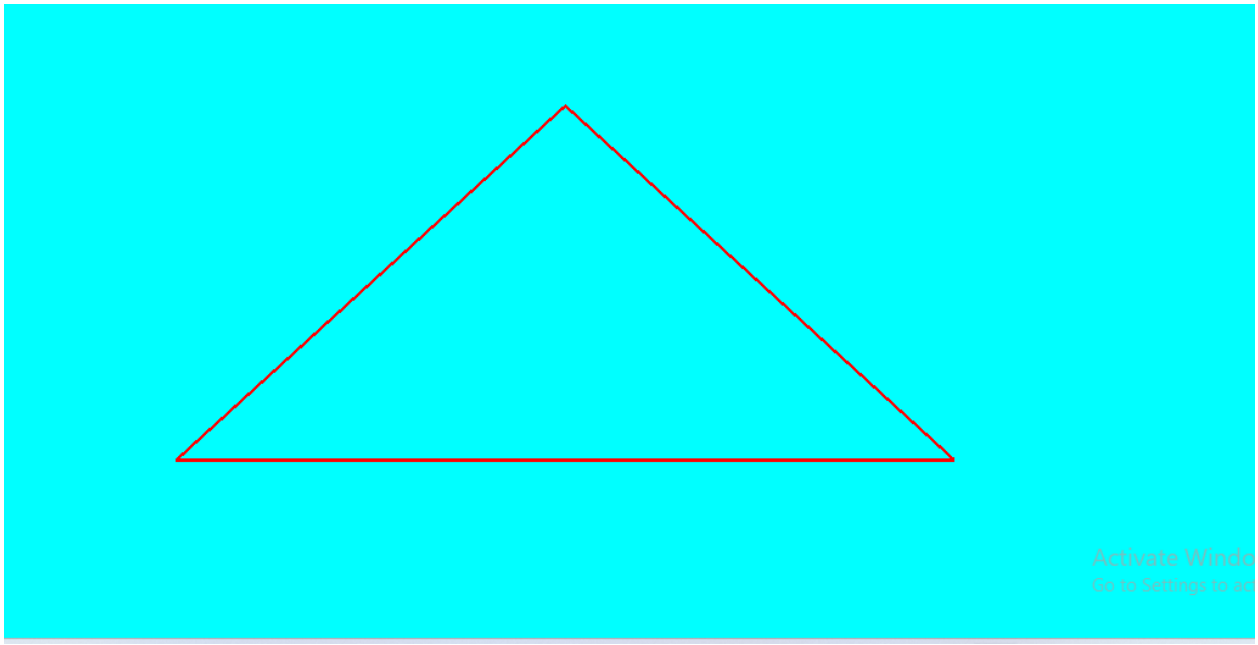
1) boundary fill algorithm implementaion using traingle drawing.txt

```
#include<windows.h>
#include <iostream>
#include <math.h>
#include <time.h>
#include <GL/glut.h>

using namespace std;

void delay(float ms){
   clock_t goal = ms + clock();
   while(goal>clock());
}

void init(){
   glClearColor(0.0,1.0,1.0,0.0);
   glMatrixMode(GL_PROJECTION);
   gluOrtho2D(0,640,0,480);
}

void bound_it(int x, int y, float* fillColor, float* bc){
   float color[3];
   glReadPixels(x,y,1.0,1.0,GL_RGB,GL_FLOAT,color);
   if((color[0]!=bc[0] || color[1]!=bc[1] || color[2]!=bc[2])&&(
    color[0]!=fillColor[0] || color[1]!=fillColor[1] || color[2]!=fillColor[2])){
      glColor3f(fillColor[0],fillColor[1],fillColor[2]);
      glBegin(GL_POINTS);
         glVertex2i(x,y);
      glEnd();
      glFlush();
      bound_it(x+1,y,fillColor,bc);
      bound_it(x-2,y,fillColor,bc);
      bound_it(x,y+2,fillColor,bc);
      bound_it(x,y-2,fillColor,bc);
   }
}
```

```
void mouse(int btn, int state, int x, int y){
   y = 480-y;
   if(btn==GLUT_LEFT_BUTTON)
   {
      if(state==GLUT_DOWN)
      {
         float bCol[] = {1,0,0};
         float color[] = {0,0,1};
         //glReadPixels(x,y,1.0,1.0,GL_RGB,GL_FLOAT,intCol);
         bound_it(x,y,color,bCol);
      }
   }
}

void world(){
   glLineWidth(3);
   glPointSize(2);
   glClear(GL_COLOR_BUFFER_BIT);
   glColor3f(1,0,0);
   glBegin(GL_LINE_LOOP);
      glVertex2i(150,100);
      glVertex2i(300,300);
      glVertex2i(450,100);
   glEnd();
   glFlush();
}

int main(int argc, char** argv){
   glutInit(&argc, argv);
   glutInitDisplayMode(GLUT_SINGLE|GLUT_RGB);
   glutInitWindowSize(640,480);
   glutInitWindowPosition(200,200);
   glutCreateWindow("Boundary Fill Algorithm Implementation");
   glutDisplayFunc(world);
   glutMouseFunc(mouse);
   init();
```

```
    glutMainLoop();
    return 0;
}
```



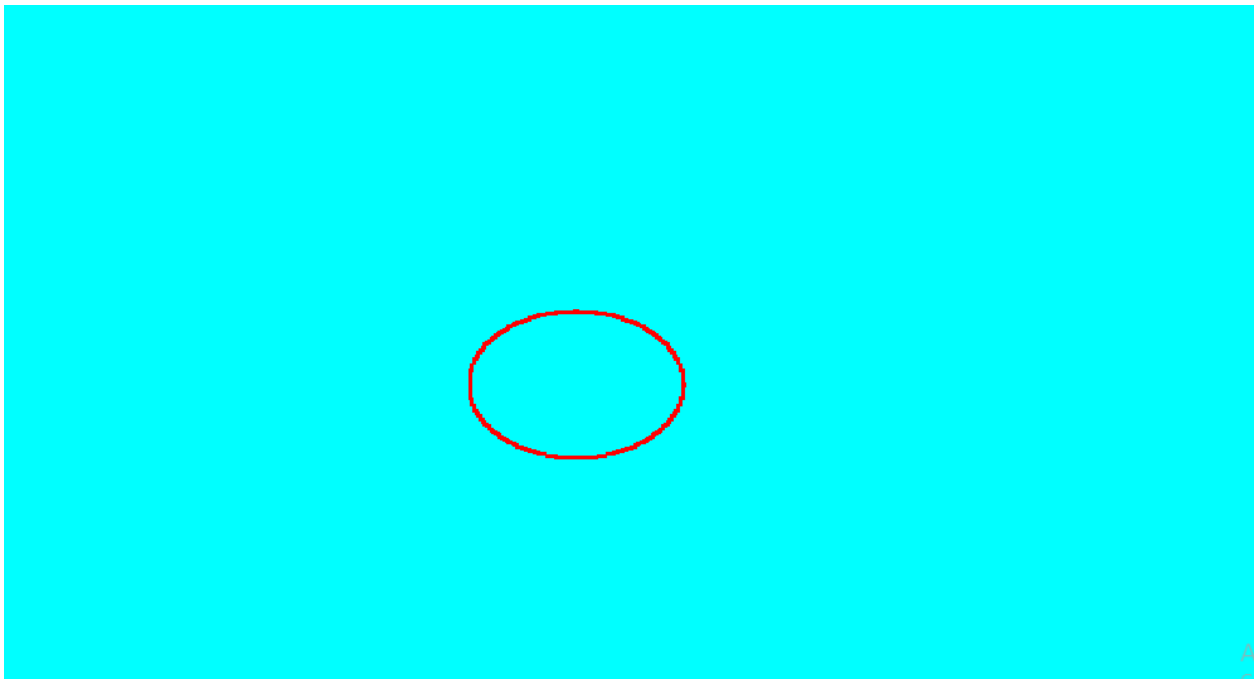
2)boundary fill circle.txt

```
#include <windows.h>
#include <bits/stdc++.h>
#include <math.h>
#include <gl/glut.h>

struct Point {
        GLint x;
        GLint y;
};

struct Color {
        GLfloat  r;
        GLfloat g;
        GLfloat b;
};
```

```
void init() {
	glClearColor(0.0, 1.0, 1.0, 0.0);
	glColor3f(1.0, 0.0, 0.0);
	glPointSize(3.0);
	glMatrixMode(GL_PROJECTION);
	glLoadIdentity();
	gluOrtho2D(0, 800, 0, 600);
}

Color getPixelColor(GLint x, GLint y) {
	Color color;
	glReadPixels(x, y, 1, 1, GL_RGB, GL_FLOAT, &color);
	return color;
}

void setPixelColor(GLint x, GLint y, Color color) {
	glColor3f(color.g, color.r, color.b);
	glBegin(GL_POINTS);
	glVertex2i(x, y);
	glEnd();
	glFlush();

}

void BoundaryFill(int x, int y, Color fillColor, Color boundaryColor) {
	Color currentColor = getPixelColor(x, y);
	if(currentColor.r != boundaryColor.r && currentColor.g !=
boundaryColor.g && currentColor.b != boundaryColor.b) {
		setPixelColor(x, y,  fillColor);
		BoundaryFill(x+1, y, fillColor, boundaryColor);
		BoundaryFill(x-1, y, fillColor, boundaryColor);
		BoundaryFill(x, y+1, fillColor, boundaryColor);
		BoundaryFill(x, y-1, fillColor, boundaryColor);
	}
}

void onMouseClick(int button, int state, int x, int y)
```

```
{
	Color fillColor = {1.0f, 0.0f, 0.0f};		// red color will be filled
	Color boundaryColor = {0.0f, 0.0f, 0.0f}; // black- boundary

	Point p = {321, 241}; // a point inside the circle

	BoundaryFill(p.x, p.y, fillColor, boundaryColor);
}

void draw_circle(Point pC, GLfloat radius) {
	GLfloat step = 1/radius;
	GLfloat x, y;

	for(GLfloat theta = 0; theta <= 360; theta += step) {
		x = pC.x + (radius * cos(theta));
		y = pC.y + (radius * sin(theta));
		glVertex2i(x, y);
	}
}

void display(void) {
	Point pt = {320, 240};
	GLfloat radius = 20;

	glClear(GL_COLOR_BUFFER_BIT);
	glBegin(GL_POINTS);
		draw_circle(pt, 50);
	glEnd();
	glFlush();
}

int main(int argc, char** argv)
{
	glutInit(&argc, argv);
	glutInitDisplayMode(GLUT_SINGLE|GLUT_RGB);
	glutInitWindowSize(800, 600);
	glutInitWindowPosition(200, 200);
```

```
        glutCreateWindow("Boundary Fill Circle");
        init();
        glutDisplayFunc(display);
        glutMouseFunc(onMouseClick);
        glutMainLoop();
        return 0;
}
```



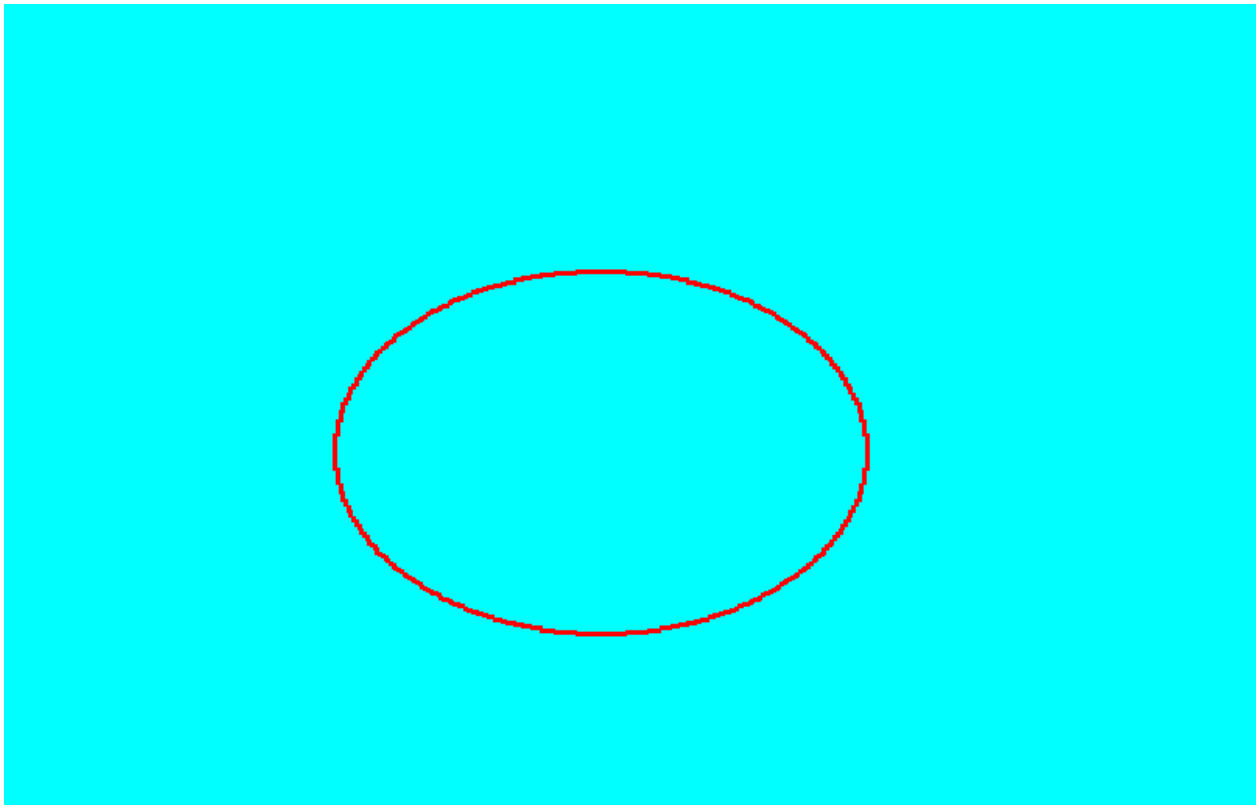
3)bresenhams circle drawing.txt

```
#include<windows.h>
#include<stdio.h>
#include<math.h>
#include<GL/glut.h>

// Center of the circle = (320, 240)
int xc = 320, yc = 240;

// Plot eight points using circle's symmetrical property
void plot_point(int x, int y)
{
```

```
  glBegin(GL_POINTS);
  glVertex2i(xc+x, yc+y);
  glVertex2i(xc+x, yc-y);
  glVertex2i(xc+y, yc+x);
  glVertex2i(xc+y, yc-x);
  glVertex2i(xc-x, yc-y);
  glVertex2i(xc-y, yc-x);
  glVertex2i(xc-x, yc+y);
  glVertex2i(xc-y, yc+x);
  glEnd();
}

// Function to draw a circle using bresenham's
// circle drawing algorithm
void bresenham_circle(int r)
{
  int x=0,y=r;
  float pk=(5.0/4.0)-r;

  /* Plot the points */
  /* Plot the first point */
  plot_point(x,y);
//  int k;
  /* Find all vertices till x=y */
  while(x < y)
  {
    x = x + 1;
    if(pk < 0)
      pk = pk + 2*x+1;
    else
    {
      y = y - 1;
      pk = pk + 2*(x - y) + 1;
    }
    plot_point(x,y);
  }
  glFlush();
```

```
}

// Function to draw two concentric circles
void concentric_circles(void)
{
  //Clears buffers to preset values
  glClear(GL_COLOR_BUFFER_BIT);
  int radius = 100;
  bresenham_circle(radius);

}

void Init()
{
    glClearColor(0.0,1.0,1.0,0.0); //clear values for RGBA
    glColor3f(1.0f,0.0f,0.0f); //set current color - RGB
    glPointSize(3.0); //diameters of rasterized points
    glMatrixMode(GL_PROJECTION); // specifies current matrix
    glLoadIdentity();
    gluOrtho2D(0.0,800.0,0.0,600.0);
}

int main(int argc, char **argv)
{
  /* Initialise GLUT library */
  glutInit(&argc,argv);
  glutInitDisplayMode(GLUT_SINGLE | GLUT_RGB); //Set the initial display
mode
  glutInitWindowPosition(0,0);
  glutInitWindowSize(800,600);
  glutCreateWindow("Bresenham Circle Drawing");
  /* Initialize drawing colors */
  Init();
  /* Call the displaying function */
  glutDisplayFunc(concentric_circles);
  /* Keep displaying untill the program is closed */
  glutMainLoop();
```

```
}
```

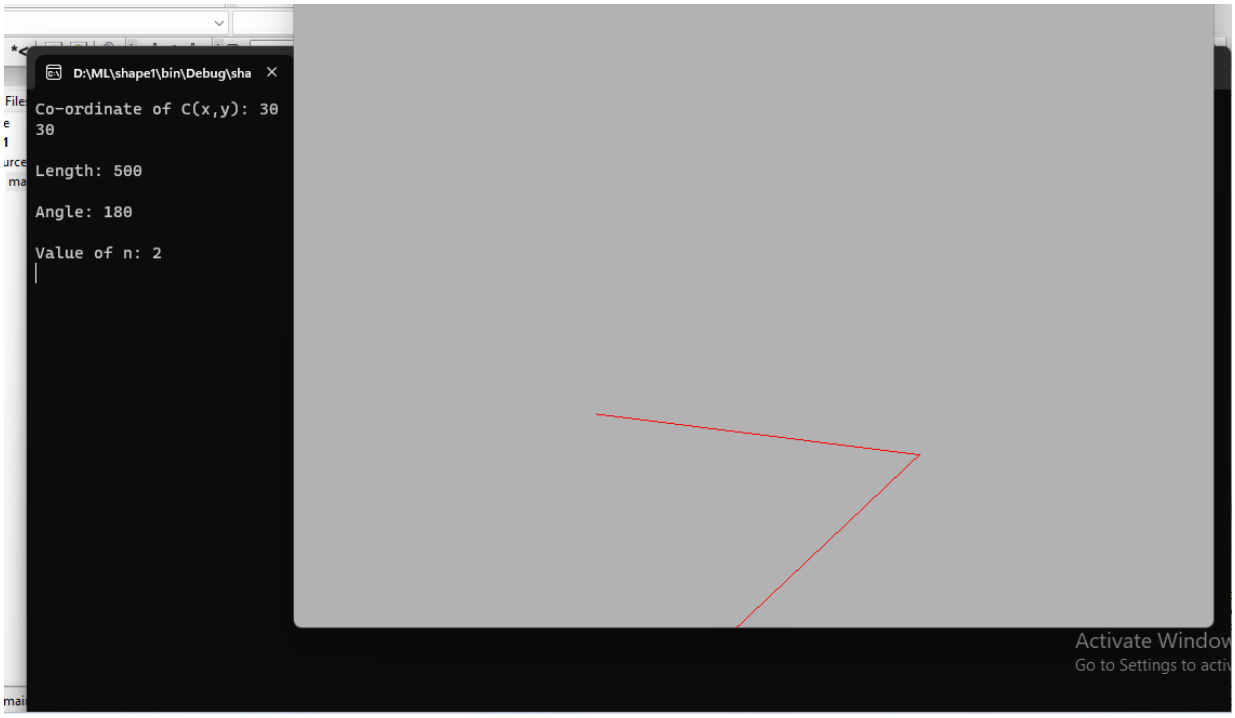


4)C curve.txt

```
#include<windows.h>
#include<GL/glut.h>
#include<bits/stdc++.h>
using namespace std;
float x, y, len, alpha;
int n;

void line (float x1, float y1, float x2, float y2)
{
   glVertex2f(x1,y1);
   glVertex2f(x2,y2);
}

void c_curve (float x, float y, float len, float alpha, int n)
{
```

```
    if(n > 0){
        len = len / sqrt(2.0);
        c_curve(x, y, len, alpha+45, n-1);

        x += len*cos(alpha+45);
        y += len*sin(alpha+45);
        c_curve(x, y, len, alpha-45, n-1);
    }
    else{
        line(x, y, x+len*cos(alpha), y+len*sin(alpha));
    }
}

void myDisplay(void)
{
          glClear(GL_COLOR_BUFFER_BIT);
          glColor3f (1.0, 0.0, 0.0);
          glPointSize(1);
          glBegin(GL_LINES);
          c_curve(x, y, len, alpha, n);
          glEnd();
          glFlush ();
}

void init (void)
{
    glClear(GL_COLOR_BUFFER_BIT);
    glClearColor(0.7,0.7,0.7,0.7);
    glMatrixMode(GL_PROJECTION);
    glLoadIdentity();
    gluOrtho2D(-200,500,-200,500);
}

int main(int argc, char** argv)
{
    cout<<"Co-ordinate of C(x,y): ";
    cin>>x>>y;
```

```
    cout<<"\nLength: ";
    cin>>len;
    cout<<"\nAngle: ";
    cin>>alpha;
    cout<<"\nValue of n: ";
    cin>>n;

    glutInit(&argc, argv);
    glutInitDisplayMode(GLUT_SINGLE | GLUT_RGB);
    glutInitWindowSize(850, 600);
    glutInitWindowPosition(100, 50);
    glutCreateWindow("C CURVE");
    init();
    glutDisplayFunc(myDisplay);
    glutMainLoop();

    return 0;
}
```



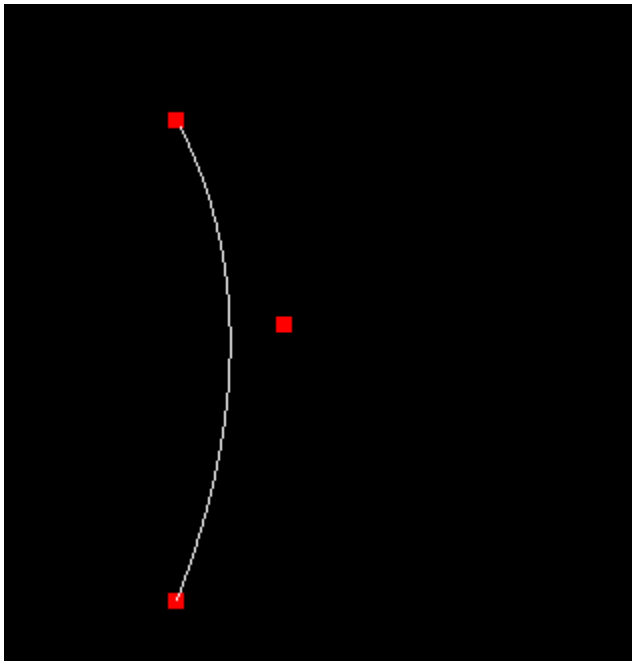
5)cubic bezier curve.txt

```
#include <windows.h>
#include <GL/glut.h>
#include <math.h>
#include  <stdio.h>
#define CTRL_COUNT 100
int ctrlPointsCount;
int ctrlPointsX[CTRL_COUNT], ctrlPointsY[CTRL_COUNT];
int X1[3]={20,25,20}, Y1[3]={5,24,38};  //first point(x1[0],y1[0])
second(x1[1],y1[1]) third(x1[2],y1[2])

void myInit()
{
glClearColor(0.0,0.0,0.0,0.0);
glColor3f(1.0,0.0,0.0);
glPointSize(8.0);
glMatrixMode(GL_PROJECTION);
glLoadIdentity();
gluOrtho2D(0.0,128.0,0.0,96.0);
}
//p(t)=(1-t)^3*p0+3t(1-t)^2*p1+3t^2(1-t)p2+t^3p3
float getNextBezierPointX(float t)
{
float x=0.0;

for(int i=0; i<ctrlPointsCount; i++)
{
int c;
if(i==0 || i==ctrlPointsCount-1)
   c = 1;
else
{
   c = ctrlPointsCount-1;
}
x +=  c * pow(t, i) * pow(1-t, ctrlPointsCount-1-i) * ctrlPointsX[i];
}
```

```
return x;
}

float getNextBezierPointY(float t)
{
float y=0.0;

for(int i=0; i<ctrlPointsCount; i++)
{
int c;
if(i==0 || i==ctrlPointsCount-1)
   c = 1;
else
{
   c = ctrlPointsCount-1;
}
y +=  c * pow(t, i) * pow(1-t, ctrlPointsCount-1-i) * ctrlPointsY[i];
}
return y;
}

void drawline()
{
// draw control points using red color
for(int i=0; i < 3; i++)
{
glBegin(GL_POINTS);
glVertex2i(ctrlPointsX[i], ctrlPointsY[i]);
glEnd();
glFlush();
}
// draw bezier curve using control points by calculating next points using
cubic bezier curve formula
float oldX=ctrlPointsX[0], oldY=ctrlPointsY[0];
for(double t = 0.0;t <= 1.0; t += 0.01) {
```

```
float x = getNextBezierPointX(t);
float y = getNextBezierPointY(t);
//glColor3f(1.0,t,1.0);
glColor3f(1.0,1.0,1.0);
glBegin(GL_LINES);
glVertex2f(oldX, oldY);
glVertex2f(x, y);
glEnd();
glFlush();

oldX = x;
oldY = y;
}
}

void myDisplay()
{
glClear(GL_COLOR_BUFFER_BIT);
glColor3f(1.0,0.0,0.0);
ctrlPointsCount=3;
for(int i=0;i<3;i++)
{
ctrlPointsX[i] = X1[i];
ctrlPointsY[i] = Y1[i];
}
drawline();

glFlush();
}


int main(int argc, char *argv[])
{

glutInit(&argc, argv);
glutInitDisplayMode(GLUT_SINGLE|GLUT_RGB);
```

```
glutInitWindowSize(640,480);
glutInitWindowPosition(100,150);
glutCreateWindow("Cubic Bezier Curve");
glutDisplayFunc(myDisplay);
myInit();
glutMainLoop();
return 0;
}
```



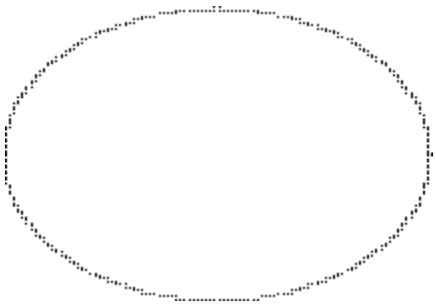
6)Flood fill circle algorithm.txt

```
#include <windows.h>
#include <bits/stdc++.h>
#include <math.h>
#include <gl/glut.h>

struct Point {
        GLint x;
        GLint y;
};

struct Color {
```

```
        GLfloat  r;
        GLfloat g;
        GLfloat b;
};

void init() {
        glClearColor(1.0, 1.0, 1.0, 0.0);
        glColor3f(0.0, 0.0, 0.0);
        glPointSize(1.0);
        glMatrixMode(GL_PROJECTION);
        glLoadIdentity();
        gluOrtho2D(0, 640, 0, 480);
}

Color getPixelColor(GLint x, GLint y) {
        Color color;
        glReadPixels(x, y, 1, 1, GL_RGB, GL_FLOAT, &color);
        return color;
}

void setPixelColor(GLint x, GLint y, Color color) {
        glColor3f(color.r, color.g, color.b);
        glBegin(GL_POINTS);
        glVertex2i(x, y);
        glEnd();
        glFlush();
}

void floodFill(GLint x, GLint y, Color oldColor, Color newColor) {
        Color color;
        color = getPixelColor(x, y);

        if(color.r == oldColor.r && color.g == oldColor.g && color.b ==
oldColor.b)
        {
                setPixelColor(x, y, newColor);
                floodFill(x+1, y, oldColor, newColor);
```

```
            floodFill(x, y+1, oldColor, newColor);
            floodFill(x-1, y, oldColor, newColor);
            floodFill(x, y-1, oldColor, newColor);
        }
        return;
}

void onMouseClick(int button, int state, int x, int y)
{
        Color newColor = {1.0f, 0.0f, 0.0f};
        Color oldColor = {1.0f, 1.0f, 1.0f};

        floodFill(320, 240, oldColor, newColor);
}

void draw_circle(Point pC, GLfloat radius) {
        GLfloat step = 1/radius;
        GLfloat x, y;

        for(GLfloat theta = 0; theta <= 360; theta += step) {
            x = pC.x + (radius * cos(theta));
            y = pC.y + (radius * sin(theta));
            glVertex2i(x, y);
        }
}

void display(void) {
        Point pt = {320, 240};
        GLfloat radius = 50;

        glClear(GL_COLOR_BUFFER_BIT);
        glBegin(GL_POINTS);
            draw_circle(pt, radius);
        glEnd();
        glFlush();
}
```

```
int main(int argc, char** argv)
{
	glutInit(&argc, argv);
	glutInitDisplayMode(GLUT_SINGLE|GLUT_RGB);
	glutInitWindowSize(640, 480);
	glutInitWindowPosition(200, 200);
	glutCreateWindow("Flood Fill Circle");
	init();
	glutDisplayFunc(display);
	glutMouseFunc(onMouseClick);
	glutMainLoop();
	return 0;
}
```



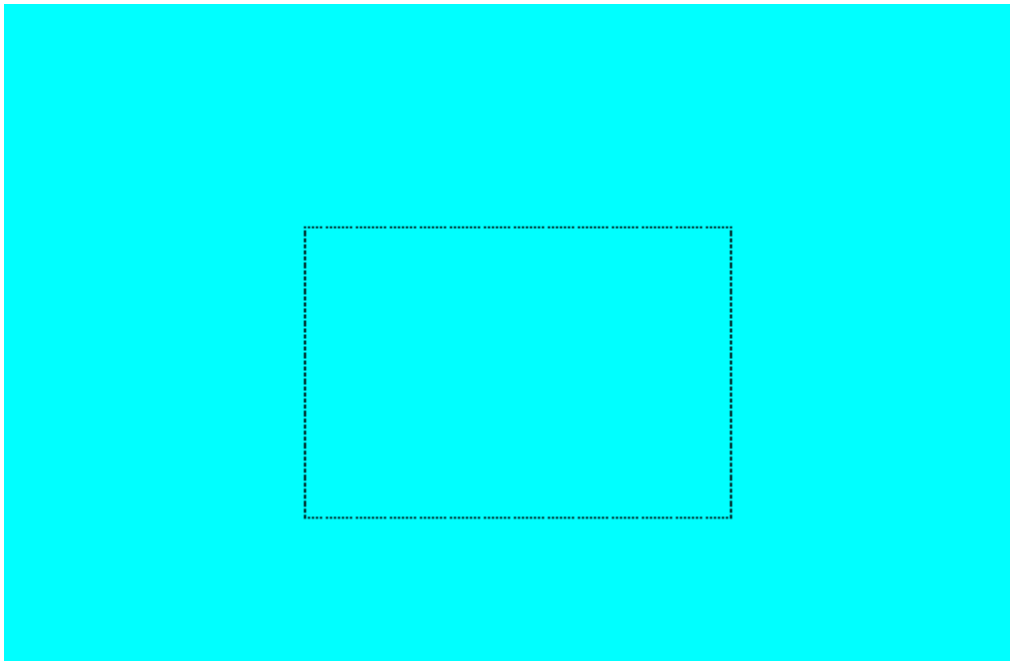
7)Flood fill sqaure.txt

```
#include <windows.h>
#include <bits/stdc++.h>
#include <math.h>
#include <gl/glut.h>

struct Point {
	GLint x;
	GLint y;
};
```

```
struct Color {
	GLfloat  r;
	GLfloat g;
	GLfloat b;
};

void draw_dda(Point p1, Point p2) {
	GLfloat dx = p2.x - p1.x;
	GLfloat dy = p2.y - p1.y;

	GLfloat x1 = p1.x;
	GLfloat y1 = p1.y;

	GLfloat step = 0;

	if(abs(dx) > abs(dy)) {
		step = abs(dx);
	} else {
		step = abs(dy);
	}

	GLfloat xInc = dx/step;
	GLfloat yInc = dy/step;

	for(float i = 1; i <= step; i++) {
		glVertex2i(x1, y1);
		x1 += xInc;
		y1 += yInc;
	}
}

void init() {
	glClearColor(0.0, 1.0, 1.0, 0.0);
	glColor3f(0.0, 0.0, 0.0);
	glPointSize(1.0);
	glMatrixMode(GL_PROJECTION);
	glLoadIdentity();
```

```
        gluOrtho2D(0, 640, 0, 480);
}

Color getPixelColor(GLint x, GLint y) {
        Color color;
        glReadPixels(x, y, 1, 1, GL_RGB, GL_FLOAT, &color);
        return color;
}

void setPixelColor(GLint x, GLint y, Color color) {
        glColor3f(color.r, color.g, color.b);
        glBegin(GL_POINTS);
                glVertex2i(x, y);
        glEnd();
        glFlush();
}

void floodFill(GLint x, GLint y, Color oldColor, Color newColor) {
        Color color;
        color = getPixelColor(x, y);

        if(color.r == oldColor.r && color.g == oldColor.g && color.b ==
oldColor.b)
        {
                setPixelColor(x, y, newColor);
                floodFill(x+1, y, oldColor, newColor);
                floodFill(x, y+1, oldColor, newColor);
                floodFill(x-1, y, oldColor, newColor);
                floodFill(x, y-1, oldColor, newColor);
        }
        return;
}

void onMouseClick(int button, int state, int x, int y)
{
        Color newColor = {1.0f, 0.0f, 0.0f};
        Color oldColor = {0.0f, 1.0f, 1.0f};
```

```
        floodFill(101, 199, oldColor, newColor);
}

void display(void) {
        Point p1 = {100, 100}, // bottom-right
              p2 = {200, 100}, // bottom-left
              p3 = {200, 200}, // top-right
              p4 = {100, 200}; // top-left

        glClear(GL_COLOR_BUFFER_BIT);
        glBegin(GL_POINTS);
              draw_dda(p1, p2);
              draw_dda(p2, p3);
              draw_dda(p3, p4);
              draw_dda(p4, p1);
        glEnd();
        glFlush();
}

int main(int argc, char** argv)
{
        glutInit(&argc, argv);
        glutInitDisplayMode(GLUT_SINGLE|GLUT_RGB);
        glutInitWindowSize(640, 480);
        glutInitWindowPosition(200, 200);
        glutCreateWindow("Flood Fill Square");
        init();
        glutDisplayFunc(display);
        glutMouseFunc(onMouseClick);
        glutMainLoop();
        return 0;
}
```



8)Implement Cohen Sutherland polygon clipping method to clip the polygon with respect the.txt

```
/*Problem Statement :
Implement Cohen Sutherland polygon clipping method to clip the polygon with respect the
viewport and window. Use mouse click, keyboard interface */

#include<windows.h>
#include <stdio.h>
#include<iostream>
#include<GL/glut.h>
#include<math.h>
#include<bits/stdc++.h>

using namespace std ;
int result;
int xmin, ymin, xmax, ymax, pt[30][2], w[30][2],n=0,flg=0;

int leftClip(int limit, int xm)
```

```
{
    int i, j = 0, x1, y1, x2, y2;
    float m;
    for (i = 0; i < limit; i++)
    {
        x1 = pt[i][0];
        y1 = pt[i][1];
        x2 = pt[(i + 1) % limit][0];
        y2 = pt[(i + 1) % limit][1];
        if (x2 - x1)
            m = (y2 - y1) * 1.0 / (x2 - x1);

        if (x1 < xm && x2 < xm)
            continue;
        if (x1 > xm && x2 > xm)
        {
            w[j][0] = x2;
            w[j++][1] = y2;
            continue;
        }
        if (x1 > xm && x2 < xm)
        {
            w[j][0] = xm;
            w[j++][1] = y1 + m * (xm - x1);
            continue;
        }
        if (x1 < xm && x2 > xm)
        {
            w[j][0] = xm;
            w[j++][1] = y1 + m * (xm - x1);
            w[j][0] = x2;
            w[j++][1] = y2;
        }
    }

    for (i = 0; i < j; i++)
    {
```

```
        pt[i][0] = w[i][0];
        pt[i][1] = w[i][1];
        w[i][0] = w[i][1] = 0;
    }

    if (j < limit)
        for (; i < limit; i++)
            pt[i][0] = pt[i][1] = 0;

    return j;
}

int topClip(int limit, int ym)
{
    int i, j = 0, x1, y1, x2, y2;
    float m;
    for (i = 0; i < limit; i++)
    {
        x1 = pt[i][0];
        y1 = pt[i][1];
        x2 = pt[(i + 1) % limit][0];
        y2 = pt[(i + 1) % limit][1];
        if (x2 - x1)
            m = (y2 - y1) * 1.0 / (x2 - x1);

        if (y1 < ym && y2 < ym)
            continue;
        if (y1 > ym && y2 > ym)
        {
            w[j][0] = x2;
            w[j++][1] = y2;
            continue;
        }
        if (y1 > ym && y2 < ym)
        {
            w[j][0] = x1 + (ym - y1) / m;
            w[j++][1] = ym;
```

```
            continue;
        }
        if (y1 < ym && y2 > ym)
        {
            w[j][0] = x1 + (ym - y1) / m;
            w[j++][1] = ym;
            w[j][0] = x2;
            w[j++][1] = y2;
        }
    }

    for (i = 0; i < j; i++)
    {
        pt[i][0] = w[i][0];
        pt[i][1] = w[i][1];
        w[i][0] = w[i][1] = 0;
    }

    if (j < limit)
        for (; i < limit; i++)
            pt[i][0] = pt[i][1] = 0;

    return j;
}

int rightClip(int limit, int xm)
{
    int i, j = 0, x1, y1, x2, y2;
    float m;
    for (i = 0; i < limit; i++)
    {
        x1 = pt[i][0];
        y1 = pt[i][1];
        x2 = pt[(i + 1) % limit][0];
        y2 = pt[(i + 1) % limit][1];
        if (x2 - x1)
            m = (y2 - y1) * 1.0 / (x2 - x1);
```

```
        if (x1 > xm && x2 > xm)
            continue;
        if (x1 < xm && x2 < xm)
        {
            w[j][0] = x2;
            w[j++][1] = y2;
            continue;
        }
        if (x1 < xm && x2 > xm)
        {
            w[j][0] = xm;
            w[j++][1] = y1 + m * (xm - x1);
            continue;
        }
        if (x1 > xm && x2 < xm)
        {
            w[j][0] = xm;
            w[j++][1] = y1 + m * (xm - x1);
            w[j][0] = x2;
            w[j++][1] = y2;
        }
    }

    for (i = 0; i < j; i++)
    {
        pt[i][0] = w[i][0];
        pt[i][1] = w[i][1];
        w[i][0] = w[i][1] = 0;
    }

    if (j < limit)
        for (; i < limit; i++)
            pt[i][0] = pt[i][1] = 0;

    return j;
}
```

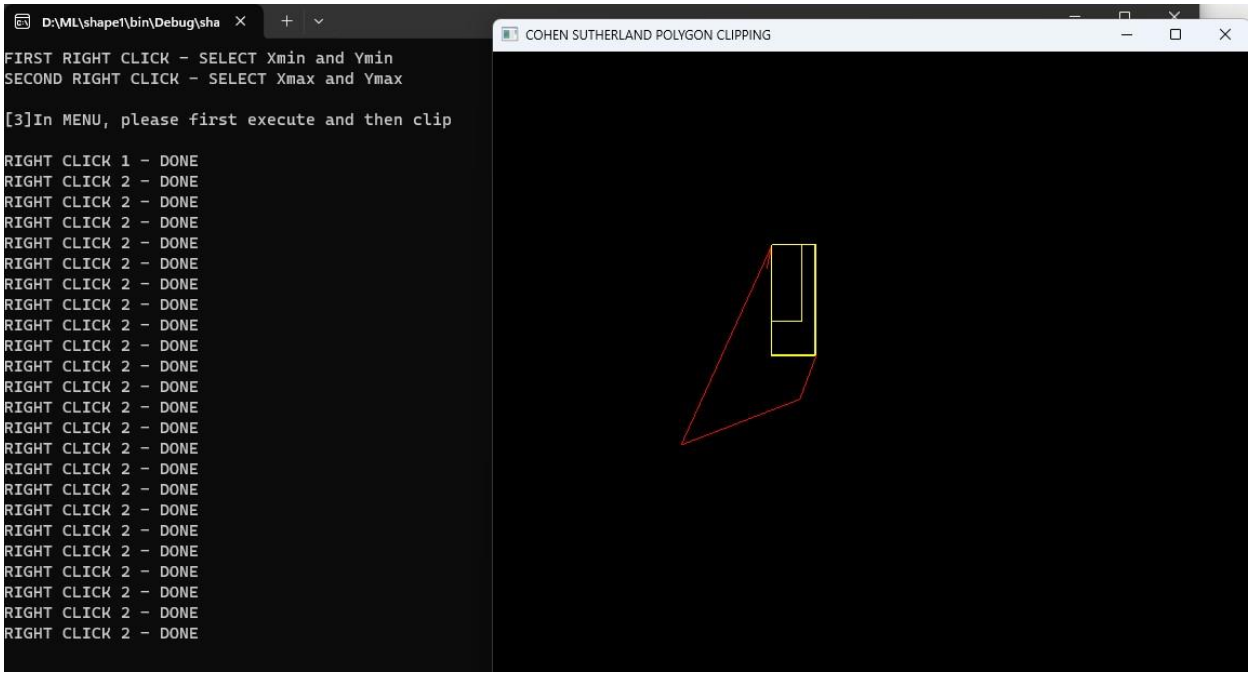
```
int bottomClip(int limit, int ym)
{
    int i, j = 0, x1, y1, x2, y2;
    float m;
    for (i = 0; i < limit; i++)
    {
        x1 = pt[i][0];
        y1 = pt[i][1];
        x2 = pt[(i + 1) % limit][0];
        y2 = pt[(i + 1) % limit][1];
        if (x2 - x1)
            m = (y2 - y1) * 1.0 / (x2 - x1);

        if (y1 > ym && y2 > ym)
            continue;
        if (y1 < ym && y2 < ym)
        {
            w[j][0] = x2;
            w[j++][1] = y2;
            continue;
        }
        if (y1 < ym && y2 > ym)
        {
            w[j][0] = x1 + (ym - y1) / m;
            w[j++][1] = ym;
            continue;
        }
        if (y1 > ym && y2 < ym)
        {
            w[j][0] = x1 + (ym - y1) / m;
            w[j++][1] = ym;
            w[j][0] = x2;
            w[j++][1] = y2;
        }
    }
```

```
    for (i = 0; i < j; i++)
    {
        pt[i][0] = w[i][0];
        pt[i][1] = w[i][1];
        w[i][0] = w[i][1] = 0;
    }

    if (j < limit)
        for (; i < limit; i++)
            pt[i][0] = pt[i][1] = 0;

    return j;
}

void display(void)
{
}

void init()
{
    glClearColor(0.0,0.0,0.0,0.0);
    glClear (GL_COLOR_BUFFER_BIT);
    glClear(GL_COLOR_BUFFER_BIT);
    glColor3f(1.0,0.0,0.0);
    glPointSize(2.0);
    glMatrixMode(GL_PROJECTION);
    glLoadIdentity();
    gluOrtho2D(0,700,0,700) ;
}


void menu(int c)
{
    if(c==1)
    {
        result = leftClip(n, xmin);
        result = topClip(result, ymin);
```

```
        result = rightClip(result, xmax);
        result = bottomClip(result, ymax);
    }
    if(c==2)
    {
        glClear(GL_COLOR_BUFFER_BIT);
        glColor3f(0.0,0.0,0.0);
        glBegin(GL_POINTS);
        glVertex2i(0,0);
        glEnd();
        glFlush();
        glColor3f(1.0,1.0,0.0);
        glBegin(GL_LINE_LOOP);
        glVertex2i(xmin,ymin);
        glVertex2i(xmax,ymin);
        glVertex2i(xmax,ymax);
        glVertex2i(xmin,ymax);
        glEnd();
        glFlush();
        for (int i = 0; i < result; i++)
        {
            glColor3f(0.0,0.0,1.0);
            glBegin(GL_LINE_STRIP);
            glVertex2i(pt[i][0],pt[i][1]);
            glVertex2i(pt[(i+1)%result][0],pt[(i+1)%result][1]);
            glEnd();
            glFlush();
        }
    }

}

void mouse(int button, int state, int cx, int cy )
{
    if(state==GLUT_DOWN)
    {
        if(button==GLUT_LEFT_BUTTON)
```

```
{
   pt[n][0] = cx ;
   pt[n][1] = 700-cy ;
   n++;
   if(n>1)
   {
      glColor3f(1.0,0.0,0.0);
      glBegin(GL_LINE_STRIP);
      glVertex2i(pt[n-2][0],pt[n-2][1]);
      glVertex2i(pt[n-1][0],pt[n-1][1]);
      glEnd();
      glFlush();
   }
}
if(button==GLUT_RIGHT_BUTTON)
{
   if(flg==0)
   {
      cout<<"RIGHT CLICK 1 - DONE"<<endl;
      xmin=cx;
      ymin=700-cy;
      flg++;
   }
   else
   {
      cout<<"RIGHT CLICK 2 - DONE"<<endl;
      xmax=cx;
      ymax=700-cy;
      glColor3f(1.0,1.0,0.0);
      glBegin(GL_LINE_LOOP);
      glVertex2i(xmin,ymin);
      glVertex2i(xmax,ymin);
      glVertex2i(xmax,ymax);
      glVertex2i(xmin,ymax);
      glEnd();
      glFlush();
   }
```

```
      }
   }
}

int main(int argc, char *argv[])
{
   glutInit(&argc,argv);
   glutInitWindowSize(700,700);
   glutInitWindowPosition(500,50);
   glutCreateWindow(" COHEN SUTHERLAND POLYGON CLIPPING ");
   cout<<"PLEASE FOLLOW THESE STEPS:"<<endl;
   cout<<"[1] MAKE POLYGON by USING LEFT BUTTON CLICK"<<endl;
   cout<<"[2] SELECT WINDOW COORDINATES by USING RIGHT BUTTON
CLICK: where"<<endl;
   cout<<"FIRST RIGHT CLICK - SELECT Xmin and Ymin"<<endl;
   cout<<"SECOND RIGHT CLICK - SELECT Xmax and Ymax"<<endl<<endl;
   cout<<"[3]In MENU, please first execute and then clip"<<endl<<endl;
   init();

   glutMouseFunc(mouse);
   glutDisplayFunc(display);
   glutCreateMenu(menu);
   glutAddMenuEntry("EXECUTE",1);
   glutAddMenuEntry("SHOW CLIPPED",2);
   glutAttachMenu(GLUT_MIDDLE_BUTTON);

   glutMainLoop();
   return 0;

}
```



9)Implement following 2D transformations on the object with respect to axis.txt

/*Problem Statement :
Implement following 2D transformations on the object with respect to axis :
i) Scaling
ii) Rotation about arbitrary point
iii) Reflection
iv) Translation */

```
#include<windows.h>
#include<iostream>
#include<GL/glut.h>
#include<math.h>
#include<bits/stdc++.h>

using namespace std ;

int m[20][3], n = 0 ;
```

```
void setpixel(GLint x, GLint y)
{
   glColor3f(0.0,0.0,1.0);
   glBegin(GL_POINTS);
   glVertex2f(x,y);
   glEnd();
   glFlush();
}

void choice()
{
   int  i;
   glPointSize(2.0);
   for(i=-700; i<700; i++)
   {
      setpixel(0,i);
      setpixel(i,0);
   }
}

void setpcolor(double r1, double b1, double g1 )
{
   glColor3f(r1,b1,g1);
}

void conect(int x, int y, int px, int py)
{
   glPointSize(2);
   glBegin(GL_LINE_STRIP);
   glVertex2i(x,y);
   glVertex2i(px,py);
   glEnd();
   glFlush();
}

void translation(int tx,int ty)
{
```

```
   int tm[3][3] = {{1,0,tx},{0,1,ty},{0,0,1} },ne[3]= {} ;
   for(int i=0 ; i<n; i++)
   {
      ne [0]  = tm[0][0]*m[i][0] + tm[0][1]*m[i][1] + tm[0][2]*m[i][2] ;
      ne [1]  = tm[1][0]*m[i][0] + tm[1][1]*m[i][1] + tm[1][2]*m[i][2] ;
      ne [2]  = tm[2][0]*m[i][0] + tm[2][1]*m[i][1] + tm[2][2]*m[i][2] ;
      m[i][0] = ne[0] ;
      m[i][1] = ne[1] ;
      m[i][2] = ne[2] ;
   }
   for(int i=0 ; i<n; i++)
   {
      int ni = (i+1)%n;
      setpcolor(1,1,0) ;
      conect(m[i][0],m[i][1],m[ni][0],m[ni][1]) ;
   }


}

void rotation(double rot, int xm, int ym )
{
   double pi = 3.14159265 ;
   double rad = (pi/180.00) ;
   rad *= rot ;
   double rm[3][3] =
{{cos(rad),sin(rad),0},{-sin(rad),cos(rad),0},{-xm*cos(rad)+ym*sin(rad)+xm,-
xm*sin(rad)-ym*cos(rad)+ym,1} } ;
   int ne[3]= {};
   for(int i=0 ; i<n; i++)
   {
      ne [0]  = rm[0][0]*m[i][0] + rm[0][1]*m[i][1] + rm[0][2]*m[i][2] ;
      ne [1]  = rm[1][0]*m[i][0] + rm[1][1]*m[i][1] + rm[1][2]*m[i][2] ;
      ne [2]  = rm[2][0]*m[i][0] + rm[2][1]*m[i][1] + rm[2][2]*m[i][2] ;
      m[i][0] = ne[0] ;
      m[i][1] = ne[1] ;
      m[i][2] = ne[2] ;
```

```
    }
    for(int i=0 ; i<n; i++)
    {
        int ni = (i+1)%n;
        setpcolor(1,1,0);
        conect(m[i][0],m[i][1],m[ni][0],m[ni][1]) ;
    }
}


void scale(int sx, int sy )
{
    int sm[3][3] = {{sx,0,0},{0,sy,0},{0,0,1} } ;
    int ne[3]= {} ;
    for(int i=0 ; i<n; i++)
    {
        ne [0]  = sm[0][0]*m[i][0] + sm[0][1]*m[i][1] + sm[0][2]*m[i][2] ;
        ne [1]  = sm[1][0]*m[i][0] + sm[1][1]*m[i][1] + sm[1][2]*m[i][2] ;
        ne [2]  = sm[2][0]*m[i][0] + sm[2][1]*m[i][1] + sm[2][2]*m[i][2] ;
        m[i][0] = ne[0] ;
        m[i][1] = ne[1] ;
        m[i][2] = ne[2] ;
    }
    for(int i=0 ; i<n; i++)
    {
        int ni = (i+1)%n;
        setpcolor(1,1,0) ;
        conect(m[i][0],m[i][1],m[ni][0],m[ni][1]) ;
    }
}

void reflect(char c)
{
    int sm[3][3] = {{1,0,0},{0,1,0},{0,0,1} } ;
    if(c=='x'||c=='X')
    {
        sm[1][1]=-1 ;
```

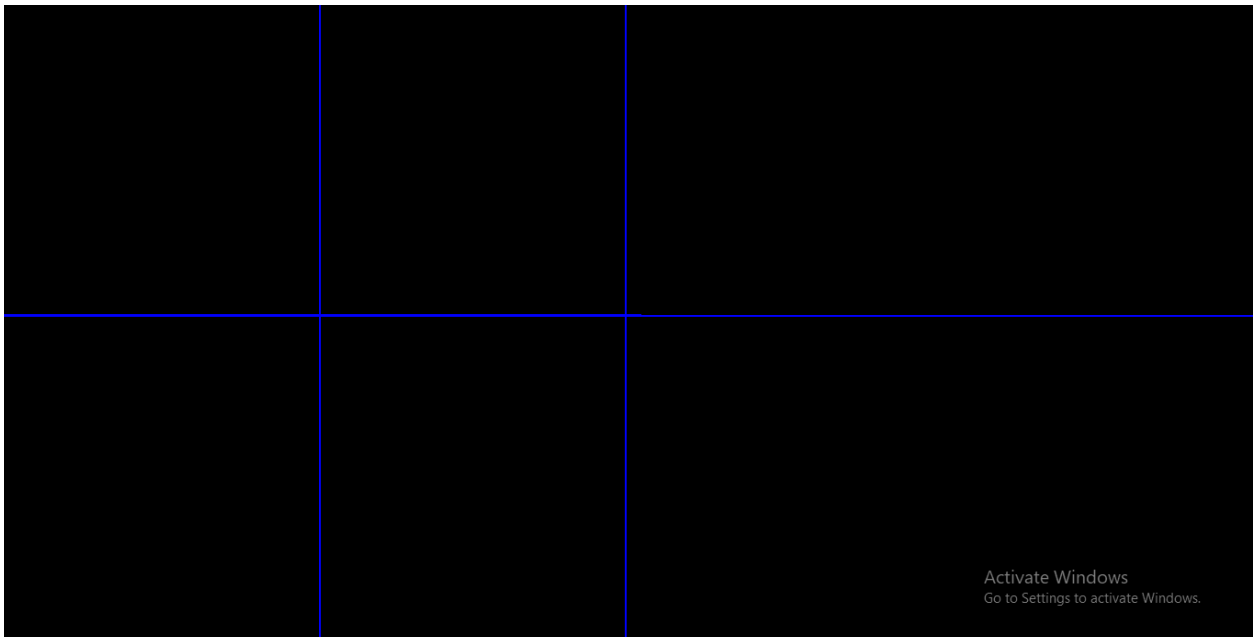
```
    }
    else
    {
        sm[0][0] = - 1 ;
    }
    int ne[3]= {} ;
    for(int i=0 ; i<n; i++)
    {
        ne [0]  = sm[0][0]*m[i][0] + sm[0][1]*m[i][1] + sm[0][2]*m[i][2] ;
        ne [1]  = sm[1][0]*m[i][0] + sm[1][1]*m[i][1] + sm[1][2]*m[i][2] ;
        ne [2]  = sm[2][0]*m[i][0] + sm[2][1]*m[i][1] + sm[2][2]*m[i][2] ;
        m[i][0] = ne[0] ;
        m[i][1] = ne[1] ;
        m[i][2] = ne[2] ;
    }
    for(int i=0 ; i<n; i++)
    {
        int ni = (i+1)%n;
        setpcolor(1,1,0) ;
        conect(m[i][0],m[i][1],m[ni][0],m[ni][1]) ;
    }
}


void init()
{
    glClearColor(0.0,0.0,0.0,0.0);
    glClear (GL_COLOR_BUFFER_BIT);
    glClear(GL_COLOR_BUFFER_BIT);
    glColor3f(1.0,0.0,0.0);
    glPointSize(2.0);
    glMatrixMode(GL_PROJECTION);
    glLoadIdentity();
    gluOrtho2D(-350,350,-350,350) ;
}
```

```
void menu(int c)
{
   for(int i=0 ; i<n; i++)
   {
      int ni = (i+1)%n;
      setpcolor(1,1,1) ;
      conect(m[i][0],m[i][1],m[ni][0],m[ni][1]) ;
   }
   glFlush() ;

   if (c==1)
   {
      for(int i=0; i<n; i++)
      {
         cout<<m[i][0]<<"  "<<m[i][1]<<endl;
      }
   }
   else if(c==2)
   {
      int tx = 0, ty = 0 ;
      cout <<"Enter x-translation factor :  " ;
      cin >> tx ;
      cout <<"Enter y-translation factor :  " ;
      cin >> ty ;
      translation(tx,ty) ;
   }
   else if(c==3)
   {
      double rot ;
      int flg = 1,ym,xm ;
      cout <<"Enter the arbitrary point x :" ;
      cin >> xm ;
      cout <<"Enter the arbitrary point y :" ;
      cin >> ym ;
      cout <<"Enter 1 for clockwise else enter 0 for anti-clock wise :  " ;
      cin >> flg ;
      cout <<"Enter by how much degree the object is to be rotated :  " ;
```

```
        cin >> rot ;
        if(flg)
        {
            rot = -rot ;
        }
        rotation(rot,xm,ym) ;
    }
    else if(c==4)
    {
        int sx = 1, sy = 1 ;
        cout <<"Enter the horizontal scaling factor :  " ;
        cin >> sx ;
        cout <<"Enter the vertical scaling factor :  " ;
        cin >> sy ;
        scale(sx,sy) ;
    }
    else if(c==5)
    {
        char c ;
        cout <<"Enter the axis of reflection :  (X | Y |)" ;
        cin >> c ;
        reflect(c) ;
    }

}

void mouse(int button, int state, int cx, int cy )
{
    cx -= 350 ;
    cy  -= 350 ;
    cy = - cy ;
    if(state==GLUT_DOWN)
    {
        if(button==GLUT_LEFT_BUTTON)
        {
            m[n][0] = cx ;
            m[n][1] = cy ;
```

```
            m[n][2] = 1 ;
            n++;
            if(n>1)
            {
               glColor3f(1.0,0.0,0.0);
               glBegin(GL_LINE_STRIP);
               glVertex2i(m[n-2][0],m[n-2][1]);
               glVertex2i(m[n-1][0],m[n-1][1]);
               glEnd();
               glFlush();
            }
         }
      }
}


int main(int argc, char *argv[])
{
   glutInit(&argc,argv);
   glutInitWindowSize(700,700);
   glutInitWindowPosition(500,50);
   glutCreateWindow(" 2D TRANSFORMATION ");
   cout<<"PLEASE FOLLOW THESE STEPS:"<<endl;
   cout<<"MAKE POLYGON by USING LEFT BUTTON CLICK"<<endl;
   cout<<"FOR MENU, use the RIGHT button of the mouse"<<endl;
   init();
   glutDisplayFunc(choice);

   glutMouseFunc(mouse);

   glutCreateMenu(menu);
   glutAddMenuEntry("DISPLAY AXES OF POLYGON",1);
   glutAddMenuEntry("TRANSLATION",2);
   glutAddMenuEntry("ROTATION",3);
   glutAddMenuEntry("SCALING",4);
   glutAddMenuEntry("REFLECTION",5);
```

```
    glutAttachMenu(GLUT_RIGHT_BUTTON);

    glutMainLoop();
    return 0;

}
```

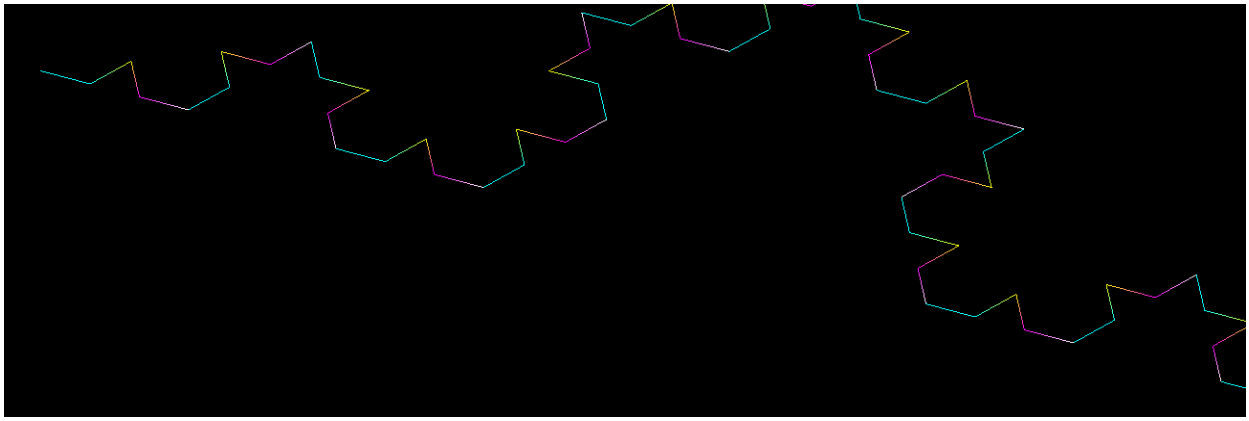


10)Koch curve.txt

```
#include<windows.h>
#include<iostream>
#include<GL/glut.h>
#include<stdio.h>

using namespace std;
float x1,x2,y1,y2,n;

void getdata()
{
    cout<<"Enter Start & End Points of Line: ";
    cin>>x1>>y1>>x2>>y2;
    cout<<"Enter no. of Iteration: ";
```

```
    cin>>n;
}

void koch(float x1,float y1,float x2,float y2,float n)
{
    float ang=60;ang=ang*3.14/180;
    float x3=(2*x1+x2)/3;
    float y3=(2*y1+y2)/3;
    float x4=(x1+2*x2)/3;
    float y4=(y1+2*y2)/3;
    float  x=x3+(x4-x3)*0.5+(y4-y3)*0.8660;
    float  y=y3-(x4-x3)*0.8660+(y4-y3)*0.5;
    if(n>0)
    {
        koch(x1,y1,x3,y3,n-1);
        koch(x3,y3,x,y,n-1);
        koch(x,y,x4,y4,n-1);
        koch(x4,y4,x2,y2,n-1);
    }
    else
    {
        glBegin(GL_LINE_STRIP);
        glClearColor(1.0,1.0,1.0,0.0);
        glColor3f(0.0,1.0,1.0);
        glVertex2f(x1,y1);
        glColor3f(0.0,1.0,1.0);
        glVertex2f(x3,y3);
        glColor3f(1.0,1.0,0.0);
        glVertex2f(x,y);
        glColor3f(1.0,0.0,1.0);
        glVertex2f(x4,y4);
        glColor3f(1.0,1.0,1.0);
        glVertex2f(x2,y2);
        glEnd();
    }
}
```

```
void Init()
{
glClearColor(0.0,0.0,0.0,0.0);
glColor3f(0.0,0.0,0.0);
gluOrtho2D(0.0,640.0,480.0,0.0);
}
void display()
{
glClear(GL_COLOR_BUFFER_BIT);
koch(x1,y1,x2,y2,n);
glFlush();
}
int main(int argv,char **argc)
{

getdata();

glutInit(&argv,argc);
glutInitDisplayMode(GLUT_SINGLE | GLUT_RGB);
glutInitWindowPosition(100,100);
glutInitWindowSize(640,480);
glutCreateWindow("Koch Curve Implementation");
Init();
glutDisplayFunc(display);
glutMainLoop();

return 0;
}
```



11)Line clipping algorithm.txt

```
#include <windows.h>
#include<GL/glut.h>
#include<math.h>
#include<stdio.h>
#include<iostream>

void display();
using namespace std;
float xmin=-100;
float ymin=-100;
float  xmax=100;
float ymax=100;
float xd1,yd1,xd2,yd2;


void init(void)
{

   glClearColor(0.0,0,0,0);
   glMatrixMode(GL_PROJECTION);
   gluOrtho2D(-300,300,-300,300);

}

int code(float x,float y)
```

```
{
   int c=0;
   if(y>ymax)c=8;
   if(y<ymin)c=4;
   if(x>xmax)c=2;
   if(x<xmin)c=1;
   return c;
}

void cohen_Line(float x1,float y1,float x2,float y2)
{
   int c1=code(x1,y1);
   int c2=code(x2,y2);
   float m=(y2-y1)/(x2-x1);
   while((c1|c2)>0)
   {
      if((c1 & c2)>0)
      {
         exit(0);
      }

   float xi=x1;float yi=y1;
   int c=c1;
   if(c==0)
   {
       c=c2;
       xi=x2;
       yi=y2;
   }
   float x,y;
   if((c & 8)>0)
   {
     y=ymax;
     x=xi+ 1.0/m*(ymax-yi);
   }
   else
    if((c & 4)>0)
```

```
      {
         y=ymin;
         x=xi+1.0/m*(ymin-yi);
      }
      else
       if((c & 2)>0)
       {
          x=xmax;
          y=yi+m*(xmax-xi);
       }
       else
       if((c & 1)>0)
       {
          x=xmin;
          y=yi+m*(xmin-xi);
       }

       if(c==c1)
       {
          xd1=x;
          yd1=y;
          c1=code(xd1,yd1);
       }

       if(c==c2)
       {
          xd2=x;
          yd2=y;
          c2=code(xd2,yd2);
       }
}

 display();

}

void mykey(unsigned char key,int x,int y)
```

```
{
    if(key=='c')
    {
        cohen_Line(xd1,yd1,xd2,yd2);
        glFlush();
    }
}
void display()
{

   glClear(GL_COLOR_BUFFER_BIT);
    glColor3f(0.0,1.0,0.0);

   glBegin(GL_LINE_LOOP);
   glVertex2i(xmin,ymin);
   glVertex2i(xmin,ymax);
   glVertex2i(xmax,ymax);
   glVertex2i(xmax,ymin);
   glEnd();
   glColor3f(1.0,0.0,0.0);
   glBegin(GL_LINES);
   glVertex2i(xd1,yd1);
   glVertex2i(xd2,yd2);
   glEnd();
   glFlush();


}


int main(int argc,char** argv)
{
    printf("Enter line co-ordinates:");
    cin>>xd1>>yd1>>xd2>>yd2;
    glutInit(&argc,argv);
    glutInitDisplayMode(GLUT_SINGLE|GLUT_RGB);
    glutInitWindowSize(600,600);
```

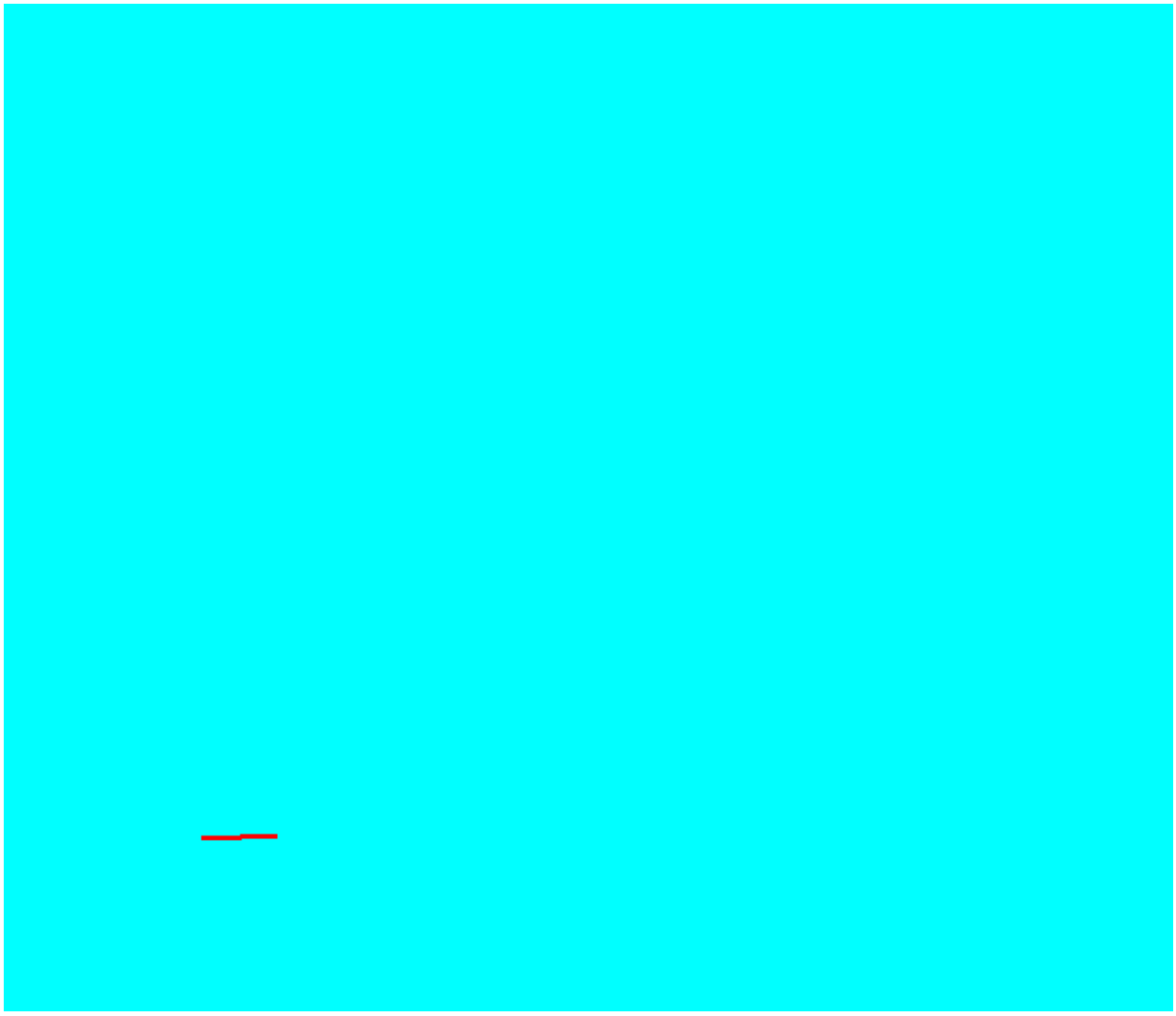
```
    glutInitWindowPosition(0,0);
    glutCreateWindow("Line Clipping");
    glutDisplayFunc(display);
    glutKeyboardFunc(mykey);
    init();
    glutMainLoop();
    return 0;
}
```

12)line program.txt

```
#include<windows.h>
#include<GL/glut.h>
#include<stdlib.h>
#include<stdio.h>
GLint x0,y0,xEnd,yEnd;
inline GLint round(const GLfloat a)
{
```

```
    return GLint(a+0.5);
}
void myInit(void)
{
    glClearColor(0.0,1.0,1.0,0.0);
    glColor3f(1.0f,0.0f,0.0f);
    glPointSize(3.0);
    glMatrixMode(GL_PROJECTION);
    glLoadIdentity();
    gluOrtho2D(0.0,640.0,0.0,480.0);
}
void readInput()
{

    printf("Enter x0, y0, xEnd, yEnd: ");
    scanf("%i %i %i %i",&x0,&y0,&xEnd,&yEnd);

}
void setPixel(GLint xcoordinate, GLint ycoordinate)
{
    glBegin(GL_POINTS);
    glVertex2i(xcoordinate,ycoordinate);
    glEnd();
    glFlush(); //forces execution in finite time
}

void lineDDA(GLint x0,GLint y0,GLint xEnd,GLint yEnd)
{
    GLint dx = abs(xEnd-x0);
    GLint dy = abs(yEnd-y0);
    GLint steps,k;
    GLfloat xIncrement,yIncrement,x=x0,y=y0;

    if(dx>dy)
        steps = dx;
    else
        steps = dy;
```

```
    xIncrement = GLfloat(dx) / GLfloat(steps);
    yIncrement = GLfloat(dy) / GLfloat(steps);
    setPixel(round(x),round(y));

    for(k=1;k<steps;k++)
    {
        x+= xIncrement;
        y+= yIncrement;
        setPixel(round(x),round(y));
    }
}

void Display(void)
{
    glClear(GL_COLOR_BUFFER_BIT);
    lineDDA(x0,y0,xEnd,yEnd);
}

int main(int argc,char *argv[])
{
    glutInit(&argc,argv);
    glutInitDisplayMode(GLUT_SINGLE | GLUT_RGB);
    glutInitWindowSize(600,600);
    glutInitWindowPosition(50,50);
    glutCreateWindow("DDA Line Algorithm");
    readInput();
    glutDisplayFunc(Display);
    myInit();
    glutMainLoop();
    return EXIT_SUCCESS;
}
```



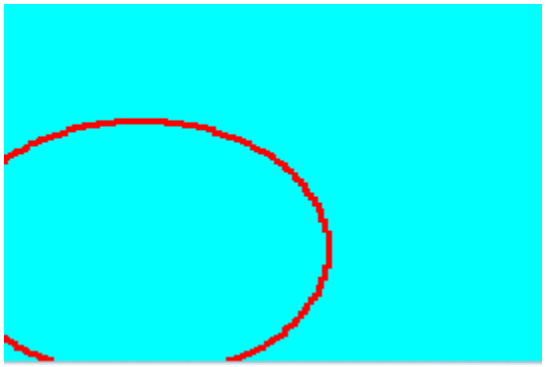
13) Mid Point circle drawing.txt

```
#include<windows.h>
#include<GL/glut.h>
#include<stdio.h>
GLint xc,yc,r;
void myInit(void)
{
   glClearColor(0.0,1.0,1.0,0.0); //clear values for RGBA
   glColor3f(1.0f,0.0f,0.0f); //set current color - RGB
   glPointSize(3.0); //diameters of rasterized points
   glMatrixMode(GL_PROJECTION); // specifies current matrix
   glLoadIdentity();
```

```
    gluOrtho2D(0.0,800.0,0.0,600.0); //left, right, top, bottom
    //glOrtho(-sizes/2,sizes/2,-sizes/2,sizes/2,-1,1);
}
void readInput()
{

    printf("Enter xc, yc, radius: ");
    scanf("%i %i %i",&xc,&yc,&r);

}
void setPixel(GLint xcoordinate, GLint ycoordinate)
{
    glBegin(GL_POINTS);
    glVertex2i(xcoordinate,ycoordinate);
    glEnd();
    glFlush();
}
/* void draw_axis()
{
    GLint i=(-sizes)/2;
    for(;i<(sizes/2);i++)
    {
        setPixel(i,0);
        setPixel(0,i);
    }

} */
void draw_in_each_oct(GLint xk,GLint yk, GLint xc,GLint yc)
{
    setPixel(xc+xk,yc+yk);
    setPixel(xc+yk,yc+xk);
    setPixel(xc-yk,yc+xk);
    setPixel(xc-xk,yc+yk);
    setPixel(xc-xk,yc-yk);
    setPixel(xc-yk,yc-xk);
    setPixel(xc+yk,yc-xk);
    setPixel(xc+xk,yc-yk);
```

```
}

void midPtCircle(GLint xc,GLint yc,GLint r)
{
   GLint pk,xk,yk;
   pk=1-r;
   xk=0;
   yk=r;
   draw_in_each_oct(xk,yk,xc,yc);
   while(xk<=yk)
   {
      if(pk<0)
      {
         xk=xk+1;
         pk=pk+(2*xk)+1;
      }
      else
      {
         xk=xk+1;
         yk=yk-1;
         pk=pk+(2*xk)+1-(2*yk);
      }
      draw_in_each_oct(xk,yk,xc,yc);
   }

}


void Display(void)
{
   glClear(GL_COLOR_BUFFER_BIT);
   //draw_axis();
   midPtCircle(xc,yc,r);
}

int main(int argc,char *argv[])
{
```

```
    glutInit(&argc,argv);
    glutInitDisplayMode(GLUT_SINGLE | GLUT_RGB);
    glutInitWindowSize(800,600);
    glutInitWindowPosition(100,50);
    glutCreateWindow("Mid Point Circle");
    readInput();
    glutDisplayFunc(Display);
    myInit();
    glutMainLoop();
    return 0;
}
```

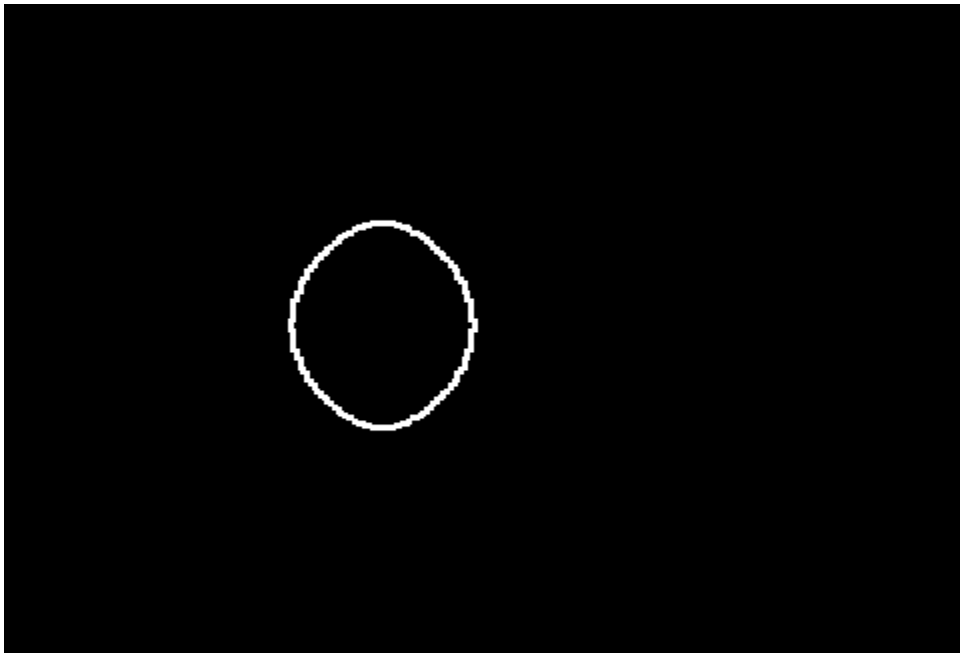


14) mid point ellipse.txt

```
#include<windows.h>
#include<bits/stdc++.h>
#include<GL/glut.h>

using namespace std;

int xc,yc,a,b;
void pp(int x,int y)
{
    glBegin(GL_POINTS);
        glVertex2i(x,y);
    glEnd();
}
void getpixel(int x,int y)
{
```

```
    pp(300+x,300+y);
    pp(300-x,300+y);
    pp(300-x,300-y);
    pp(300+x,300-y);
}

void display ()
{
    glClear(GL_COLOR_BUFFER_BIT);
    int x=0;
    int y=b;
    int e=a*a;
    int g=b*b;
    int fx=0;
    int fy=2*e*b;

    int p0=g-e*b+0.25*e;
    while(fx<fy){
        getpixel(x,y);
        x++;
        fx=fx+2*g;
        if(p0<0){
            p0=p0+fx+g;
        }
        else{
            y--;
            fy=fy-2*e;
            p0=p0+fx+g-fy;
        }


    }
    getpixel(x,y);
    p0=g*(x+0.5)*(x+0.5)+e*(y-1)*(y-1)-e*g;
    while(y>0)
    {
        y--;
```

```
        fy=fy-2*e;
        if(p0>=0)
           p0=p0-fy+e;
        else{
           x++;
           fx=fx+2*e;
           p0=p0+fx-fy+e;
        }
        getpixel(x,y);
    }
    glFlush();
}

void init(void)
{
    glClearColor(0.0,0.0,0.0,0.0); //clear values for RGBA
    glColor3f(1.0f,1.0f,1.0f); //set current color - RGB
    glPointSize(3.0); //diameters of rasterized points
    glMatrixMode(GL_PROJECTION); // specifies current matrix
    glLoadIdentity();
    gluOrtho2D(0.0,800.0,0.0,600.0); //left, right, top, bottom
}

int main (int argc, char **argv)
{
    cout<<"enter values of a and b:"<<endl;
    cin>>a>>b;

    glutInit(&argc,argv);
    glutInitDisplayMode(GLUT_SINGLE | GLUT_RGB);
    glutInitWindowSize(800,600);
    glutInitWindowPosition(100,50);
    glutCreateWindow("MidPoint Ellipse Algorithm");
    init();
    glutDisplayFunc(display);
    glutMainLoop();
}
```



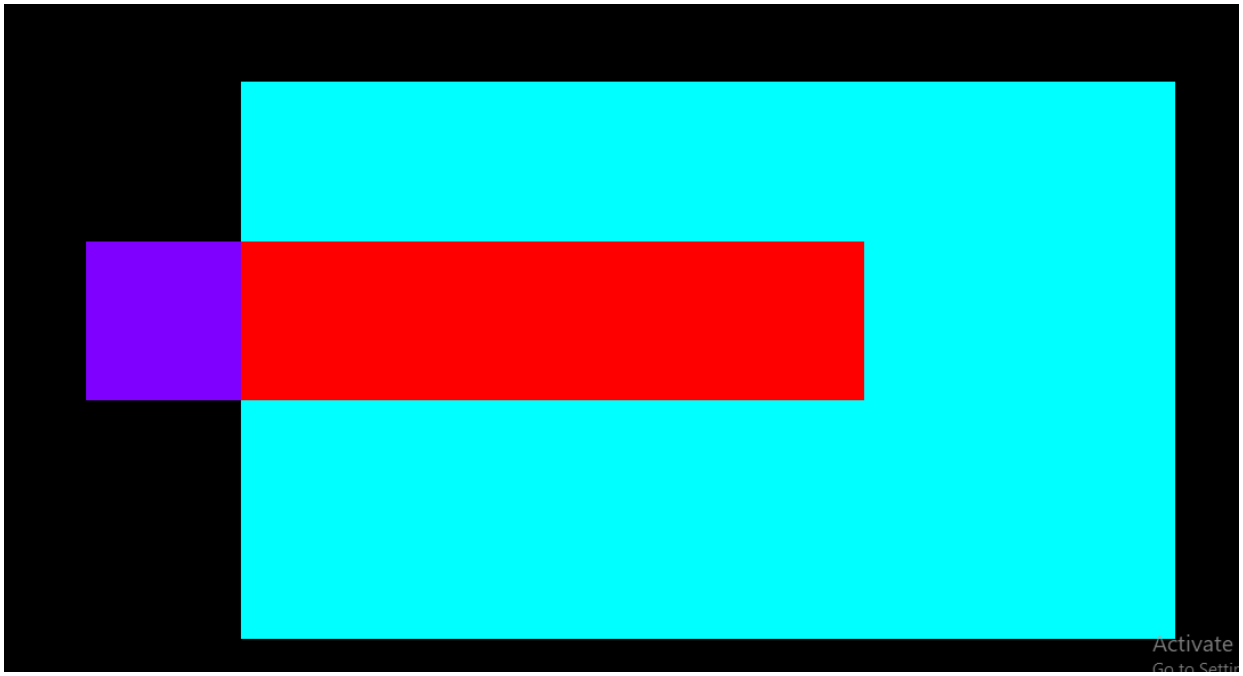
15) Polygon clipping algorithm.txt

```
#include <windows.h>
#include <gl/glut.h>

struct Point{
   float x,y;
} w[4],oVer[4];
int Nout;

void drawPoly(Point p[],int n){
   glBegin(GL_POLYGON);
   for(int i=0;i<n;i++)
      glVertex2f(p[i].x,p[i].y);
   glEnd();
}

bool insideVer(Point p){
      if((p.x>=w[0].x)&&(p.x<=w[2].x))
         if((p.y>=w[0].y)&&(p.y<=w[2].y))
            return true;
      return false;
```

```
}

void addVer(Point p){
   oVer[Nout]=p;
   Nout=Nout+1;
}

Point getInterSect(Point s,Point p,int edge){
   Point in;
   float m;
   if(w[edge].x==w[(edge+1)%4].x){ //Vertical Line
      m=(p.y-s.y)/(p.x-s.x);
      in.x=w[edge].x;
      in.y=in.x*m+s.y;
   }
   else{//Horizontal Line
      m=(p.y-s.y)/(p.x-s.x);
      in.y=w[edge].y;
      in.x=(in.y-s.y)/m;
   }
   return in;
}

void clipAndDraw(Point inVer[],int Nin){
   Point s,p,interSec;
   for(int i=0;i<4;i++)
   {
      Nout=0;
      s=inVer[Nin-1];
      for(int j=0;j<Nin;j++)
      {
         p=inVer[j];
         if(insideVer(p)==true){
            if(insideVer(s)==true){
               addVer(p);
            }
            else{
```

```
                interSec=getInterSect(s,p,i);
                addVer(interSec);
                addVer(p);
            }
        }
        else{
            if(insideVer(s)==true){
                interSec=getInterSect(s,p,i);
                addVer(interSec);
            }
        }
        s=p;
    }
    inVer=oVer;
    Nin=Nout;
  }
  drawPoly(oVer,4);
}

void init(){
  glClearColor(0.0f,0.0f,0.0f,0.0f);
  glMatrixMode(GL_PROJECTION);
  glLoadIdentity();
  glOrtho(0.0,100.0,0.0,100.0,0.0,100.0);
  glClear(GL_COLOR_BUFFER_BIT);
  w[0].x =20,w[0].y=10;
  w[1].x =20,w[1].y=80;
  w[2].x =80,w[2].y=80;
  w[3].x =80,w[3].y=10;
}
void display(void){
  Point inVer[4];
  init();
  // As Window for Clipping
  glColor3f(0.0f,1.0f,1.0f);
  drawPoly(w,4);
  // As Rect
```

```
    glColor3f(0.5f,0.0f,1.0f);
    inVer[0].x =10,inVer[0].y=40;
    inVer[1].x =10,inVer[1].y=60;
    inVer[2].x =60,inVer[2].y=60;
    inVer[3].x =60,inVer[3].y=40;
    drawPoly(inVer,4);
    // As Rect
    glColor3f(1.0f,0.0f,0.0f);
    clipAndDraw(inVer,4);
    // Print
    glFlush();
}

int main(int argc,char *argv[]){
    glutInit(&argc,argv);
    glutInitDisplayMode(GLUT_SINGLE|GLUT_RGB);
    glutInitWindowSize(400,400);
    glutInitWindowPosition(100,100);
    glutCreateWindow("Polygon Clipping!");
    glutDisplayFunc(display);
    glutMainLoop();
    return 0;
}
```



```
#include <iostream>
#include <conio.h> // For _getch()
// Function to clear the console screen
void clearScreen() {
#ifdef _WIN32
system("cls");
#else
// Assuming a Unix-like system
system("clear");
#endif
}
int main() {
const int screenWidth = 40;
const int screenHeight = 20;
int ballX = screenWidth / 2;
int ballY = screenHeight / 2;
int ballSpeedX = 1;
int ballSpeedY = 1;
while (true) {
clearScreen();// Print the game board
for (int i = 0; i < screenHeight; ++i) {
for (int j = 0; j < screenWidth; ++j) {
```

```
if (i == ballY && j == ballX) {
std::cout << 'O'; // Print the ball
} else {
std::cout << ' ';
}
}
std::cout << std::endl;
}
// Move the ball
ballX += ballSpeedX;
ballY += ballSpeedY;
// Check for collisions with screen boundaries
if (ballX <= 0 || ballX >= screenWidth - 1) {
ballSpeedX = -ballSpeedX; // Reverse X direction on
collision
}
if (ballY <= 0 || ballY >= screenHeight - 1) {
ballSpeedY = -ballSpeedY; // Reverse Y direction on
collision
}
// Wait for a key press without blocking
if (_kbhit()) {
char key = _getch();
switch (key) {
case 'w':
ballSpeedY = -1; // Move ball up
break;
case 's':
ballSpeedY = 1; // Move ball down
break;case 'a':
ballSpeedX = -1; // Move ball left
break;
case 'd':
ballSpeedX = 1; // Move ball right
break;
case 'q':
return 0; // Quit the game
}
}
```

```
// Add a delay to control the speed of the ball
// Adjust this based on your system's speed
for (int i = 0; i < 10000000; ++i) {}
}
return 0;
}
Tic tac toe game=
#include <iostream>
#include <vector>
// Function to print the Tic-Tac-Toe board
void printBoard(const std::vector<std::vector<char>>& board) {
for (const auto& row : board) {
for (char cell : row) {
std::cout << cell << " ";
}
std::cout << std::endl;
}
}
// Function to check if a player has wonbool checkWin(const
std::vector<std::vector<char>>& board,
char player) {
// Check rows and columns
for (int i = 0; i < 3; ++i) {
if ((board[i][0] == player && board[i][1] == player &&
board[i][2] == player) ||
(board[0][i] == player && board[1][i] == player &&
board[2][i] == player)) {
return true;
}
}
// Check diagonals
if ((board[0][0] == player && board[1][1] == player &&
board[2][2] == player) ||
(board[0][2] == player && board[1][1] == player &&
board[2][0] == player)) {
return true;
}
return false;
}
```

```
// Function to check if the board is full (tie)
bool isBoardFull(const std::vector<std::vector<char>>& board)
{
for (const auto& row : board) {
for (char cell : row) {
if (cell == ' ')
return false; // There's an empty cell, the board is not
full
}
}
return true; // All cells are filled, the board is full
}
int main() {std::vector<std::vector<char>> board(3,
std::vector<char>(3, '
')); // 3x3 Tic-Tac-Toe board
char currentPlayer = 'X';
while (true) {
// Print the current state of the board
printBoard(board);
// Get the player's move
int row, col;
std::cout << "Player " << currentPlayer << "'s turn. Enter
row (0-2) and column (0-2): ";
std::cin >> row >> col;
// Check if the chosen cell is valid
if (row < 0 || row >= 3 || col < 0 || col >= 3 ||
board[row][col] != ' ') {
std::cout << "Invalid move. Try again." << std::endl;
continue;
}
// Make the move
board[row][col] = currentPlayer;
// Check for a win
if (checkWin(board, currentPlayer)) {
// Print the final board and declare the winner
printBoard(board);
std::cout << "Player " << currentPlayer << " wins!" <<
std::endl;
break;
```

```
}
// Check for a tie
if (isBoardFull(board)) {
// Print the final board and declare a tie
printBoard(board);std::cout << "It's a tie!" << std::endl;
break;
}
// Switch to the other player
currentPlayer = (currentPlayer == 'X') ? 'O' : 'X';
}
return 0;
```