SSN COLLEGE OF ENGINEERING, KALAVAKKAM

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

UCS1712-Graphics and Multimedia Lab

Programming Assignment 7

Cohen Sutherland Line clipping in C++ using OpenGL

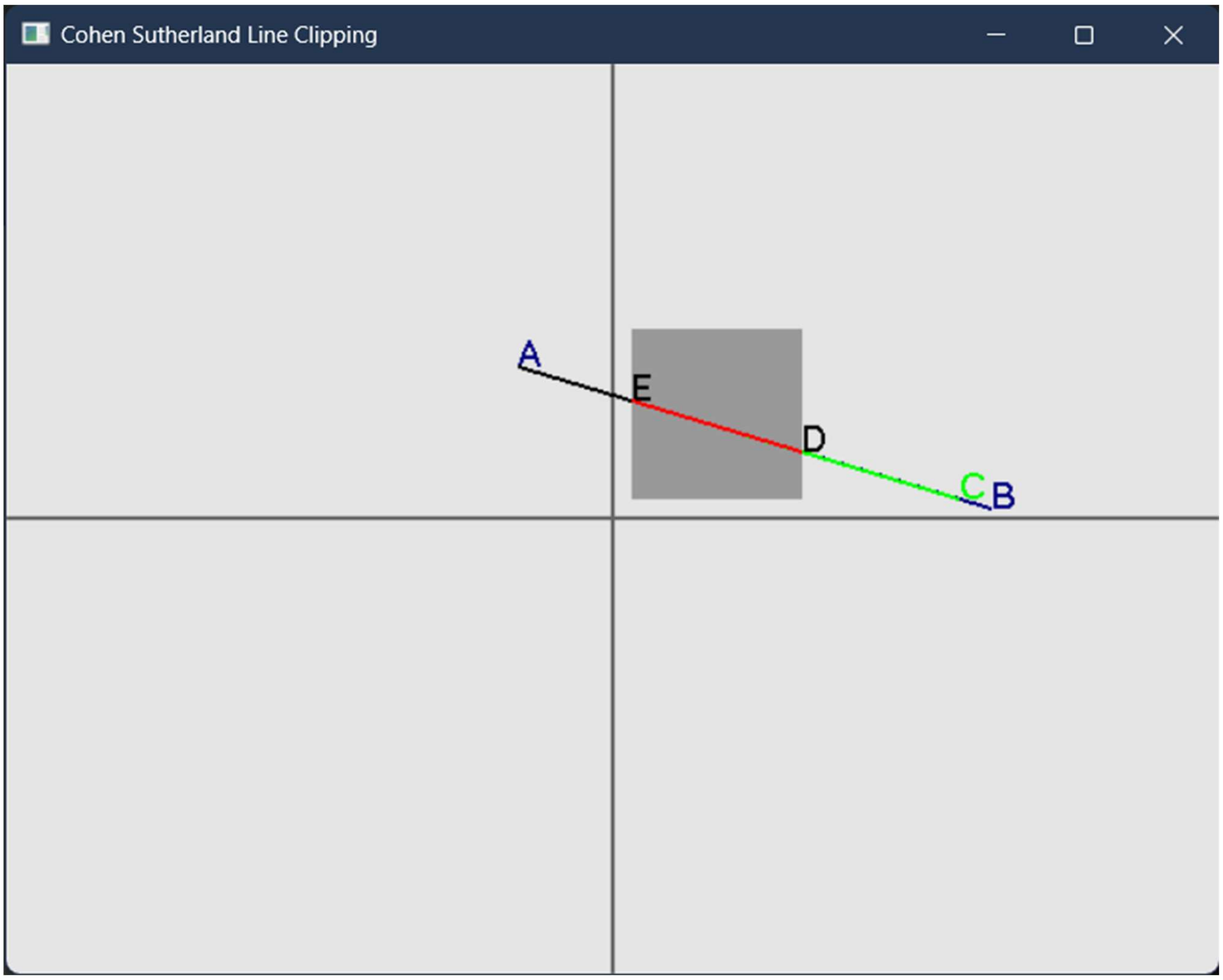
Name: Jayannthan P T *Dept: CSE 'A'* *Roll No.: 205001049*

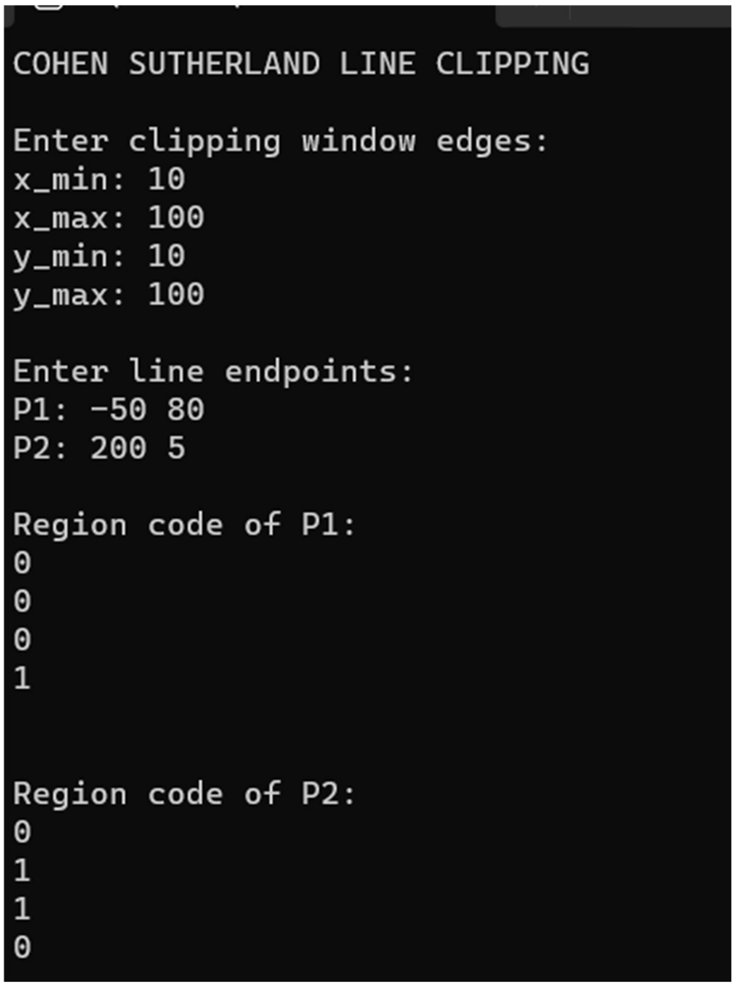
Apply Cohen Sutherland line clipping on a line (x1,y1) (x2,y2) with respect to a clipping window (XWmin,YWmin) (XWmax,YWmax). After clipping with an edge, display the line segment with the calculated intermediate intersection points.

Source code:

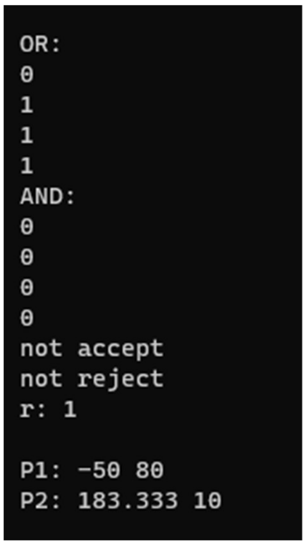
```
#define GL_SILENCE_DEPRECATION

#include<GL/glut.h>
#include<iostream>
#include<math.h>
using namespace std;

float xmin, xmax, ymin, ymax;
char letter = 'A';

void myInit() {
    glClearColor(0.9, 0.9, 0.9, 0);
    glColor3f(0.0f, 0.0f, 0.0f);
    glPointSize(5);
    glMatrixMode(GL_PROJECTION);
    glLineWidth(1.5);
    glLoadIdentity();
    gluOrtho2D(0.0, 640.0, 0.0, 480.0);
}


void labelPoint(float x, float y, char label) {

    glRasterPos2f(x + 320, y + 240);
    glutBitmapCharacter(GLUT_BITMAP_HELVETICA_18, label);
}

void displayPoint(float x, float y) {
    glBegin(GL_POINTS);
    glVertex2d(x + 320, y + 240);
    glEnd();
}

void displayLine(int x1, int y1, int x2, int y2) {
    glBegin(GL_LINES);
    glVertex2d(x1 + 320, y1 + 240);
    glVertex2d(x2 + 320, y2 + 240);
    glEnd();
}

void displayQuads(int x1, int y1, int x2, int y2, int x3, int y3, int x4, int y4) {
    glBegin(GL_QUADS);
    glVertex2d(x1 + 320, y1 + 240);
    glVertex2d(x2 + 320, y2 + 240);
    glVertex2d(x3 + 320, y3 + 240);
    glVertex2d(x4 + 320, y4 + 240);
    glEnd();
}
void drawPlane() {
    glClear(GL_COLOR_BUFFER_BIT);
    glColor4f(0.4, 0.4, 0.4, 1);
    displayLine(-320, 0, 320, 0);
    displayLine(0, -240, 0, 240);
    glFlush();
}
void printMatrix(float* arr, int m, int n)
{
    int i, j;
    for (i = 0; i < m; i++) {
        for (j = 0; j < n; j++)
            cout << *((arr + i * n) + j) << " ";
        cout << endl;
    }
}

void printRegionCode(float* RC) {
    printMatrix(RC, 4, 1);
}

float* getRegionCode(float x, float y) {
    float* TBRL = new float[4];

    TBRL[0] = (y > ymax) ? 1 : 0;
    TBRL[1] = (y < ymin) ? 1 : 0;
    TBRL[2] = (x > xmax) ? 1 : 0;
    TBRL[3] = (x < xmin) ? 1 : 0;

    return TBRL;
}

bool isTrivialAccept(float* OR) {
    for (int i = 0; i < 4; i++) {
        if (OR[i] == 1) {
            cout << "not accept" << endl;
            return false;
        }
    }
    cout << "accept" << endl;
    return true;
}

bool isTrivialReject(float* AND) {
    for (int i = 0; i < 4; i++) {
        if (AND[i] == 1) {
            cout << "reject" << endl;
            return true;
        }
    }
    cout << "not reject" << endl;
    return false;
}

int firstRegion(float* OR) {
    int i;
    for (i = 0; OR[i] == 0; i++);
    return i;
}
void plotClippingWindow() {
    glColor4f(0.6, 0.6, 0.6, 1);
    displayQuads(xmin, ymin, xmin, ymax, xmax, ymax, xmax, ymin);
}

void plotInputLine(float x1, float y1, float x2, float y2) {
    glColor4f(0.0, 0.0, 0.5, 1);
    displayLine(x1, y1, x2, y2);
}

void applyCSLineClipping(float x1, float y1, float x2, float y2) {
    float* RC1 = getRegionCode(x1, y1);
    cout << "\nRegion code of P1: " << endl;
    printRegionCode(RC1);
    cout << endl;

    float* RC2 = getRegionCode(x2, y2);
    cout << "\nRegion code of P2: " << endl;
    printRegionCode(RC2);
    cout << endl;

    bool algoEnd = false;
    int green = 1;
    do {
        float* OR = new float[4];
        float* AND = new float[4];
        for (int i = 0; i < 4; i++) {
            OR[i] = max(RC1[i], RC2[i]);
            AND[i] = min(RC1[i], RC2[i]);
        }
        cout << "\nOR: " << endl;
        printRegionCode(OR);
        cout << "AND: " << endl;
        printRegionCode(AND);

        if (isTrivialAccept(OR) || isTrivialReject(AND)) {
            cout << "\nend" << endl;
            algoEnd = true;
            glColor4f(1, 0, 0, 1);
            displayLine(x1, y1, x2, y2);
        }
        else {
            int r = firstRegion(OR);
            cout << "r: " << r << endl;
            float x = x1, y = y1;
            float m = (y2 - y1) / (x2 - x1);
            glColor4f(0, green, 0, 1); green -= 0.2;
            if (r == 0) {
                y = ymax;
                x = x1 + (1 / m) * (y - y1);
                RC1 = getRegionCode(x, y);
                x1 = x; y1 = y;
                labelPoint(x1, y1, letter++);
            }
            else if (r == 1) {
                y = ymin;
                x = x1 + (1 / m) * (y - y1);
                RC2 = getRegionCode(x, y);
                x2 = x; y2 = y;
                labelPoint(x2, y2, letter++);
            }
            else if (r == 2) {
                x = xmax;
                y = y1 + m * (x - x1);
                RC2 = getRegionCode(x, y);
                x2 = x; y2 = y;
                labelPoint(x2, y2, letter++);
            }
            else if (r == 3) {
                x = xmin;
                y = y1 + m * (x - x1);
                RC1 = getRegionCode(x, y);
                x1 = x; y1 = y;
                labelPoint(x1, y1, letter++);
            }
            cout << "\nP1: " << x1 << " " << y1 << endl;
            cout << "P2: " << x2 << " " << y2 << endl;
            displayLine(x1, y1, x2, y2);
        }
    } while (!algoEnd);
}

void plotChart() {
    glClear(GL_COLOR_BUFFER_BIT);
    drawPlane();

    cout << "COHEN SUTHERLAND LINE CLIPPING" << endl;


    cout << "\nEnter clipping window edges: " << endl;
    cout << "x_min: "; cin >> xmin;
    cout << "x_max: "; cin >> xmax;
    cout << "y_min: "; cin >> ymin;
    cout << "y_max: "; cin >> ymax;
    plotClippingWindow();


    float x1, y1, x2, y2;
    cout << "\nEnter line endpoints: " << endl;
    cout << "P1: "; cin >> x1 >> y1;
    cout << "P2: "; cin >> x2 >> y2;
    if (x2 < x1) {
        cout << "Swapping points so that P1 lies to the left of P2..." << endl;
        float tx = x1, ty = y1;
        x1 = x2; y1 = y2;
        x2 = tx; y2 = ty;
    }
    plotInputLine(x1, y1, x2, y2);

    labelPoint(x1, y1, letter++);
    labelPoint(x2, y2, letter++);


    applyCSLineClipping(x1, y1, x2, y2);

    glFlush();
}

int main(int argc, char* argv[]) {
    glutInit(&argc, argv);
    glutInitDisplayMode(GLUT_SINGLE | GLUT_RGBA);
    glutInitWindowSize(640, 480);
    glutCreateWindow("Cohen Sutherland Line Clipping");
    glutDisplayFunc(plotChart);
    myInit();
    glutMainLoop();
    return 1;
}
```

Output

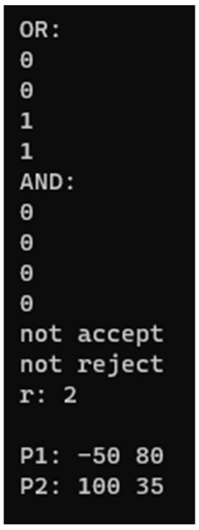




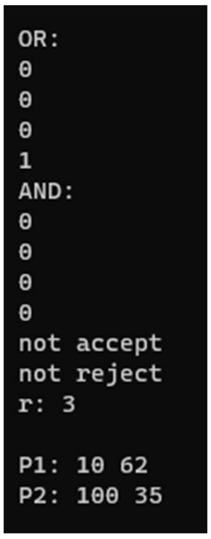
```
COHEN SUTHERLAND LINE CLIPPING

Enter clipping window edges:
x_min: 10
x_max: 100
y_min: 10
y_max: 100

Enter line endpoints:
P1: -50 80
P2: 200 5

Region code of P1:
0
0
0
1


Region code of P2:
0
1
1
0
```



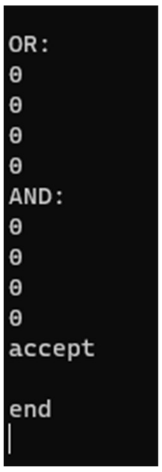
```
OR:
0
1
1
1
AND:
0
0
0
0
not accept
not reject
r: 1

P1: -50 80
P2: 183.333 10
```



```
OR:
0
0
1
1
AND:
0
0
0
0
not accept
not reject
r: 2

P1: -50 80
P2: 100 35
```



```
OR:
0
0
0
1
AND:
0
0
0
0
not accept
not reject
r: 3

P1: 10 62
P2: 100 35
```



```
OR:
0
0
0
0
AND:
0
0
0
0
accept

end
```