FINAL PRACTICAL FILE

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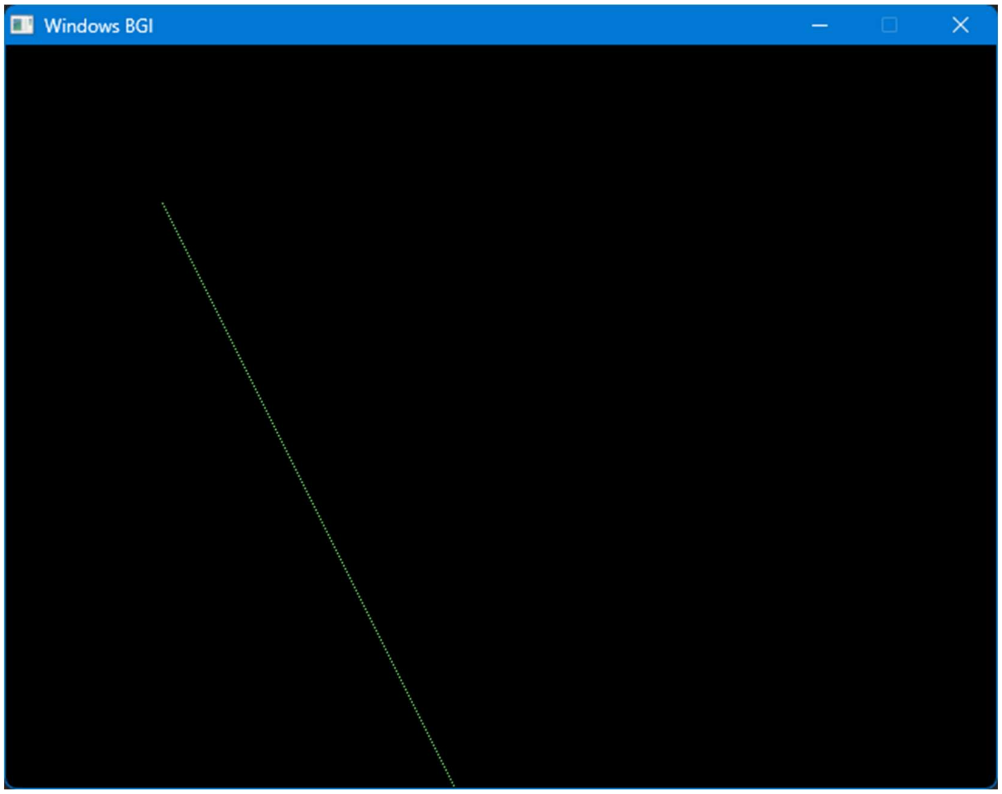
Que1 Write a program to implement DDA and Bresenham's line drawing algorithm.

Ans

#DAA

```
#include <graphics.h>
#include <stdio.h>
#include <dos.h>
void drawseg(int x1,int y1,int x2,int y2){
    float m = (x2-x1)/(y2-y1);
    int prex = x1;
    int prey = y1;
    int newx = x1;
    int newy = y1;
    while(prex<= x2) {
        newx += 1;
        newy = prey + m;
        putpixel(newx,newy,LIGHTGREEN);
        prex = newx;
        prey = newy;
        delay(10);
    }
}
int main(){
    int gd = DETECT,gm;
    initgraph(&gd,&gm,(char*) "");
    setcolor(getmaxcolor());
    drawseg(100,100,300,200);
    getch();
    closegraph();
    return 0;
}
```

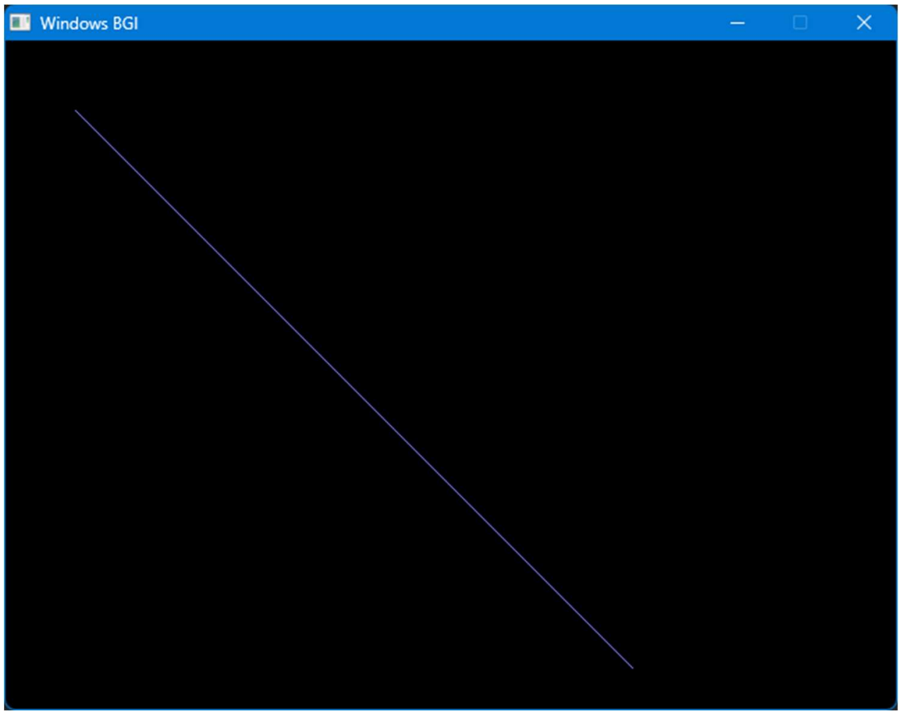
#Output



# Bresenham’s

```
#include <stdio.h>
#include <graphics.h>
#include <dos.h>
float getD_T(float di,int dy,int dx){
    return di + 2*(dy - dx);
}
float getD_S(float di, int dx){
    return di - 2*dx;
}

void drawline(int x0,int y0,int x1,int y1){
    float dx = x1 - x0;
    float dy = y1 - y0;
    int di = 2*dy - dx;
    float m = dy / dx;
    int x_old = x0;
    int y_old = y0;

    if (m<=1){
        while (x_old <= x1){
            putpixel(x_old,y_old,LIGHTBLUE);
            x_old+=1;
            if (di>=0) {
                y_old++;
                di = getD_T(di,dy,dx);
            } else {
                di = getD_S(di,dx);
            }
        delay(5);
        }
    } else {
        printf("slope greater than 1");
    }
}
int main(){
    int gd = DETECT, gm;
    initgraph(&gd, &gm,(char*) "");
    setcolor(getmaxcolor());
    drawline(50,50,450,450);
    getch();
    closegraph();
    return 0;
}
```

#Output

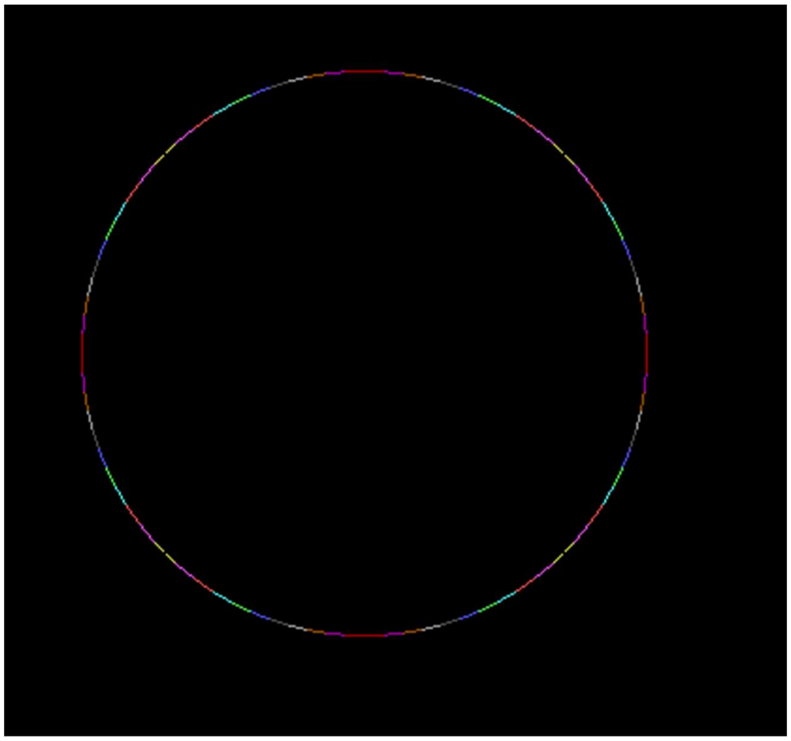


Que2 Simulate Mid point Circle Drawing Algorithm

Ans

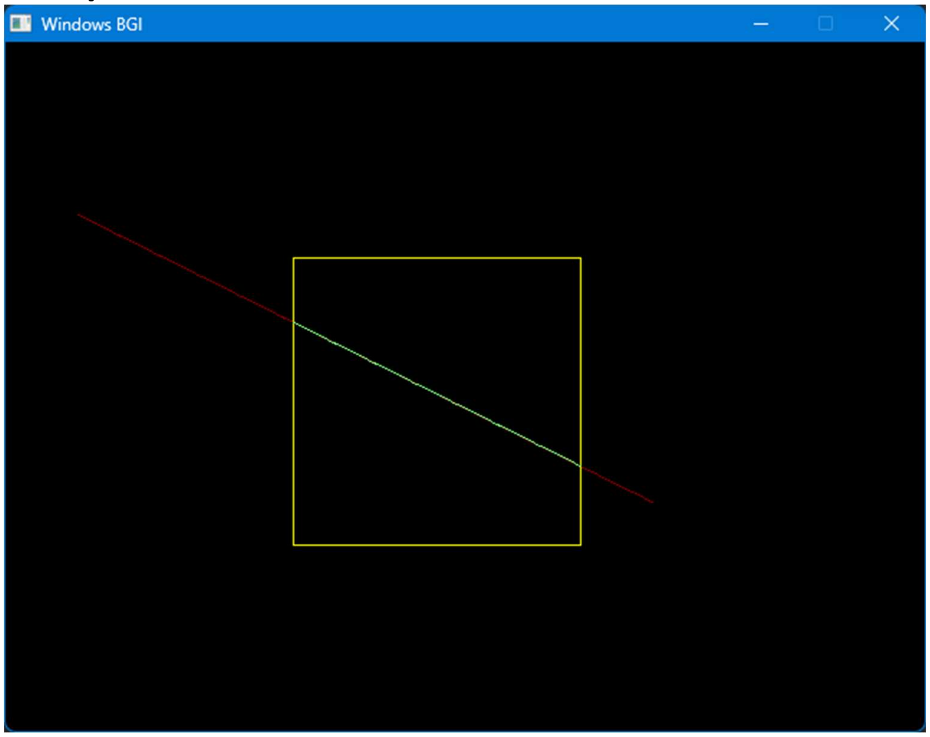
```
#include <stdio.h>
#include <stdlib.h>
```

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

void drawCircle(int x, int y, int r)
{
    float d = 1-r;
    float col = 100;
    int x_old = 0;
    int y_old = r;
    while (x_old < y_old){
        putpixel( x_old+x, y_old+y, col);
        putpixel(-x_old+x, y_old+y, col);
        putpixel( x_old+x,-y_old+y, col);
        putpixel(-x_old+x,-y_old+y, col);

        putpixel( y_old+x, x_old+y, col);
        putpixel(-y_old+x, x_old+y, col);
        putpixel( y_old+x,-x_old+y, col);
        putpixel(-y_old+x,-x_old+y, col);

        if (d<=0){
            d = d+3+2*x_old;
        } else {
            d = d+5+2*(x_old-y_old);
            y_old--;
        }
        x_old++;
        delay(5);
        col += 0.1;
    }
}
int main()
{
    int gdriver = DETECT, gmode, errorcode;
    initgraph(&gdriver, &gmode, "C:\\TURBOC3\\BGI");
    errorcode = graphresult();
    setcolor(getmaxcolor());
    drawCircle(200, 200, 150);
    getch();
    closegraph();
    return 0;
}
```
#Output



Que3 Write a program to clip a line using Cohen and Sutherland line clipping algorithm**.**

Ans

```
#include <graphics.h>
#include <stdio.h>
#include <stdlib.h>
#include <iostream>
using namespace std;

const int xmin = 200;
const int xmax = 400;
const int ymin = 150;
const int ymax = 350;

int get_code(float x, float y){
    int code = 0;

    if (x <= xmin)
        code += 1;
    else if (x >= xmax)
        code += 2;

    if (y <= ymin)
        code += 4;
    else if (y >= ymax)
        code += 8;
    return code;
}

void clip_line(float x1, float y1, float x2, float y2){
    int pt1_code = get_code(x1, y1);
    int pt2_code = get_code(x2, y2);

    if (!(pt1_code | pt2_code)){
        printf("Line is fully visible\n");
        setcolor(GREEN);
        line(x1, y1, x2, y2);
    }
    else{
        if (pt1_code & pt2_code){
            printf("Line is fully invisible\n");
            setcolor(RED);
            line(x1, y1, x2, y2);
        }
        else{
            printf("Line if partially visble\n");
            float m = (y2 - y1) / (x2 - x1);
            int x1new = x1;
            int y1new = y1;
            int x2new = x2;
            int y2new = y2;
            // *-----------------------------------
            if (pt1_code & 8){
                x1new = x1 + (ymax - y1) / m;
                y1new = ymax;
            }
            if (pt1_code & 4){
                x1new = x1 + (ymin - y1) / m;
                y1new = ymin;
            }
            if (pt1_code & 2){
                y1new = y1 + (xmax - x1) * m;
                x1new = xmax;
            }
            if (pt1_code & 1){
                y1new = y1 + (xmin - x1) * m;
                x1new = xmin;
            }
            // *-----------------------------------
            if (pt2_code & 8){
                x2new = x2 + (ymax - y2) / m;
                y2new = ymax;
            }
            if (pt2_code & 4){
                x2new = x2 + (ymin - y2) / m;
                y2new = ymin;
            }
            if (pt2_code & 2){
                y2new = y2 + (xmax - x2) * m;
                x2new = xmax;
            }
            if (pt2_code & 1){
                y2new = y2 + (xmin - x2) * m;
                x2new = xmin;
            }
            // *-----------------------------------
            setcolor(LIGHTGREEN);
            line(x1new,y1new,x2new,y2new);
        }
    }
}
int main(){
    int gd = DETECT, gm;
    initgraph(&gd, &gm, (char *)"");

    float x1 = 50;
    float y1 = 120;
    float x2 = 450;
    float y2 = 320;

    setcolor(RED);
    line(x1,y1,x2,y2);
    setcolor(YELLOW);
    line(xmin,ymin,xmin,ymax);
    line(xmin,ymin,xmax,ymin);
    line(xmin,ymax,xmax,ymax);
    line(xmax,ymin,xmax,ymax);

    clip_line(x1,y1,x2,y2);
    getch();
    closegraph();
    return 0;
}
```
#Output


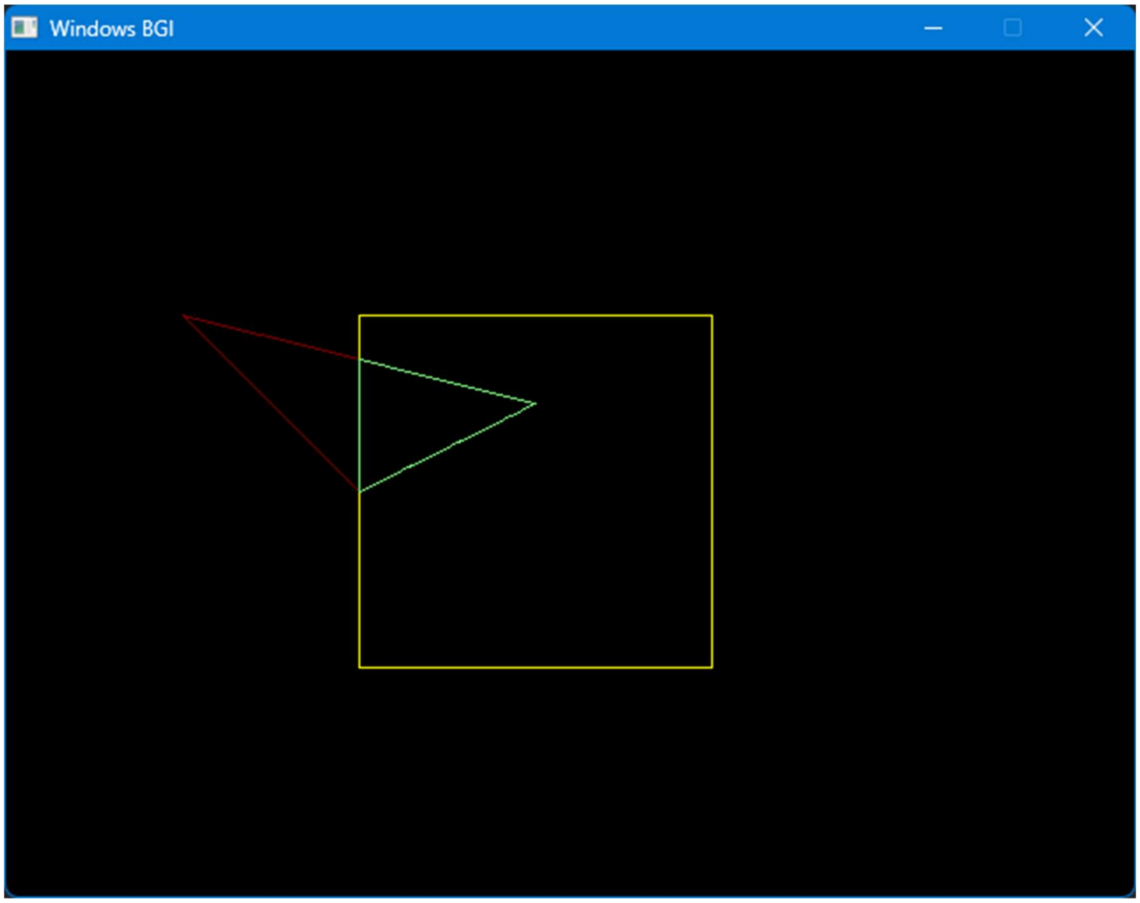
Que4 Write a program to clip a polygon using Sutherland Hodgeman algorithm.

Ans

```
#include <graphics.h>

const int MAX_POINTS = 20;
const int xmin = 200, xmax = 400, ymin = 150, ymax = 350;

void drawpoly(int poly[][2], int count, int color){
    setcolor(color);
    for (int i = 0; i < count-1; i++){
        line(poly[i][0], poly[i][1], poly[i + 1][0], poly[i + 1][1]);
    }
    line(poly[count-1][0], poly[count-1][1], poly[0][0], poly[0][1]);
}


int x_intersect(int x1, int y1, int x2, int y2,int x3, int y3, int x4, int
y4){
    int num = (x1 * y2-y1 * x2) * (x3-x4)-(x1-x2) * (x3 * y4-y3 * x4);
    int den = (x1-x2) * (y3-y4)-(y1-y2) * (x3-x4);
    return num / den;
}

int y_intersect(int x1, int y1, int x2, int y2,int x3, int y3, int x4, int
y4){
    int num = (x1 * y2-y1 * x2) * (y3-y4)-(y1-y2) * (x3 * y4-y3 * x4);
    int den = (x1-x2) * (y3-y4)-(y1-y2) * (x3-x4);
    return num / den;
}

void clip(int poly_points[][2], int &poly_size,int x1, int y1, int x2, int
y2){
    int nP[MAX_POINTS][2], ns = 0;
    for (int i = 0; i < poly_size; i++){
        int k = (i + 1) % poly_size;
        int ix = poly_points[i][0], iy = poly_points[i][1];
        int kx = poly_points[k][0], ky = poly_points[k][1];
        int i_pos = (x2-x1) * (iy-y1)-(y2-y1) * (ix-x1);
        int k_pos = (x2-x1) * (ky-y1)-(y2-y1) * (kx-x1);
        if (i_pos < 0 && k_pos < 0){
            nP[ns][0] = kx;
            nP[ns][1] = ky;
            ns++;
        } else if (i_pos >= 0 && k_pos < 0){
            nP[ns][0] = x_intersect(x1, y1, x2, y2, ix, iy, kx, ky);
            nP[ns][1] = y_intersect(x1, y1, x2, y2, ix, iy, kx, ky);
            ns++;
            nP[ns][0] = kx;
            nP[ns][1] = ky;
            ns++;
        } else if (i_pos < 0 && k_pos >= 0){
            nP[ns][0] = x_intersect(x1, y1, x2, y2, ix, iy, kx, ky);
            nP[ns][1] = y_intersect(x1, y1, x2, y2, ix, iy, kx, ky);
            ns++;
        }
    }

    poly_size = ns;
    for (int i = 0; i < poly_size; i++) {
        poly_points[i][0] = nP[i][0];
        poly_points[i][1] = nP[i][1];
    }
}

void suthHodgClip(int poly_points[][2], int poly_size,int ClipP[][2], int
CLipS){
    for (int i = 0; i < CLipS; i++){
        int k = (i + 1) % CLipS;
        clip(poly_points, poly_size, ClipP[i][0],
             ClipP[i][1], ClipP[k][0],
             ClipP[k][1]);
    }
    drawpoly(poly_points,poly_size,LIGHTGREEN);
}

int main(){
    int gd = DETECT,gm;
    initgraph(&gd,&gm,(char *) "");
    int poly_size = 3;
    int poly_points[20][2] = {{100, 150}, {200, 250}, {300, 200}};

    drawpoly(poly_points,poly_size,RED);
    setcolor(YELLOW);
    rectangle(xmin,ymin,xmax,ymax);

    int clipper_size = 4;
    int clipper_points[][2] = {{xmin, ymin}, {xmin, ymax}, {xmax, ymax},
{xmax, ymin}};

    suthHodgClip(poly_points, poly_size, clipper_points, clipper_size);

    getch();
    closegraph();
    return 0;
```

```
}
```

#Output

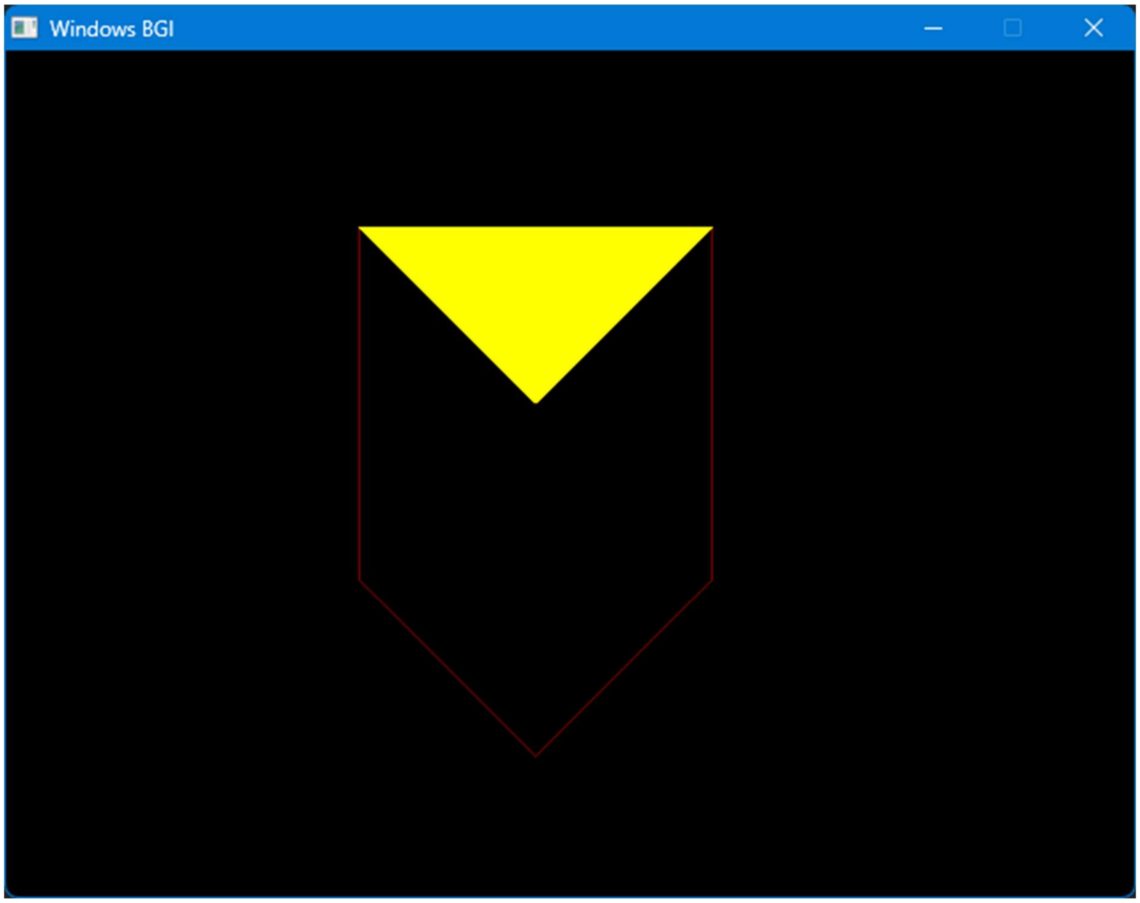


Que5 Write a program to fill a polygon using Scan line fill algorithm.

Ans

```
#include <graphics.h>

void scanLineFill(int n, int polyPoints[]){
    int minY = INT_MAX, maxY = INT_MIN;
    for (int i = 1; i <= n; i += 2){
        if (polyPoints[i] < minY)
            minY = polyPoints[i];
        if (polyPoints[i] > maxY)
            maxY = polyPoints[i];
    }
    for (int y = minY; y <= maxY; y++){
        int intersectX[100], k = 0;
        for (int i = 0; i < n; i += 2){
            int x1 = polyPoints[i];
            int y1 = polyPoints[i + 1];
            int x2 = polyPoints[(i + 2) % n];
            int y2 = polyPoints[(i + 3) % n];
            if ((y >= y1 && y < y2) || (y >= y2 && y < y1)){
                if (y1 == y2) // Horizontal line, skip
                    continue;
                int x = x1 + (y - y1) * (x2 - x1) / (y2 - y1);
                intersectX[k++] = x;
            }
        }
        for (int i = 0; i < k - 1; i++){
            for (int j = 0; j < k - i - 1; j++){
                if (intersectX[j] > intersectX[j + 1]){
                    int temp = intersectX[j];
                    intersectX[j] = intersectX[j + 1];
                    intersectX[j + 1] = temp;
                }
            }
        }
        for (int i = 0; i < k; i += 2){
            line(intersectX[i], y, intersectX[i + 1], y);
        }
    }
}

void drawpoly(int poly[][2], int count, int color){
    setcolor(color);
    for (int i = 0; i < count - 1; i++){
        line(poly[i][0], poly[i][1], poly[i + 1][0], poly[i + 1][1]);
    }
    line(poly[count - 1][0], poly[count - 1][1], poly[0][0], poly[0][1]);
}

int main(){
    int gd = DETECT, gm;
    initgraph(&gd, &gm, (char *)"");
    int n = 6;
    int polyPoints[] = {200, 100, 300, 200, 400, 100, 400, 300, 300, 400, 200,
300};
    int polyPoints2[][2] = {{200, 100}, {300, 200}, {400, 100}, {400, 300},
{300, 400}, {200, 300}};
    drawpoly(polyPoints2, n, RED);
    setcolor(YELLOW);
    scanLineFill(n, polyPoints);
    getch();
    closegraph();
    return 0;
}
```

#Output

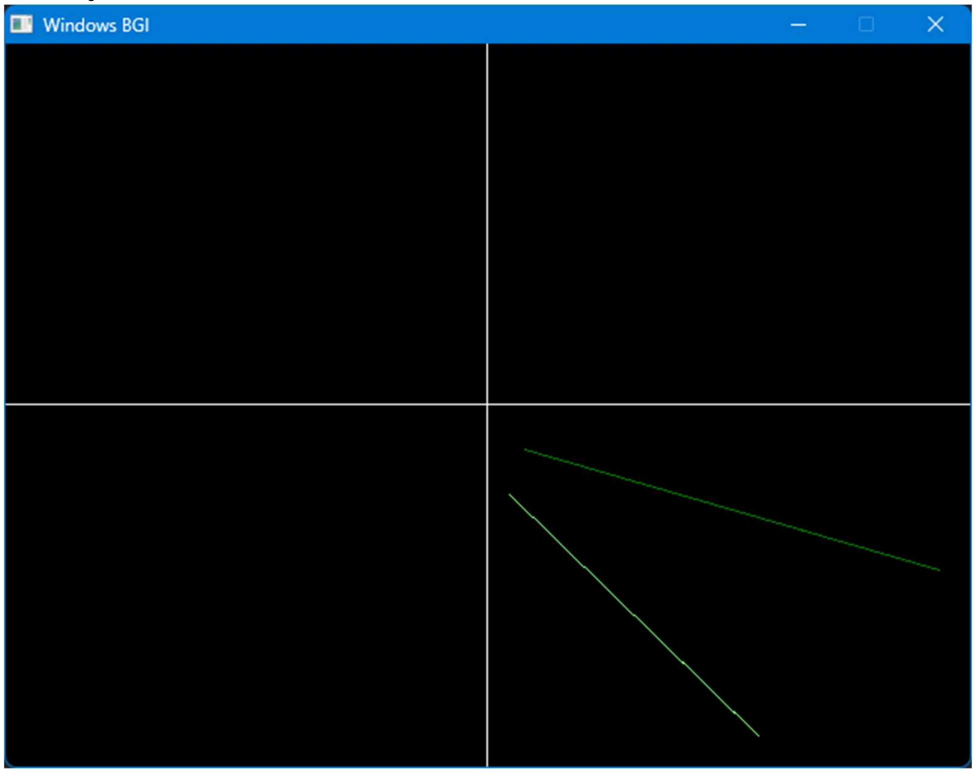

Windows BGI

Que6 Write a program to apply various 2D transformations on a 2D object (use homogenous Coordinates).

Scaling

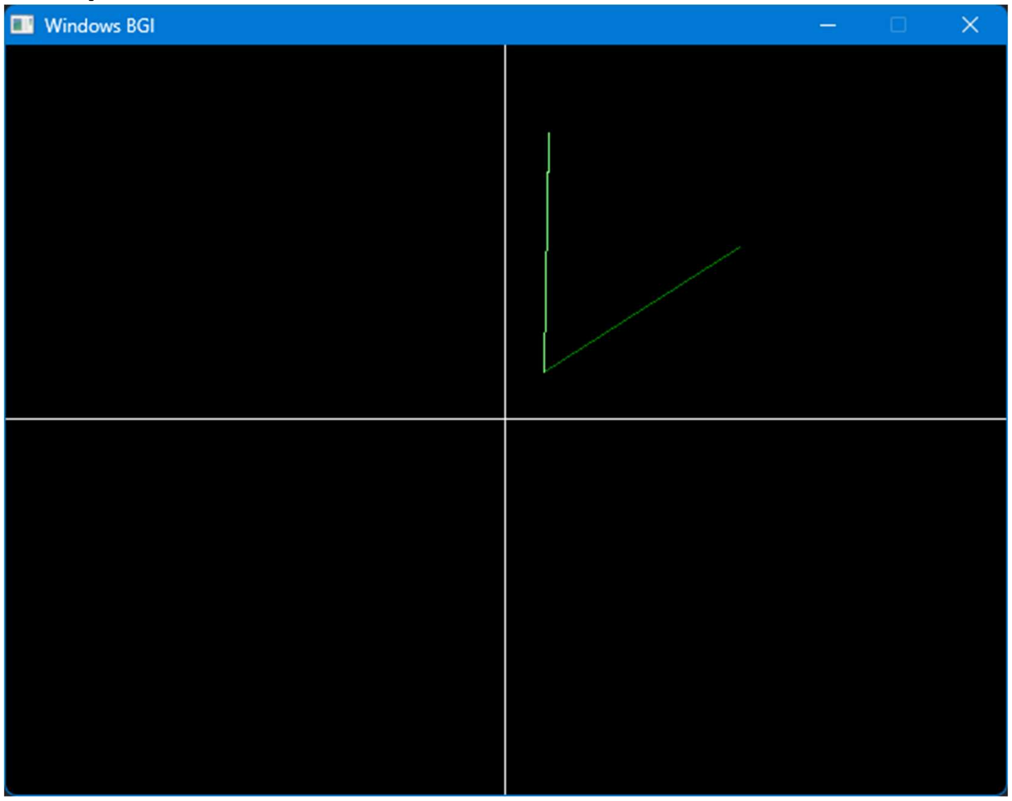
Ans

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

int **MatrixMul(int pcount, int P[][3], float T[3][3]){
    int** res = (int**)malloc(pcount * sizeof(int*));
    for (int i = 0; i < pcount; i++) {
        res[i] = (int*)malloc(3 * sizeof(int));
    }
    for (int i = 0; i < pcount; i++){
        for (int j = 0; j < 3; j++){
            res[i][j] = 0;
            for (int k = 0; k < 3; k++){
                res[i][j] += P[i][k] * T[k][j];
            }
        }
    }
    return res;
}

int **scaling(int x1,int y1,int x2,int y2,float sx,float sy){
    int points[2][3] = {{x1,y1,1},{x2,y2,1}};
    float Tmatrix[3][3] = {{sx,0,0},{0,sy,0},{0,0,1}};
    int** res = MatrixMul(2,points,Tmatrix);
    return res;
}

int main(){
    int gd = DETECT, gm;
    initgraph(&gd, &gm, (char *)"");
    int x1 = 25;
    int y1 = 30;
    int x2 = 300;
    int y2 = 110;
    float sx = 0.6;
    float sy = 2;
    int xaxis = getmaxy()/2;
    int yaxis = getmaxx()/2;
    setcolor(WHITE);
    line(yaxis,0,yaxis,getmaxy());
    line(0,xaxis,getmaxx(),xaxis);
    setcolor(GREEN);
    line(x1+yaxis,y1+xaxis,x2+yaxis,y2+xaxis);
    setcolor(LIGHTGREEN);
    int** res = scaling(x1, y1, x2, y2, sx, sy);

    line(res[0][0]+yaxis,res[0][1]+xaxis,res[1][0]+yaxis,res[1][1]+xaxis);

    getch();
    closegraph();
    return 0;
;}
```
#Output



Rotation
Ans
```
#include <stdio.h>
#include <cmath>
#include <graphics.h>
#define PI 3.1415926

int** MatMul(int pcount,int P[][3],float T[3][3]){
    int** prod = (int **) malloc(pcount * sizeof(int*));
    for(int i = 0 ; i < pcount;i++){
        prod[i] = (int* ) malloc(sizeof(int) * 2);
    }

    for(int m = 0; m < pcount;m++){
        for(int n = 0;n < 3;n++){
            int sum = 0;
            for(int k = 0;k < 3;k++){
                sum+=P[m][k]*T[k][n];
            }
            prod[m][n] = sum;
        }
    }
    return prod;
}

int **rotation(int x1,int y1,int x2,int y2,double angle){
    angle*=PI/180;
    int points[2][3] = {{x1,y1,1},{x2,y2,1}};
    float Tmatrix[3][3] = {{cos(angle),sin(angle),0},{-
sin(angle),cos(angle),0},{0,0,1}};
    if(angle < 0){
        Tmatrix[0][1]*=-1;Tmatrix[1][0]*=-1;
    }
    int** res = MatMul(2,points,Tmatrix);
    res[0][0] = x1;res[0][1] = y1;
    return res;
}

int main(){
int gd = DETECT, gm;
    initgraph(&gd, &gm, (char *)"");
    int x1 = 25;
    int y1 = 30;
    int x2 = 150;
    int y2 = 110;
    double ang = 45;
    int xaxis = getmaxy()/2;
    int yaxis = getmaxx()/2;
    setcolor(WHITE);
    line(yaxis,0,yaxis,getmaxy());
    line(0,xaxis,getmaxx(),xaxis);

    setcolor(GREEN);
    line(x1+yaxis,-y1+xaxis,x2+yaxis,-y2+xaxis);

    int** res = rotation(x1, y1, x2, y2, ang);

    setcolor(LIGHTGREEN);
    line(res[0][0]+yaxis,-res[0][1]+xaxis,res[1][0]+yaxis,-res[1][1]+xaxis);

    getch();
    closegraph();
    return 0;
}
```

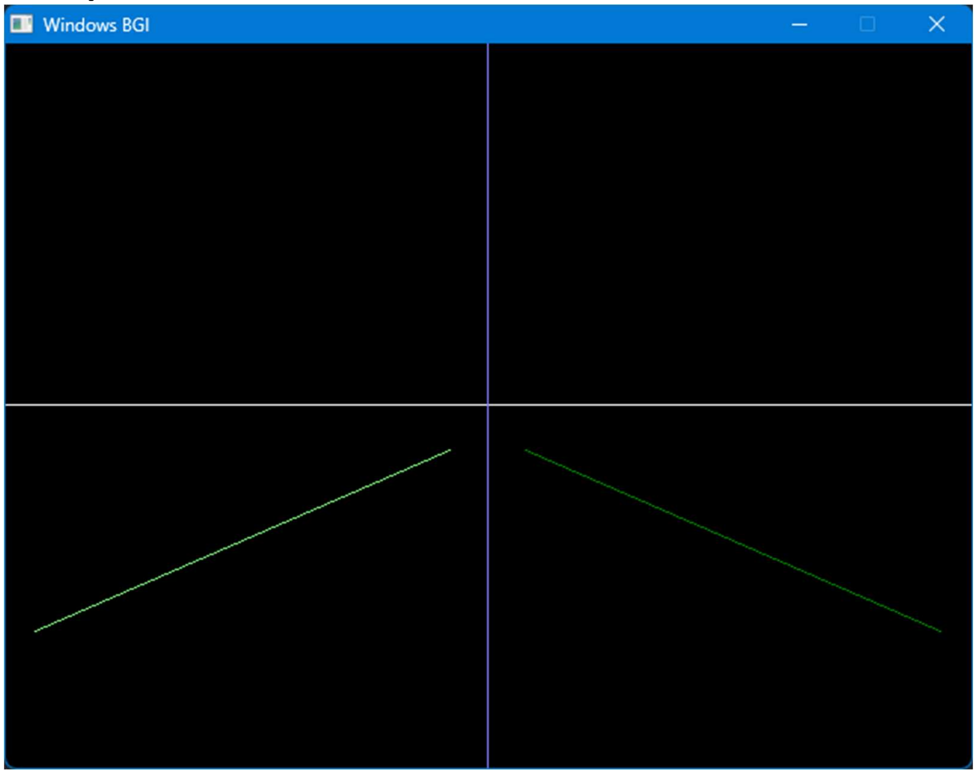
#Output



Reflection

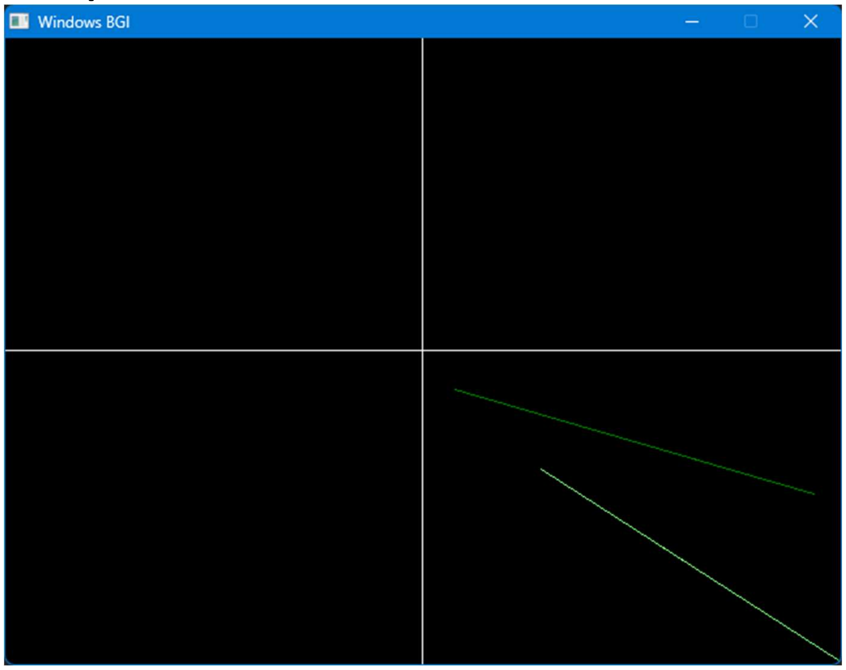
```
#include <graphics.h>
#include <stdio.h>
#include <math.h>

int **MatrixMul(int pcount, int P[][3], int T[3][3]){
    int** res = (int**)malloc(pcount * sizeof(int*));
    for (int i = 0; i < pcount; i++) {
        res[i] = (int*)malloc(2 * sizeof(int));
    }
    for (int i = 0; i < pcount; i++){
        for (int j = 0; j < 3; j++){
            res[i][j] = 0;
            for (int k = 0; k < 3; k++){
                res[i][j] += P[i][k] * T[k][j];
            }
        }
    }
    return res;
}

int **reflection(int x1, int y1, int x2, int y2, char axis){
    int points[][3] = {{x1,y1,1}, {x2, y2,1}};
    int** a;
    if (axis == 'x'){
        int Tmatrix[3][3] = {{1,0,0},{0,-1,0},{0,0,1}};
        a = MatrixMul(2, points, Tmatrix);
    } else if (axis == 'y'){
        int Tmatrix[3][3] = {{-1,0,0},{0,1,0},{0,0,1}};
        a = MatrixMul(2, points, Tmatrix);
    }
    return a;
}

int main(){
    int gd = DETECT, gm;
    initgraph(&gd, &gm, (char *)"");
    int x1 = 25;
    int y1 = 30;
    int x2 = 300;
    int y2 = 150;
    char axis = 'y';
    int xaxis = getmaxy()/2;
    int yaxis = getmaxx()/2;
    setcolor(WHITE);
    line(yaxis,0,yaxis,getmaxy());
    line(0,xaxis,getmaxx(),xaxis);
    setcolor(GREEN);
    line(x1+yaxis,y1+xaxis,x2+yaxis,y2+xaxis);
    setcolor(LIGHTBLUE);
    if (axis == 'x'){
        line(0,xaxis,getmaxx(),xaxis);
    } else if (axis == 'y'){
        line(yaxis,0,yaxis,getmaxy());
    }

    int** res = reflection(x1, y1, x2, y2, axis);

    setcolor(LIGHTGREEN);
    line(res[0][0]+yaxis,res[0][1]+xaxis,res[1][0]+yaxis,res[1][1]+xaxis);

    getch();
    closegraph();
    return 0;
}
```

#Output



Shearing

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

int **MatrixMul(int pcount, int P[][3], float T[3][3]){
    int** res = (int**)malloc(pcount * sizeof(int*));
    for (int i = 0; i < pcount; i++) {
        res[i] = (int*)malloc(2 * sizeof(int));
    }
    for (int i = 0; i < pcount; i++){
        for (int j = 0; j < 3; j++){
            res[i][j] = 0;
            for (int k = 0; k < 3; k++){
                res[i][j] += P[i][k] * T[k][j];
            }
        }
    }
    return res;
}

int **shearing(int x1,int y1,int x2,int y2,float sx,float sy){
    int points[2][3] = {{x1,y1,1},{x2,y2,1}};
    float Tmatrix[3][3] = {{1+(sx*sy),sx,0},{sy,1+(sx*sy),0},{0,0,1}};
    int** res = MatrixMul(2,points,Tmatrix);
    return res;
}

int main(){
    int gd = DETECT, gm;
    initgraph(&gd, &gm, (char *)"");
    int x1 = 25;
    int y1 = 30;
    int x2 = 300;
    int y2 = 110;
    float sx = 1;
    float sy = 1.2;
    int xaxis = getmaxy()/2;
    int yaxis = getmaxx()/2;
    setcolor(WHITE);
    line(yaxis,0,yaxis,getmaxy());
    line(0,xaxis,getmaxx(),xaxis);

    setcolor(GREEN);
    line(x1+yaxis,y1+xaxis,x2+yaxis,y2+xaxis);

    int** res = shearing(x1, y1, x2, y2, sx, sy);

    setcolor(LIGHTGREEN);
    line(res[0][0]+yaxis,res[0][1]+xaxis,res[1][0]+yaxis,res[1][1]+xaxis);

    getch();
    closegraph();
    return 0;
}
```
#Output

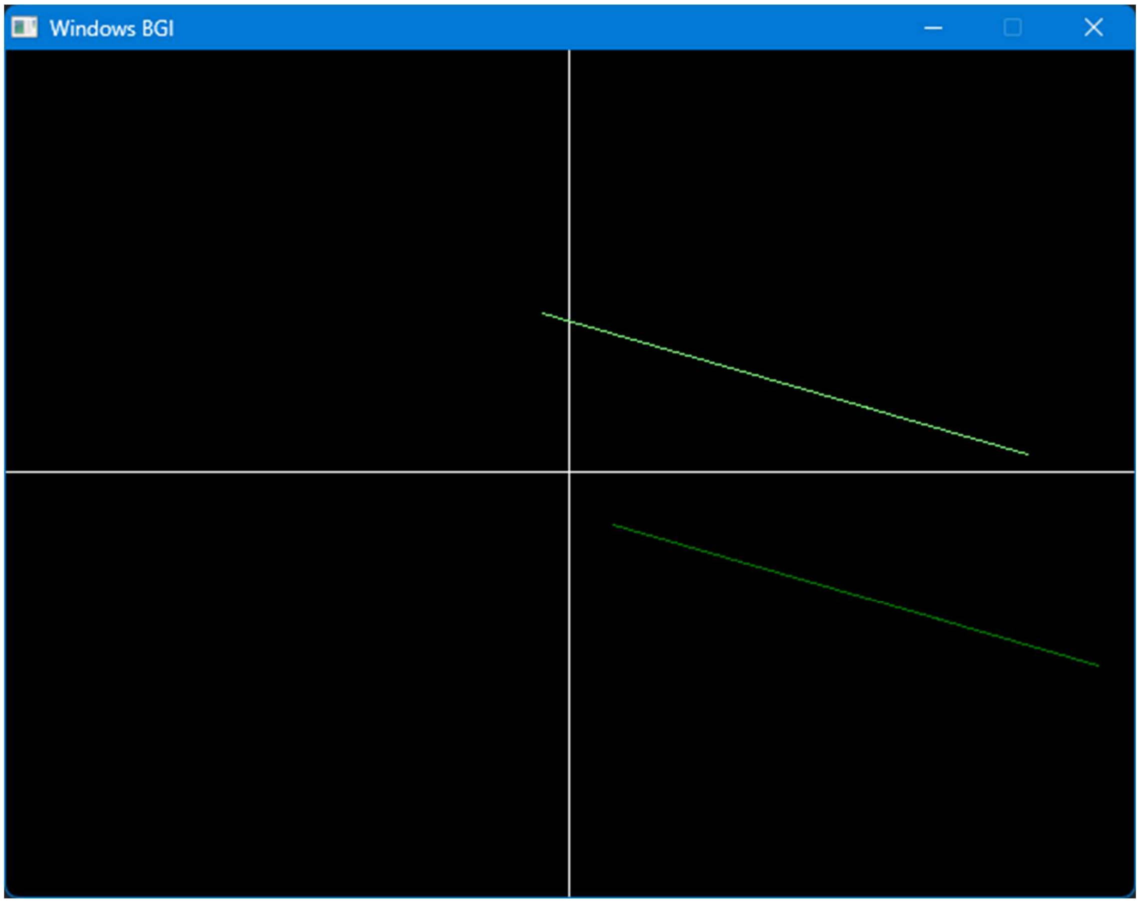


Translation

Ans

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

int **MatrixMul(int pcount, int P[][3], float T[3][3]){
    int** res = (int**)malloc(pcount * sizeof(int*));
    for (int i = 0; i < pcount; i++) {
        res[i] = (int*)malloc(2 * sizeof(int));
    }
    for (int i = 0; i < pcount; i++){
        for (int j = 0; j < 3; j++){
            res[i][j] = 0;
            for (int k = 0; k < 3; k++){
                res[i][j] += P[i][k] * T[k][j];
            }
        }
    }
    return res;
}

int **translate(int x1,int y1,int x2,int y2,float tx,float ty){
    int points[2][3] = {{x1,y1,1},{x2,y2,1}};
    float Tmatrix[3][3] = {{1,0,0},{0,1,0},{tx,ty,1}};
    int** res = MatrixMul(2,points,Tmatrix);
    return res;
}

int main(){
    int gd = DETECT, gm;
    initgraph(&gd, &gm, (char *)"");
    int x1 = 25;
    int y1 = 30;
    int x2 = 300;
    int y2 = 110;
    float tx = -40;
    float ty = -120;
    int xaxis = getmaxy()/2;
    int yaxis = getmaxx()/2;
    setcolor(WHITE);
    line(yaxis,0,yaxis,getmaxy());
    line(0,xaxis,getmaxx(),xaxis);

    setcolor(GREEN);
    line(x1+yaxis,y1+xaxis,x2+yaxis,y2+xaxis);

    int** res = translate(x1, y1, x2, y2, tx, ty);
    setcolor(LIGHTGREEN);
    line(res[0][0]+yaxis,res[0][1]+xaxis,res[1][0]+yaxis,res[1][1]+xaxis);

    getch();
    closegraph();
    return 0;
}
```

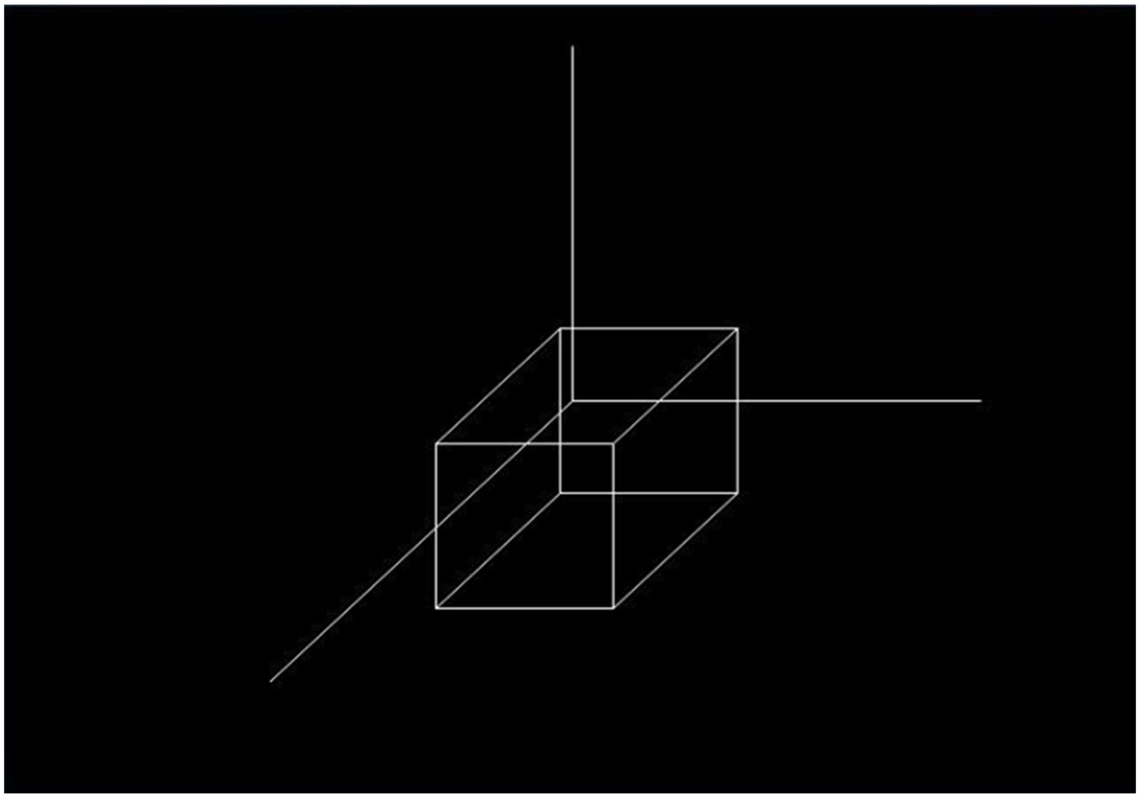
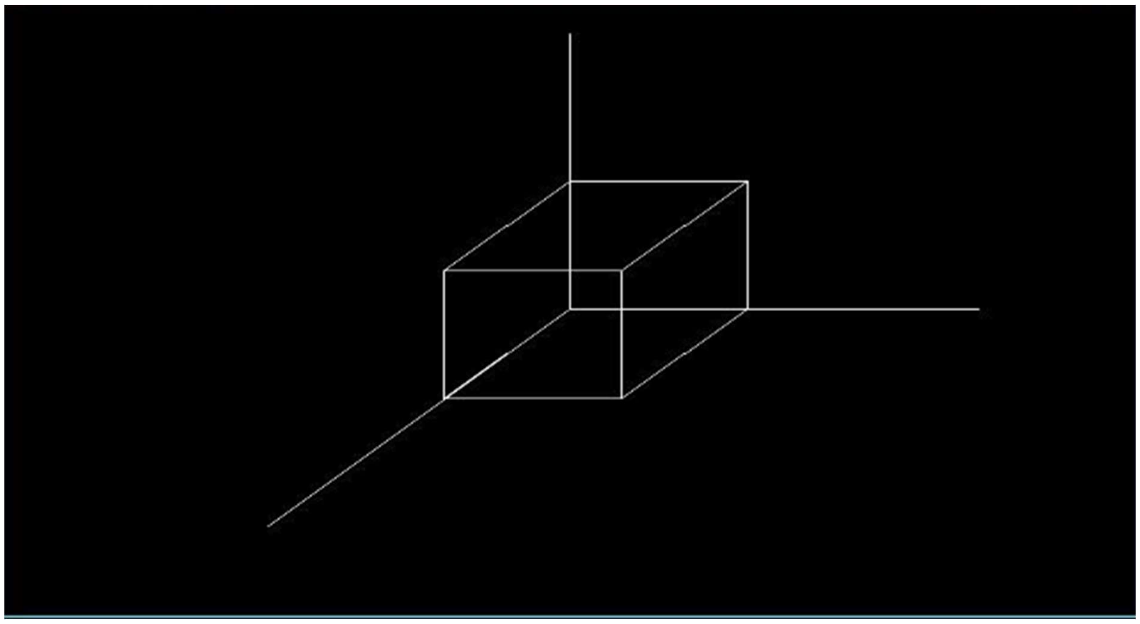
#Output

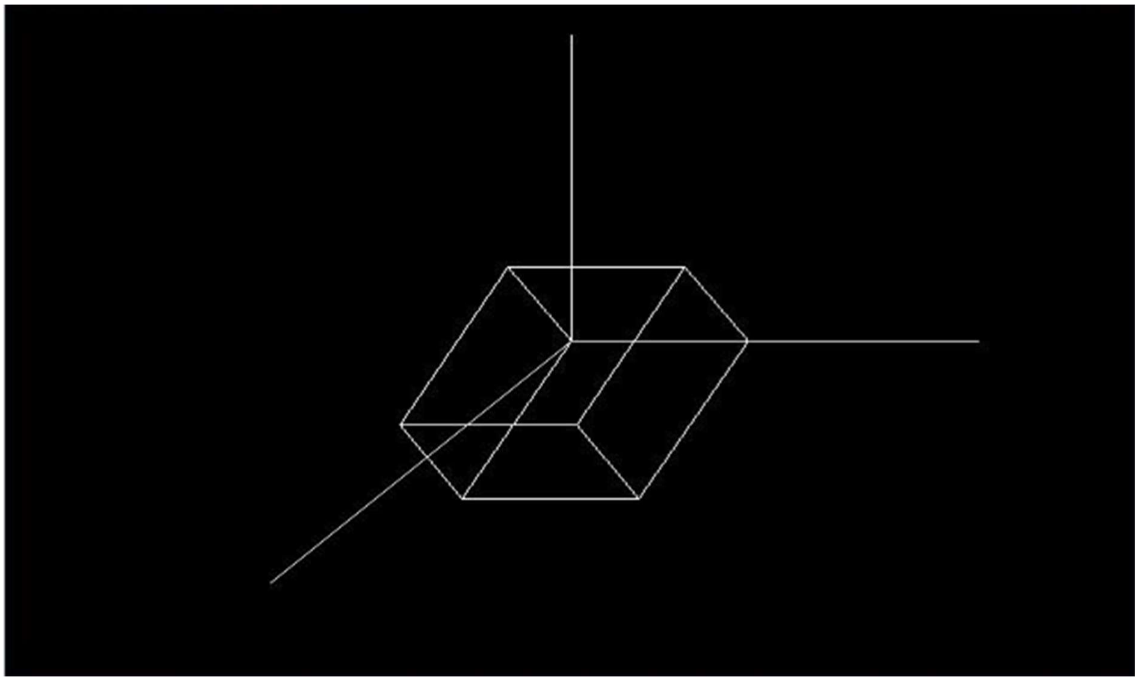


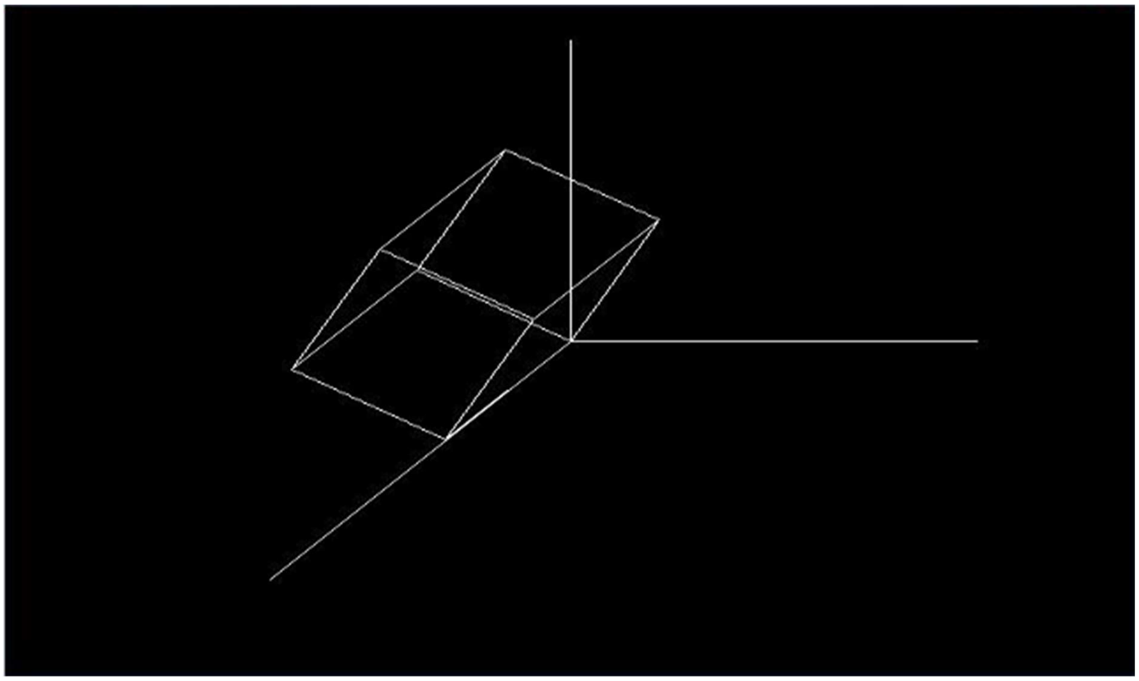
Que7 Write a program to apply various 3D transformations on a 3D object and then apply parallel and perspective projection on it.

Ans

```
#include <graphics.h>
#include <iostream>
#include <conio.h>
#include <math.h>
using namespace std;
int gd, gm, i, ch1, ch2,y1;
double x1, x2, y2, x, y, z, theta, temp, temp1;
void draw(double[20][3]);
int main(){
    do
    {
        double edge[20][3] = {100, 0, 0,
                              100, 100, 0,
                              0, 100, 0,
                              0, 100, 100,
                              0, 0, 100,
                              0, 0, 0,
                              100, 0, 0,
                              100, 0, 100,
                              100, 100, 100,
                              100, 100, 100,
                              100, 100, 100,
                              100, 100, 0,
                              100, 100, 100,
                              100, 100, 100,
                              100, 100, 100,
                              0, 100, 100,
                              0, 100, 0,
                              0, 0, 0,
                              0, 0, 100,
                              100, 0, 100};
        cleardevice();
        cout << "Choose any one 3D Transformation : ";
        cout << "\n\t1. Translation ";
        cout << "\n\t2. Rotation ";
        cout << "\n\t3. Scaling ";
        cout << "\nEnter your choice : \t";
        cin >> ch1;
        switch (ch1)
        {
        case 1:
            cout << "\nEnter the translation factors(tx,ty,tz) : \t";
            cin >> x >> y >> z;
            draw(edge);
            for (i = 0; i < 20; i++)
            {
                edge[i][0] += x;
                edge[i][1] += y;
                edge[i][2] += z;
            }
            draw(edge);
            break;
        case 2:
            cout << "\n\n\t1.Rotation about X Axis ";
            cout << "\n\t2. Rotation about Y Axis ";
            cout << "\n\t3. Rotation about Z Axis ";
            cout << "\nEnter your choice : \t";
            cin >> ch2;
            cout << "\n\nEnter the angle of rotation : \t";
            cin >> theta;
            theta = (theta * 3.14) / 180;
            switch (ch2)
            {
            case 1:
                draw(edge);
                for (i = 0; i < 20; i++){
                    temp = edge[i][1];
                    temp1 = edge[i][2];
                    edge[i][1] = temp * cos(theta) - temp1 * sin(theta);
                    edge[i][2] = temp * sin(theta) + temp1 * cos(theta);
                }
                draw(edge);
                break;
            case 2:
                draw(edge);
                for (i = 0; i < 20; i++){
                    temp = edge[i][0];
                    temp1 = edge[i][2];
                    edge[i][0] = temp * cos(theta) + temp1 * sin(theta);
                    edge[i][2] = -temp * sin(theta) + temp1 * cos(theta);
                }
                draw(edge);
                break;
            case 3:
                draw(edge);
                for (i = 0; i < 20; i++){
                    temp = edge[i][0];
                    temp1 = edge[i][1];
                    edge[i][0] = temp * cos(theta) - temp1 * sin(theta);
                    edge[i][1] = temp * sin(theta) + temp1 * cos(theta);
                }
                draw(edge);
                break;
            }
            break;
        case 3:
            cout << "\n\nEnter the scaling factors (sx,sy,sz) : \t";
            cin >> x >> y >> z;
            draw(edge);
            for (i = 0; i < 20; i++){
                edge[i][0] *= x;
                edge[i][1] *= y;
                edge[i][2] *= z;
            }
            draw(edge);
            break;
        }
    } while (ch1 < 4);
    return 0;
}

void draw(double edge[20][3]){
    initgraph(&gd, &gm,(char *) "");
    line(320, 240, 320, 25);
    line(320, 240, 550, 240);
    line(320, 240, 150, 410);
    for (int i = 0; i < 19; i++){
        x1 = edge[i][0] + edge[i][2] * (cos(2.3562));
        y1 = edge[i][1] - edge[i][2] * (sin(2.3562));
        x2 = edge[i + 1][0] + edge[i + 1][2] * (cos(2.3562));
        y2 = edge[i + 1][1] - edge[i + 1][2] * (sin(2.3562));
        line(x1+320,240-y1,x2+320,240-y2);
    }
    getch();
    closegraph();
}
```
#Output





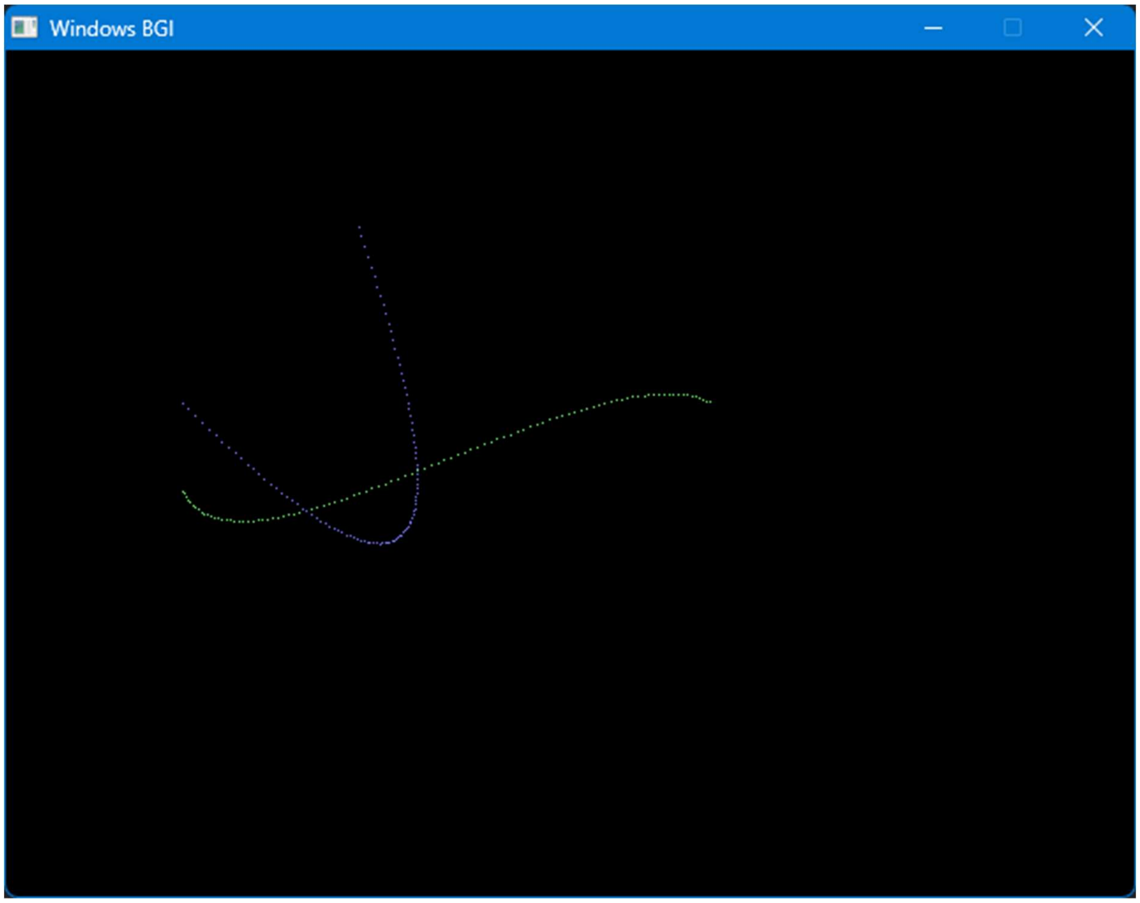
Que8 Write a program to draw Hermite /Bezier curve.

Ans

```
#include <graphics.h>
#include <iostream>
using namespace std;

float HB(int i, float t){
    if (i == 0)
```

```
        return (2 * t * t * t - 3 * t * t + 1);
    else if (i == 1)
        return (-2 * t * t * t + 3 * t * t);
    else if (i == 2)
        return (t * t * t - 2 * t * t + t);
    else
        return (t * t * t - t * t);
}

float BB(int i, int n, float t){
    if (n == 0){
        if (i == 0)
            return 1;
        else
            return 0;
    }
    return (1 - t) * BB(i, n - 1, t) + t * BB(i - 1, n - 1, t);
}

void drawHermite(int x0, int y0, int x1, int y1, int rx0, int ry0, int rx1,
int ry1){
    float step = 0.01;
    for (float t = 0; t <= 1; t += step){
        float x = x0 * HB(0, t) + x1 * HB(1, t) + rx0 * HB(2, t) + rx1 * HB(3,
t);
        float y = y0 * HB(0, t) + y1 * HB(1, t) + ry0 * HB(2, t) + ry1 * HB(3,
t);
        putpixel(x, y, LIGHTGREEN);
    }
}

void drawBezier(int x[], int y[], int n){
    float step = 0.01;
    for (float t = 0; t <= 1; t += step){
        float px = 0, py = 0;
        for (int i = 0; i <= n; i++){
            px += x[i] * BB(i, n, t);
            py += y[i] * BB(i, n, t);
        }
        putpixel(px, py, LIGHTBLUE);
    }
}

int main(){
    int gd = DETECT, gm;
    initgraph(&gd, &gm,(char *) "");

    int x0 = 100, y0 = 250, x1 = 400, y1 = 200;
    int rx0 = 100, ry0 = 200, rx1 = 200, ry1 = 100;

    int xBezier[] = {100, 300, 200};
    int yBezier[] = {200, 400, 100};
    int n = sizeof(xBezier) / sizeof(xBezier[0]) - 1;

    drawHermite(x0, y0, x1, y1, rx0, ry0, rx1, ry1);

    drawBezier(xBezier, yBezier, n);

    getch();
    closegraph();
    return 0;
}
```

#Output


Windows BGI