t1);
    break;
   case 2:
    rotation(t1);
    break;
   case 3:
    scaling(t1);
    break;
   case 4:
    reflection(t1);
    break;
   case 5:
    distortion(t1);
    break;
   default:
    printf("\n Invalid Choice !");
  }
  clrscr();
  printf("\n Do you want to choose again? (1/0) : ");
  scanf("%d",&ch);
 }while(ch == 1);
 getch();
 closegraph();
 restorecrtmode();
}
```

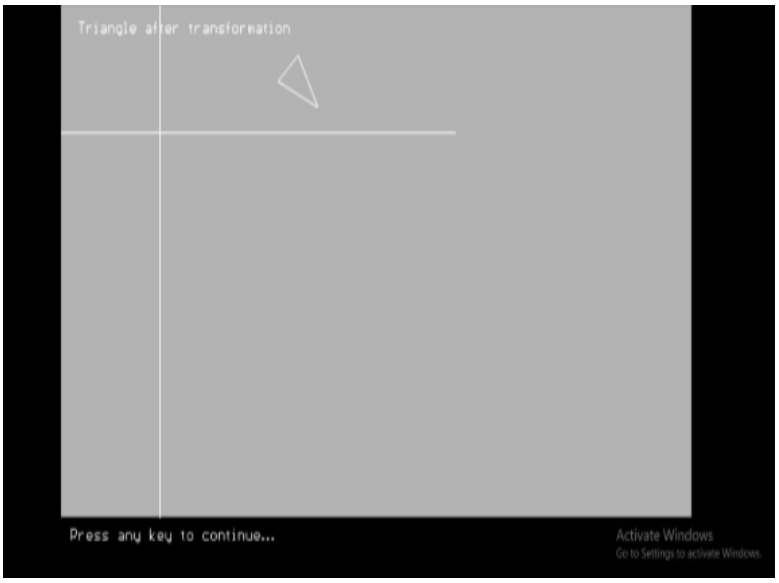
Output:

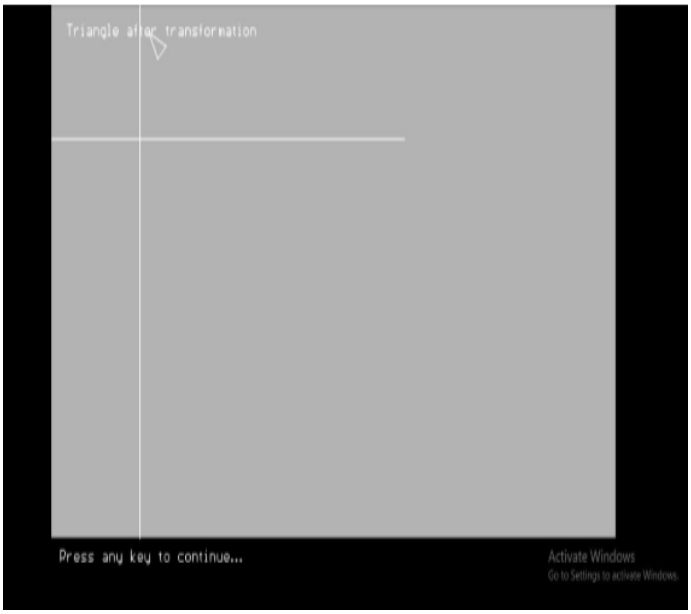


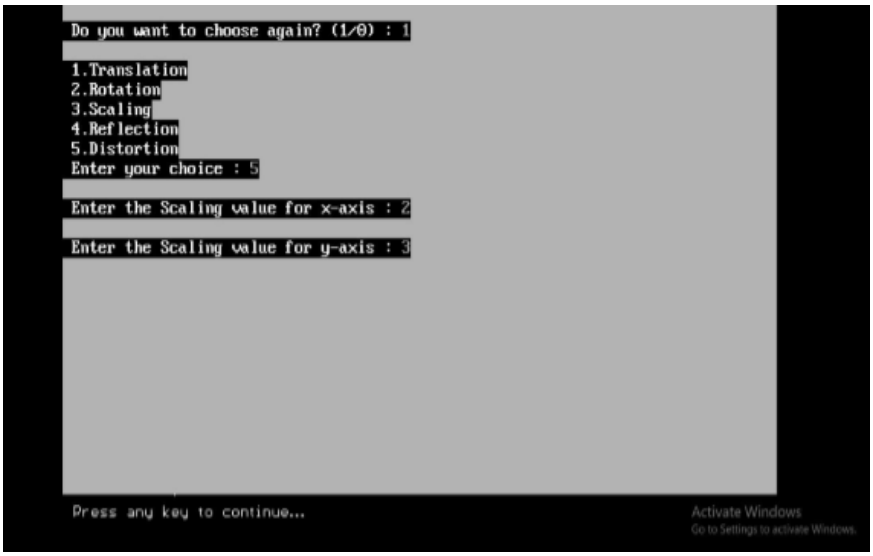












7. Write a program to apply various 3D transformations on a 3D object and then apply parallel and perspective projection on it.

```
#include<stdio.h>
#include<graphics.h>

#define pi (22/7)
#define row 8
#define col 4

double x[8][4],res[8][4],tm[4][4];
int t2[8][4];

void prod(double a[row][col],double b[col][col],double c[row][col],int r1,int c1,int c2)
{
```

```
 int i,j,k;
 for(i=0;i<r1;i++)
 {
  for(j=0;j<c2;j++)
  {
   for(k=0;k<c1;k++)
   {
    c[i][j] += a[i][k]*b[k][j];
   }
  }
 }
}
void printmat(int arr[8][4])
{
 int i,j;
 for(i=0;i<8;i++)
 {
printf("\n ");
  for(j=0;j<4;j++)
  {
   printf("%d ",arr[i][j]);
  }
 }
 printf("\n Press any key to continue...");
 getch();
 clrscr();
 cleardevice();
}
void drawcuboid(int t1[8][4])
{
 int i,j;
 int t[8][4];
 for(i=0;i<8;i++)
 {
  for(j=0;j<4;j++)
  {
   t[i][j] = t1[i][j];
  }
 }
 for(i=0;i<4;i++)
 {
  for(j=0;j<3;j++)
  {
   t[i][j] += 20;
  }
 }
 j = 4;
 for(i=0;i<4;i++)
```

```
{
 line(t[i][0],t[i][1],t[(i+1)%4][0],t[(i+1)%4][1]); // Forming sq ABCD
 line(t[j][0],t[j][1],t[((j+1)%4)+4][0],t[((j+1)%4)+4][1]); // Forming sq EFGH
 line(t[i][0],t[i][1],t[j][0],t[j][1]);        // Joining AE,BF,CG,DH
 j++;
 }
 settextstyle(2,0,5);
 outtextxy(10,405,"Press any key to continue...");
 getch();
 clrscr();
 cleardevice();
}
void translation(int t1[8][4])
{
 int i,j,val;
 for(i=0;i<8;i++)
 {
  for(j=0;j<3;j++)
  {
   x[i][j] = t1[i][j];
   t2[i][j] = 0;
   res[i][j] = 0;
   if(i == j)
    tm[i][j] = 1;
   else
    tm[i][j] = 0;
  }
  x[i][j] = 1;
  res[i][j] = 0;
  if(i == j)
   tm[i][j] = 1;
else
   tm[i][j] = 0;
 }
 printf("\n Shift in x-axis : ");
 scanf("%d",&val);
 tm[3][0] = val;
 printf("\n Shift in y-axis : ");
 scanf("%d",&val);
 tm[3][1] = val;
 printf("\n Shift in z-axis : ");
 scanf("%d",&val);
 tm[3][2] = val;
 prod(x,tm,res,row,col,col);
 for(i=0;i<8;i++)
 {
  for(j=0;j<3;j++)
  {
```

```
  t2[i][j] = (int)res[i][j];
 }
 }
 printf("\n Matrix X\' : ");
 printmat(t2);
 printf("\n Cuboid after transformation ");
 drawcuboid(t2);
}
void rotation(int t1[8][4])
{
 int i,j,ang,ch;
 double sinx[] = {0,0.5,0.7,0.8,1,0,-1,0};
 double cosx[] = {1,0.8,0.7,0.5,0,-1,0,1};
 for(i=0;i<8;i++)
{
  for(j=0;j<3;j++)
  {
   x[i][j] = t1[i][j];
   t2[i][j] = 0;
   res[i][j] = 0;
   if(i == j)
    tm[i][j] = 1;
   else
    tm[i][j] = 0;
  }
  x[i][j] = 1;
  res[i][j] = 0;
  if(i == j)
   tm[i][j] = 1;
  else
   tm[i][j] = 0;
 }
 printf("\n Choose the type of rotation : \n\t 1. Rotation about x-axis\n\t 2. Rotation about yaxis");
 printf("\n\t 3. Rotation about z-axis\n Enter your choice : ");
 scanf("%d",&ch);
 printf("\n Choose the angle of rotation : ");
 printf("\n\t 1. 0 degree\n\t 2. 30 degree\n\t 3. 45 degree\n\t 4. 60 degree\n\t 5. 90 degree");
 printf("\n\t 6. 180 degree\n\t 7. 270 degree\n\t 8. 360 degree\n Enter your choice : ");
 scanf("%d",&ang);
 if(ch <= 1) // x-axis
 {
  if(ang > 0 && ang < 9)
  {
   tm[2][2] = tm[1][1] = cosx[ang-1];
tm[1][2] = tm[2][1] = sinx[ang-1];
  }
  else
  {
```

```
  tm[2][2] = tm[1][1] = cosx[0];
  tm[1][2] = tm[2][1] = sinx[0];
 }
 tm[2][1] *= (-1);
}
else if(ch == 2) // y-axis
{
 if(ang > 0 && ang < 9)
 {
  tm[2][2] = tm[0][0] = cosx[ang-1];
  tm[0][2] = tm[2][0] = sinx[ang-1];
 }
 else
 {
  tm[2][2] = tm[1][1] = cosx[0];
  tm[1][2] = tm[2][1] = sinx[0];
 }
 tm[2][0] *= (-1);
}
else // z-axis
{
 if(ang > 0 && ang < 9)
 {
  tm[0][0] = tm[1][1] = cosx[ang-1];
  tm[0][1] = tm[1][0] = sinx[ang-1];
 }
 else
{
  tm[2][2] = tm[1][1] = cosx[0];
  tm[1][2] = tm[2][1] = sinx[0];
 }
 tm[1][0] *= (-1);
}
prod(x,tm,res,row,col,col);
for(i=0;i<8;i++)
{
 for(j=0;j<3;j++)
 {
  t2[i][j] = (int)res[i][j];
 }
}
printf("\n Matrix X\' : ");
printmat(t2);
printf("\n Cuboid after transformation ");
drawcuboid(t2);
}
void scaling(int t1[8][4])
{
```

```
 int i,j;
 for(i=0;i<8;i++)
 {
  for(j=0;j<3;j++)
  {
   x[i][j] = t1[i][j];
   t2[i][j] = 0;
   res[i][j] = 0;
   if(i == j)
    tm[i][j] = 1;
else
    tm[i][j] = 0;
  }
  x[i][j] = 1;
  res[i][j] = 0;
  if(i == j)
   tm[i][j] = 1;
  else
   tm[i][j] = 0;
 }
 printf("\n Enter the Scaling value : ");
 scanf("%lf",&tm[0][0]);
 tm[1][1] = tm[2][2] = tm[0][0];
 prod(x,tm,res,row,col,col);
 for(i=0;i<8;i++)
 {
  for(j=0;j<3;j++)
  {
   t2[i][j] = (int)res[i][j];
  }
 }
 printf("\n Matrix X\' : ");
 printmat(t2);
 printf("\n Cuboid after transformation ");
 drawcuboid(t2);
}
void reflection(int t1[8][4])
{
 int i,j,ch;
 for(i=0;i<8;i++)
 {
for(j=0;j<3;j++)
  {
   x[i][j] = t1[i][j];
   t2[i][j] = 0;
   res[i][j] = 0;
   if(i == j)
    tm[i][j] = 1;
```

```
   else
    tm[i][j] = 0;
  }
  x[i][j] = 1;
  res[i][j] = 0;
  if(i == j)
   tm[i][j] = 1;
  else
   tm[i][j] = 0;
 }
 printf("\n Type of Reflection : ");
 printf("\n\t 1. About xy plane\n\t 2. About yz plane\n\t 3. About xz plane");
 printf("\n Enter your choice : ");
 scanf("%d",&ch);
 switch(ch)
 {
  case 1:
   tm[2][2] = -1;
   break;
  case 2:
   tm[0][0] = -1;
   break;
  case 3:
   tm[1][1] = -1;
break;
  default : tm[2][2] = -1;
 }
 prod(x,tm,res,row,col,col);
 for(i=0;i<8;i++)
 {
  for(j=0;j<3;j++)
  {
   t2[i][j] = (int)res[i][j];
  }
 }
 printf("\n Matrix X\' : ");
 printmat(t2);
 printf("\n Cuboid after transformation ");
 drawcuboid(t2);
}
void shearing(int t1[8][4])
{
 int i,j;
 for(i=0;i<8;i++)
 {
  for(j=0;j<3;j++)
  {
   x[i][j] = t1[i][j];
```

```
   t2[i][j] = 0;
   res[i][j] = 0;
   if(i == j)
    tm[i][j] = 1;
   else
    tm[i][j] = 0;
}
x[i][j] = 1;
  res[i][j] = 0;
  if(i == j)
   tm[i][j] = 1;
  else
   tm[i][j] = 0;
 }
 printf("\n Enter the Scaling value x-axis, a : ");
 scanf("%lf",&tm[0][0]);
 printf("\n Enter the Scaling value y-axis, e (a != e) : ");
 scanf("%lf",&tm[1][1]);
 prod(x,tm,res,row,col,col);
 for(i=0;i<8;i++)
 {
  for(j=0;j<3;j++)
  {
   t2[i][j] = (int)res[i][j];
  }
 }
 printf("\n Matrix X\' : ");
 printmat(t2);
 printf("\n Cuboid after transformation ");
 drawcuboid(t2);
}
void main()
{
 int i,j,ch,gd = DETECT,gm,t1[8][4];
 initgraph(&gd,&gm,"C:\\TURBOC3\\BGI");
 clrscr();
 cleardevice();
 for(i=0;i<8;i++)
{
  printf("\n Enter the value of x%d : ",i+1);
  scanf("%d",&t1[i][0]);
  printf("\n Enter the value of y%d : ",i+1);
  scanf("%d",&t1[i][1]);
  printf("\n Enter the value of z%d : ",i+1);
  scanf("%d",&t1[i][2]);
  t1[i][3] = 1;
 }
 printf("\n Matrix X : ");
```

```
 printmat(t1);
 printf("\n Cuboid before transformation ");
 drawcuboid(t1);
 settextstyle(2,0,5);
 outtextxy(10,405,"Press any key to continue...");
 getch();
 do
 {
  clrscr();
  cleardevice();
  printf("\n 1.Translation\n 2.Rotation\n 3.Scaling\n 4.Reflection\n 5.Shearing\n Enter your
choice : ");
  scanf("%d",&ch);
  switch(ch)
  {
   case 1:
    translation(t1);
    break;
   case 2:
    rotation(t1);
    break;
case 3:
    scaling(t1);
    break;
   case 4:
    reflection(t1);
    break;
   case 5:
    shearing(t1);
    break;
   default:
    printf("\n Invalid Choice !");
  }
  printf("\n Do you want to choose again? (1/0) : ");
  scanf("%d",&ch);
 }while(ch == 1);
 getch();
 closegraph();
 restorecrtmode();
}
```

Output:

```
Enter the value of z5 : 80

Enter the value of x6 : 80

Enter the value of y6 : 20

Enter the value of z6 : 80

Enter the value of x7 : 80

Enter the value of y7 : 80

Enter the value of z7 : 80

Enter the value of x8 : 20

Enter the value of y8 : 80

Enter the value of z8 : 80

Matrix X :
20 20 20 1
80 20 20 1
80 80 20 1
20 80 20 1
20 20 80 1
80 20 80 1
80 80 80 1
20 80 80 1
Press any key to continue
```

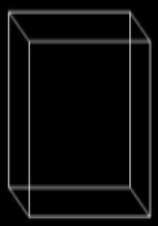

```
1.Translation
2.Rotation
3.Scaling
4.Reflection
5.Shearing
Enter your choice : 1

Shift in x-axis : 2

Shift in y-axis : 3

Shift in z-axis : 2

Matrix X' :
22 23 22 0
82 23 22 0
82 83 22 0
22 83 22 0
22 23 82 0
82 23 82 0
82 83 82 0
22 83 82 0
Press any key to continue...
```



```
5.Shearing
Enter your choice : 2

Choose the type of rotation :
        1. Rotation about x-axis
        2. Rotation about y-axis
        3. Rotation about z-axis
Enter your choice : 1

Choose the angle of rotation :
        1. 0 degree
        2. 30 degree
        3. 45 degree
        4. 60 degree
        5. 90 degree
        6. 180 degree
        7. 270 degree
        8. 360 degree
Enter your choice : 3

Matrix X' :
20 0 28 0
80 0 28 0
80 42 70 0
20 42 70 0
20 -42 70 0
80 -42 70 0
80 0 112 0
20 0 112 0
Press any key to continue...
```

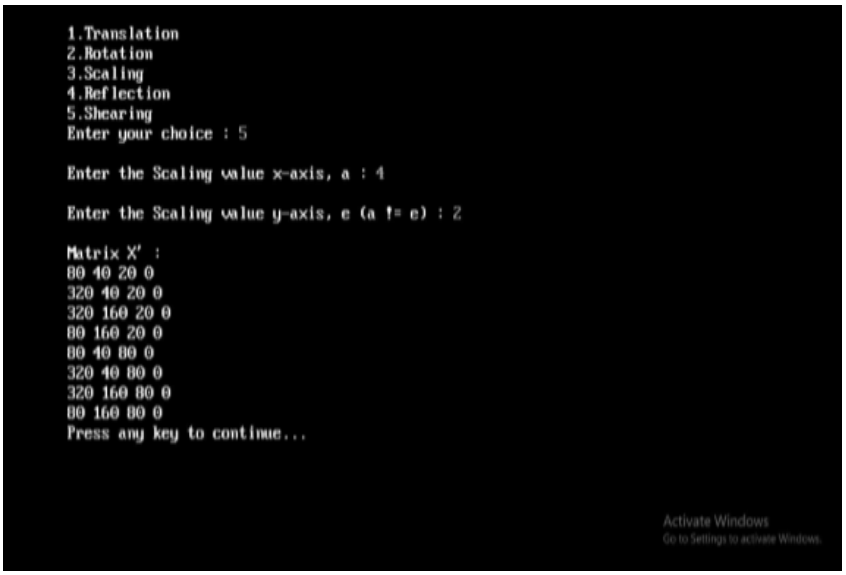

```
1.Translation
2.Rotation
3.Scaling
4.Reflection
5.Shearing
Enter your choice : 3

Enter the Scaling value : 2

Matrix X' :
40 40 40 0
160 40 40 0
160 160 40 0
40 160 40 0
40 40 160 0
160 40 160 0
160 160 160 0
40 160 160 0
Press any key to continue...
```

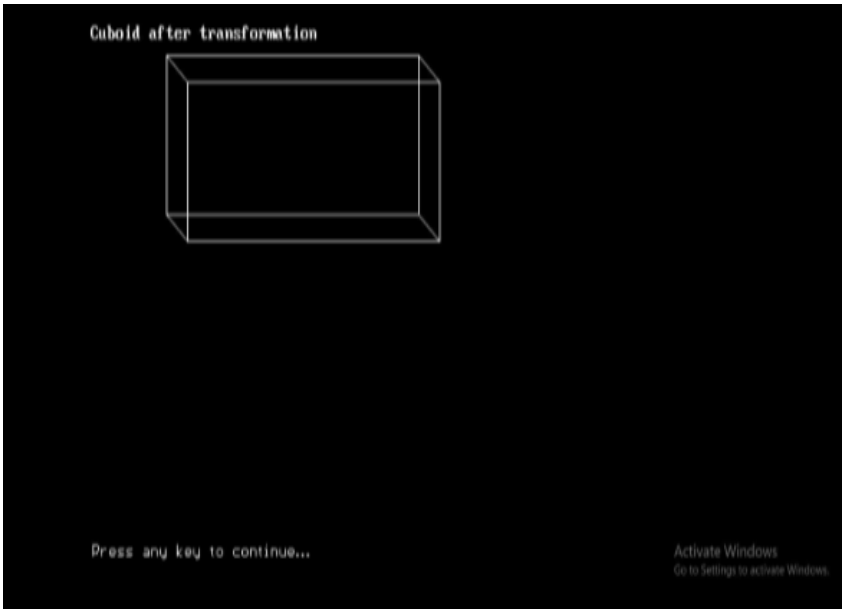

Cuboid after transformation



Press any key to continue...

```
1.Translation
2.Rotation
3.Scaling
4.Reflection
5.Shearing
Enter your choice : 4

Type of Reflection :
        1. About xy plane
        2. About yz plane
        3. About xz plane
Enter your choice : 2

Matrix X' :
-20 20 20 0
-80 20 20 0
-80 80 20 0
-20 80 20 0
-20 20 80 0
-80 20 80 0
-80 80 80 0
-20 80 80 0
Press any key to continue...
```



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

```
#include<stdio.h>
#include<conio.h>
#include<graphics.h>

int x,y,z;

void main()
{
float u;
int gd,gm,ymax,i,n,c[4][3];


for(i=0;i<4;i++) { c[i][0]=0; c[i][1]=0; }
```

```
printf("\n\n Enter four points : \n\n");

for(i=0; i<4; i++)
{
printf("\t X%d Y%d : ",i,i);
scanf("%d %d",&c[i][0],&c[i][1]);

}

c[4][0]=c[0][0];
c[4][1]=c[0][1];

detectgraph(&gd,&gm);
initgraph(&gd,&gm,"c:\\turboc3\\bgi");
ymax = 480;

setcolor(13);
for(i=0;i<3;i++)
{
line(c[i][0],ymax-c[i][1],c[i+1][0],ymax-c[i+1][1]);
}

setcolor(3);
n=3;

for(i=0;i<=40;i++)
{
u=(float)i/40.0;
bezier(u,n,c);

if(i==0)
{ moveto(x,ymax-y);}
else
{ lineto(x,ymax-y); }
getch();
}
getch();
}
bezier(u,n,p)
float u;int n; int p[4][3];
{
int j;
float v,b;
float blend(int,int,float);
x=0;y=0;z=0;
```

```
for(j=0;j<=n;j++)
{
b=blend(j,n,u);
x=x+(p[j][0]*b);
y=y+(p[j][1]*b);
z=z+(p[j][2]*b);
}
}

float blend(int j,int n,float u)
{
int k;
float v,blend;
v=C(n,j);
for(k=0;k<j;k++)
{ v*=u; }
for(k=1;k<=(n-j);k++)
{ v *= (1-u); }
blend=v;
return(blend);
}

C(int n,int j)
{
int k,a,c;
a=1;
for(k=j+1;k<=n;k++) { a*=k; }
for(k=1;k<=(n-j);k++) { a=a/k; }
c=a;
return(c);
}
```

Output: