Swetha Saseendran
CSE-C
185001183

UCS1712 – Graphics and Multimedia Laboratory

Exercise 7: Cohen Sutherland Line clipping in C++ using OpenGL

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 respect to an edge, display the line segment with the calculated intermediate intersection points and the vertex list.

Input: The clipping window co-ordinates and the line endpoints

Note: The output should show the clipping window and the line to be clipped in different colors.

You can show the intermediate steps using time delay.

main.cpp

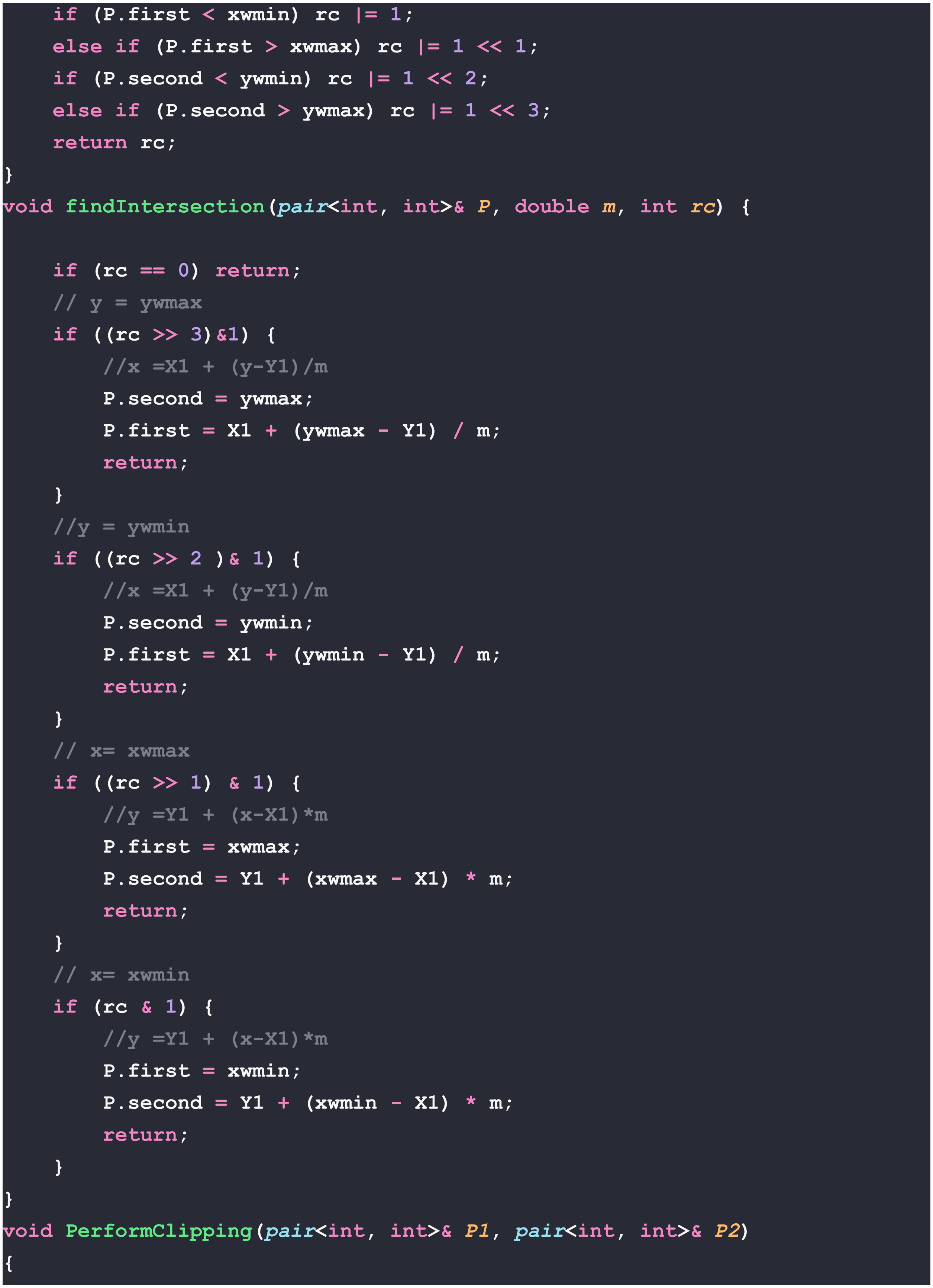
```cpp
#include<windows.h>
#include<GL/glut.h>
#include<iostream>
#include<math.h>
#include<bits/stdc++.h>
using namespace std;

pair<int, int> P1, P2;
int X1, X2, Y1, Y2;
int xwmin, xwmax, ywmin, ywmax;

void myInit()
{
    glClearColor(1.0, 1.0, 1.0, 0.0);
    glColor3f(0.0f, 0.0f, 0.0f);
    glPointSize(10);
    glMatrixMode(GL_PROJECTION);
    glLoadIdentity();
    gluOrtho2D(0.0, 640.0, 0.0, 480.0);
}
void drawWindow() {
    glBegin(GL_LINE_LOOP);
    glVertex2d(xwmin, ywmin);
    glVertex2d(xwmax, ywmin);
    glVertex2d(xwmax, ywmax);
    glVertex2d(xwmin, ywmax);
    glEnd();
}

void drawOriginal() {
    glBegin(GL_LINES);
    glVertex2d(P1.first, P1.second);
    glVertex2d(P2.first, P2.second);
    glEnd();
}

int getRC(pair<int, int>& P)
{
    int rc = 0;
```

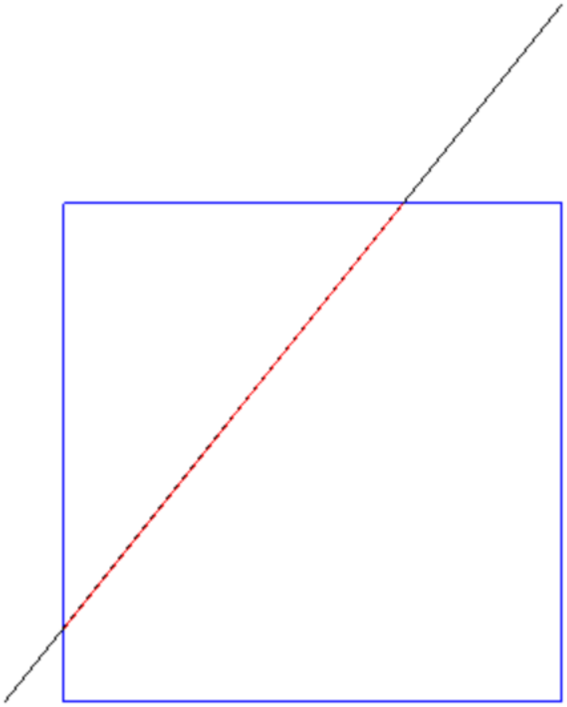


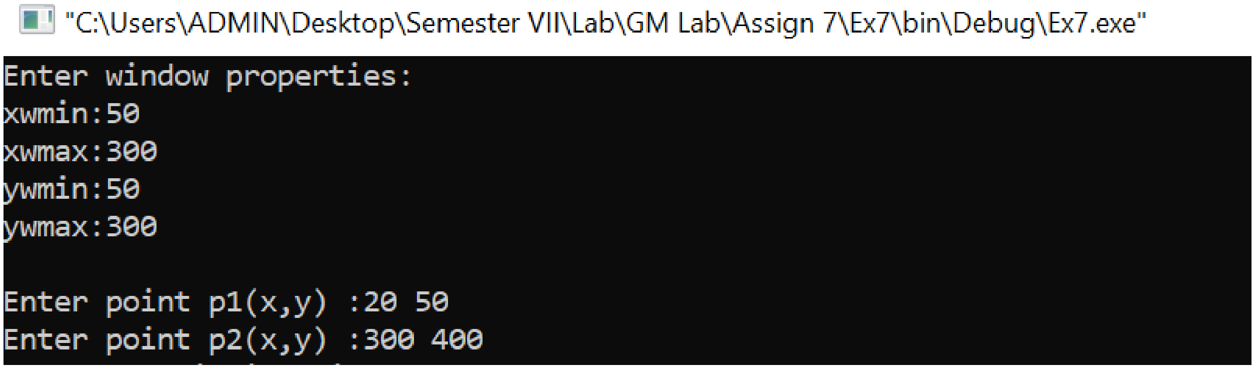
```
    if (P.first < xwmin) rc |= 1;
    else if (P.first > xwmax) rc |= 1 << 1;
    if (P.second < ywmin) rc |= 1 << 2;
    else if (P.second > ywmax) rc |= 1 << 3;
    return rc;
}
void findIntersection(pair<int, int>& P, double m, int rc) {

    if (rc == 0) return;
    // y = ywmax
    if ((rc >> 3)&1) {
        //x =X1 + (y-Y1)/m
        P.second = ywmax;
        P.first = X1 + (ywmax - Y1) / m;
        return;
    }
    //y = ywmin
    if ((rc >> 2 )& 1) {
        //x =X1 + (y-Y1)/m
        P.second = ywmin;
        P.first = X1 + (ywmin - Y1) / m;
        return;
    }
    // x= xwmax
    if ((rc >> 1)  & 1) {
        //y =Y1 + (x-X1)*m
        P.first = xwmax;
        P.second = Y1 + (xwmax - X1) * m;
        return;
    }
    // x= xwmin
    if (rc & 1) {
        //y =Y1 + (x-X1)*m
        P.first = xwmin;
        P.second = Y1 + (xwmin - X1) * m;
        return;
    }
}
void PerformClipping(pair<int, int>& P1, pair<int, int>& P2)
{
    int rc1 = getRC(P1), rc2 = getRC(P2);
    //Checking for trivial OR
    if (int(rc1 | rc2) == 0) {

        glBegin(GL_LINES);
        glVertex2d(P1.first, P1.second);
        glVertex2d(P2.first, P2.second);
        glEnd();
        return;
    }
    else if (int(rc1 & rc2) != 0) return;
    double m = (Y2-Y1) * 1.0 / (X2-X1);
    findIntersection(P1, m, rc1);
    findIntersection(P2, m, rc2);
    PerformClipping(P1, P2);
}
void myDisplay()
{
    glClear(GL_COLOR_BUFFER_BIT);
    glColor3f(0.0f, 0.0f, 1.0f);
    drawWindow();
    glColor3f(0.0f, 0.0f, 0.0f);
    drawOriginal();
    glColor3f(1.0f, 0.0f, 0.0f);
    PerformClipping(P1, P2);
    glFlush();
}
int main(int argc, char* argv[])
{
    cout << "Enter window properties:" << endl;
    cout << "xwmin:";
    cin >> xwmin;
    cout << "xwmax:";
    cin >> xwmax;
    cout << "ywmin:";
    cin >> ywmin;
    cout << "ywmax:";
    cin >> ywmax;
    int x, y;
    cout << endl << "Enter point p1(x,y) :";
    cin >> x >> y;
    P1.first = x;
    P1.second = y;
    X1 = x;
    Y1 = y;
    cout << "Enter point p2(x,y) :";
    cin >> x >> y;
    P2.first = x;
    P2.second = y;
    X2 = x;
    Y2 = y;
    cout << "Blue  -> Clipping Window" << endl;
    cout << "Black -> Original Line" << endl;
    cout << "Red   -> Clipped Line" << endl;
    glutInit(&argc, argv);
    glutInitDisplayMode(GLUT_SINGLE | GLUT_RGB);
    glutInitWindowSize(640, 480);
    glutCreateWindow("Cohen Sutherland");
    glutDisplayFunc(myDisplay);
    myInit();
    glutMainLoop();
    return 1;
}
```

Output:





"C:\Users\ADMIN\Desktop\Semester VII\Lab\GM Lab\Assign 7\Ex7\bin\Debug\Ex7.exe"

```
Enter window properties:
xwmin:50
xwmax:300
ywmin:50
ywmax:300

Enter point p1(x,y) :20 50
Enter point p2(x,y) :300 400
```