NETAJI SUBHAS UNIVERSITY OF TECHNOLOGY

Computer Graphics (COCSE64)
Practical File

Submitted by :
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(2019UCO1506)

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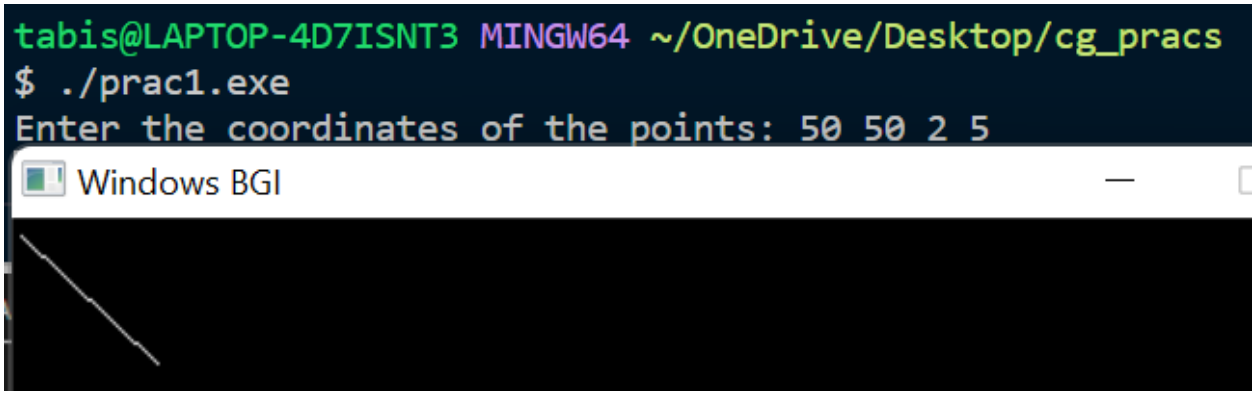
1 .Generating line primitives using DDA

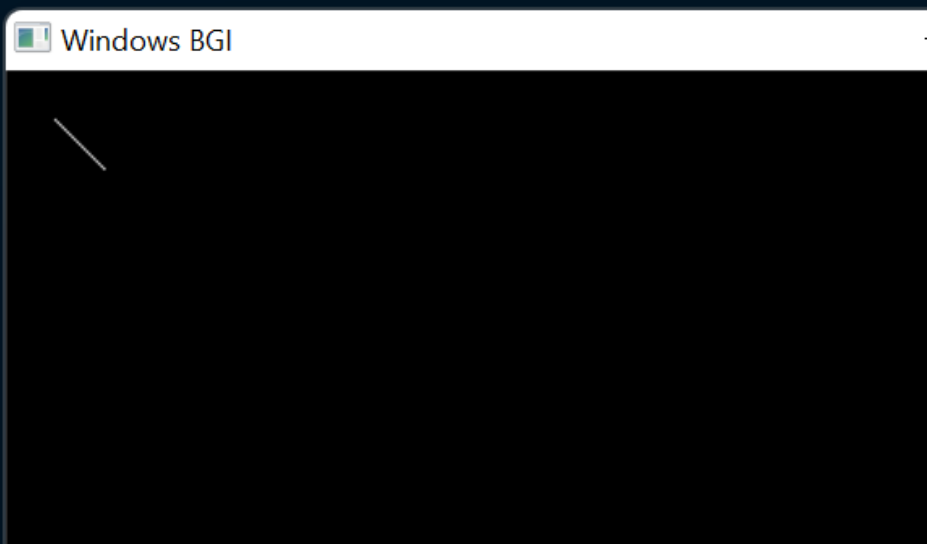
```
#include <iostream>
#include <graphics.h>
#include <cmath>
#include <time.h>
using namespace std;
//function to generate the line
void DDALine(int x0, int y0, int x1, int y1){
    int dx = x1 - x0;
    int dy = y1 - y0;

    int step = (abs(dx) > abs(dy))? abs(dx) : abs(dy);

    float x_step = (float)dx/step;
    float y_step = (float)dy/step;

    float x = x0;
    float y = y0;

    for(int i = 0; i < step; i++){
        putpixel(round(x), round(y), WHITE);
        // cout << round(x) << " " << round(y) << endl;
        x += x_step;
        y += y_step;
        delay(10);
    }

}

//driver function
int main(){
    initwindow(500,500);
    int x0, y0, x1, y1;
    cout << "Enter the coordinates of the points: ";
    cin >> x0 >> y0 >> x1 >> y1;

    DDALine(x0, y0, x1, y1);

    delay(100);
    getch();
    delay(10000);
    closegraph();
    return 0;
}
```


tabis@LAPTOP-4D7ISNT3 MINGW64 ~/OneDrive/Desktop/cg_pracs
$ ./prac1.exe
Enter the coordinates of the points: 50 50 2 5
Windows BGI

2 . Generating Line using Bresenham's Approach

```
#include <bits/stdc++.h>
#include <graphics.h>
using namespace std;

// function for line generation
void bresenham(int x1, int y1, int x2, int y2)
{
    int m_new = 2 * (y2 - y1);
    int slope_error_new = m_new - (x2 - x1);

    for (int x = x1, y = y1; x <= x2; x++)
    {
        putpixel(x, y, WHITE);
        cout << x << " " << y << endl;
        slope_error_new += m_new;
        if (slope_error_new >= 0)
        {
            y++;
            slope_error_new -= 2 * (x2 - x1);
        }
        delay(10);
    }
}

int main()
{
    initwindow(500, 500);
    int x1, y1, x2, y2;
    cout << "Enter the coordinates of the points: ";
    cin >> x1 >> y1 >> x2 >> y2;

    bresenham(x1, y1, x2, y2);
    delay(100);
    getch();
    closegraph();
    return 0;
}
```

```
tabis@LAPTOP-4D7ISNT3 MINGW64 ~/OneDrive/Desktop/cg_pracs
$ ./prac2.exe
Enter the coordinates of the points: 20 20
40 50
28 28
29 29
30 30
31 31
32 32
33 33
34 34
35 35
36 36
37 37
38 38
39 39
40 40
```



3. Generating circle using bresenham's approach

```
#include <bits/stdc++.h>
using namespace std;
#include <graphics.h>
void draw(int x, int y)
{
    putpixel(x + 200, y + 200, WHITE);
    delay(1);
    putpixel(x + 200, -y + 200, WHITE);
    delay(1);
    putpixel(-x + 200, -y + 200, WHITE);
    delay(1);
    putpixel(-x + 200, y + 200, WHITE);
    delay(1);
    putpixel(y + 200, x + 200, WHITE);
    delay(1);
    putpixel(y + 200, -x + 200, WHITE);
    delay(1);
    putpixel(-y + 200, x + 200, WHITE);
    delay(1);
    putpixel(-y + 200, -x + 200, WHITE);
}
void circle1(int a, int b, int c)
{
    float p = 3 - 2 * c;
    int x = 0, y = c;
    cout << x << ", " << y << "\n";
    putpixel(x + a, y + b, WHITE);
    while (x <= y)
    {
        if (p < 0)
        {
            p = p + 4 * x + 6;
            x = x + 1;
            draw(x, y);
        }
        else
        {
```

```
            p = p + 4 * (x - y) + 10;
            x = x + 1;
            y = y - 1;
            draw(x, y);
        }
    }
}
int main()
{
    initwindow(720, 720);
    int a = 150, b = 150, c = 100;
    circle1(a, b, c);
    getch();
    closegraph();
    return 0;
}
```

```
tabis@LAPTOP-4D7ISNT3 MINGW64 ~/OneDrive/Desktop/cg_pracs
$ ./prac3.exe
0, 100
```

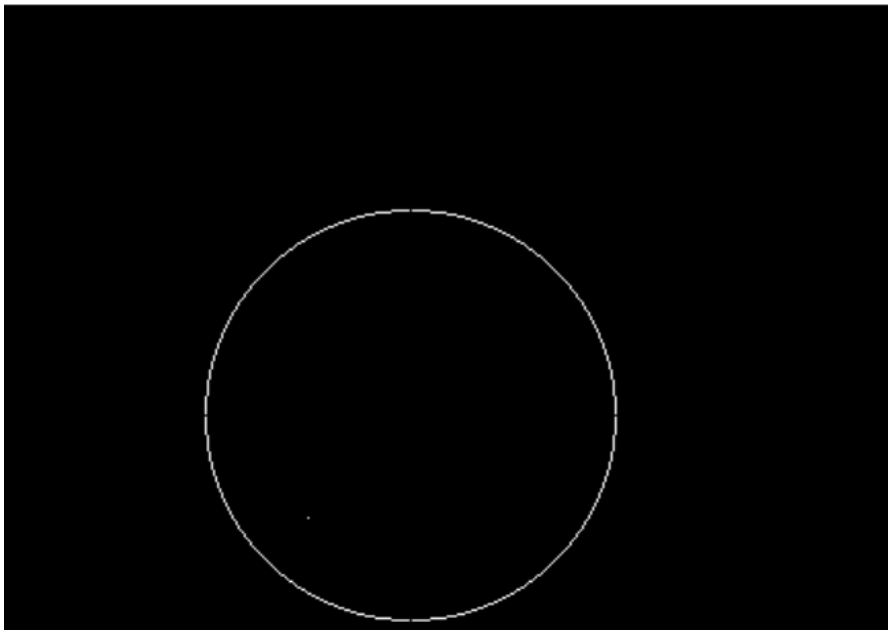
4. Generating circle using Mid point approach

```
using namespace std;
#include <iostream>
#include <graphics.h>
void draw(int x, int y)
{
    putpixel(x + 200, y + 200, WHITE);
    delay(1);
    putpixel(x + 200, -y + 200, WHITE);
    delay(1);
    putpixel(-x + 200, -y + 200, WHITE);
    delay(1);
    putpixel(-x + 200, y + 200, WHITE);
    delay(1);
    putpixel(y + 200, x + 200, WHITE);
    delay(1);
    putpixel(y + 200, -x + 200, WHITE);
    delay(1);
    putpixel(-y + 200, x + 200, WHITE);
    delay(1);
    putpixel(-y + 200, -x + 200, WHITE);
}
void circle1(int a, int b, int c)
{
    float p = 3 - 2 * c;
    int x = 0, y = c;
    cout << x << ", " << y << "\n";
    putpixel(x + a, y + b, WHITE);
    while (x <= y)
    {
        if (p < 0)
        {
            p = p + 4 * x + 6;
            x = x + 1;
            draw(x, y);
        }
        else
        {
```

```
            p = p + 4 * (x - y) + 10;
            x = x + 1;
            y = y - 1;
            draw(x, y);
        }
    }
}
int main()
{
    initwindow(720, 720);
    int a = 150, b = 150, c = 100;
    circle1(a, b, c);
    getch();
    closegraph();
    return 0;
}
```

```
tabis@LAPTOP-4D7ISNT3 MINGW64 ~/OneDrive/Desktop/cg_pracs
$ ./prac4.exe
0, 100
```

Windows BGI



5. Generating ellipse using mid point algorithm

```
#include <stdio.h>
#include <conio.h>
#include <graphics.h>
#include <math.h>
void disp();
float x, y;
int xc, yc;
int main()
{
    float p1, p2;
    initwindow(720, 720);
    int a, b;
    printf("*** Ellipse Generating Algorithm ***\n");
    printf("Enter the value of Xc\t");
    scanf("%d", &xc);
    printf("Enter the value of yc\t");
    scanf("%d", &yc);
    printf("Enter X axis length\t");
    scanf("%d", &a);
    printf("Enter Y axis length\t");
    scanf("%d", &b);
    x = 0;
    y = b;
    disp();
    p1 = (b * b) - (a * a * b) + (a * a) / 4;
    while ((2.0 * b * b * x) <= (2.0 * a * a * y))
    {
        x++;
        if (p1 <= 0)
            p1 = p1 + (2.0 * b * b * x) + (b * b);
        else
        {
            y--;
            p1 = p1 + (2.0 * b * b * x) + (b * b) - (2.0 * a * a * y);
        }
```

```
        disp();
        x = -x;
        disp();
        x = -x;
        delay(50);
    }
    x = a;
    y = 0;
    disp();
    p2 = (a * a) + 2.0 * (b * b * a) + (b * b) / 4;
    while ((2.0 * b * b * x) > (2.0 * a * a * y))
    {
        y++;
        if (p2 > 0)
            p2 = p2 + (a * a) - (2.0 * a * a * y);
        else
        {
            x--;
            p2 = p2 + (2.0 * b * b * x) - (2.0 * a * a * y) + (a * a);
        }
        disp();
        y = -y;
        disp();
        y = -y;
        delay(50);
    }
    getch();
    closegraph();
    return 0;
}
void disp()
{
    putpixel(xc + x, yc + y, 7);
    putpixel(xc - x, yc + y, 7);
    putpixel(xc + x, yc - y, 7);
    putpixel(xc + x, yc - y, 7);
}
```

```
tabis@LAPTOP-4D7ISNT3 MINGW64 ~/OneDrive/Desktop/cg_pracs
$ ./prac5.exe
*** Ellipse Generating Algorithm ***
Enter the value of Xc   50
Enter the value of yc   60
Enter X axis length     50
Enter Y axis length     30
```

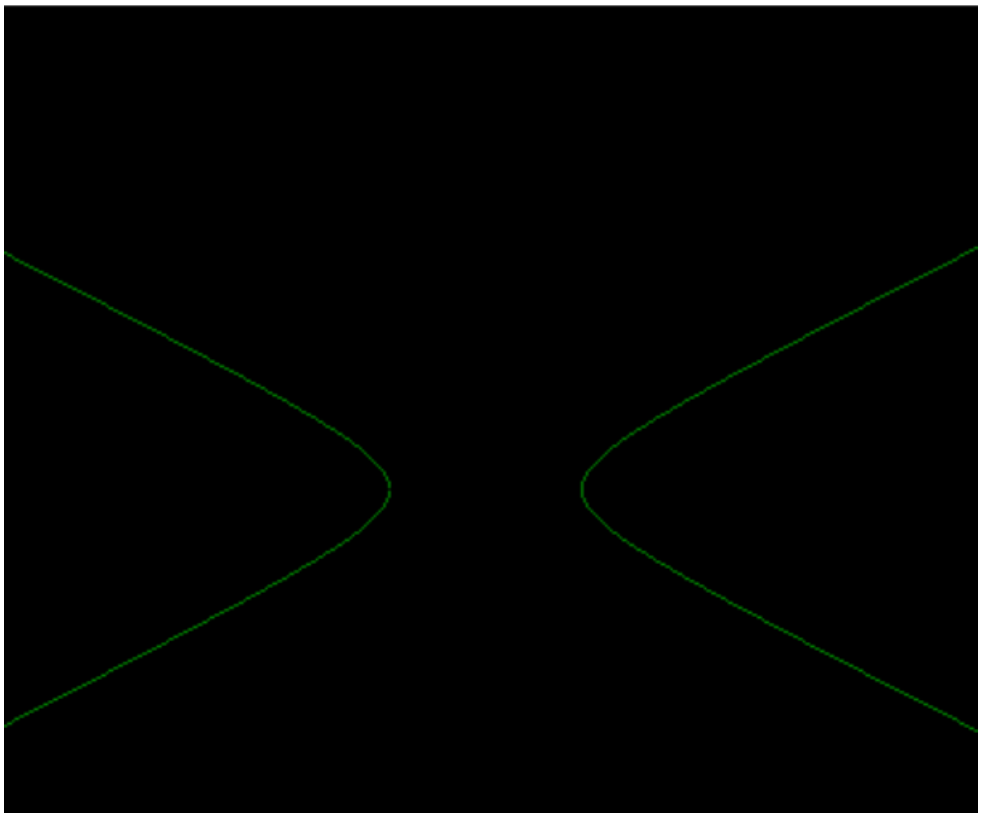
Windows BGI

6. Generating hyperbola using Mid point algorithm

```
#include <bits/stdc++.h>
using namespace std;
#include <graphics.h>
// // Driver program
void draw(int x, int y)
{
    putpixel(x + 200, y + 200, GREEN);
    delay(1);
    putpixel(x + 200, -y + 200, GREEN);
    delay(1);
    putpixel(-x + 200, -y + 200, GREEN);
    delay(1);
    putpixel(-x + 200, y + 200, GREEN);
    delay(1);
}
void hyp(int a, int b)
{
    double p = (float)(1 / 4 + a) * (b * b) - (float)1 * (a * a);
    cout << p << "\n";
    int x = a, y = 0;
    putpixel(x + 200, y + 200, GREEN);
    while (y < (b * b) / (sqrt(a * a - b * b)))
    {
        if (p > 0)
        {
            p = p - (2 * y + 3) * (a * a);
            y = y + 1;
            draw(x, y);
        }
        else
        {
            p = p + (2 * (x + 1) * (b * b)) - (2 * y + 3) * (a * a);
            y = y + 1;
            x = x + 1;
            draw(x, y);
```

```
        }
        cout << p << "\n";
    }
    p = (x + 1) * (x + 1) * b * b - (y + 1 / 2) * (y + 1 / 2) * a * a - a * a * b *
b;
    while (y < 300)
    {
        cout << "aa";
        if (p > 0)
        {
            p = p + (2 * x + 3) * b * b - a * a * (2 * (y + 1));
            y = y + 1;
            x = x + 1;
            draw(x, y);
        }
        else
        {
            p = p + (2 * x + 3) * b * b;
            x = x + 1;
            draw(x, y);
        }
    }
}
int main()
{
    initwindow(1000, 1000);
    int a = 40, b = 20;
    hyp(a, b);
    getch();
    return 0;
}
```

Windows BGI



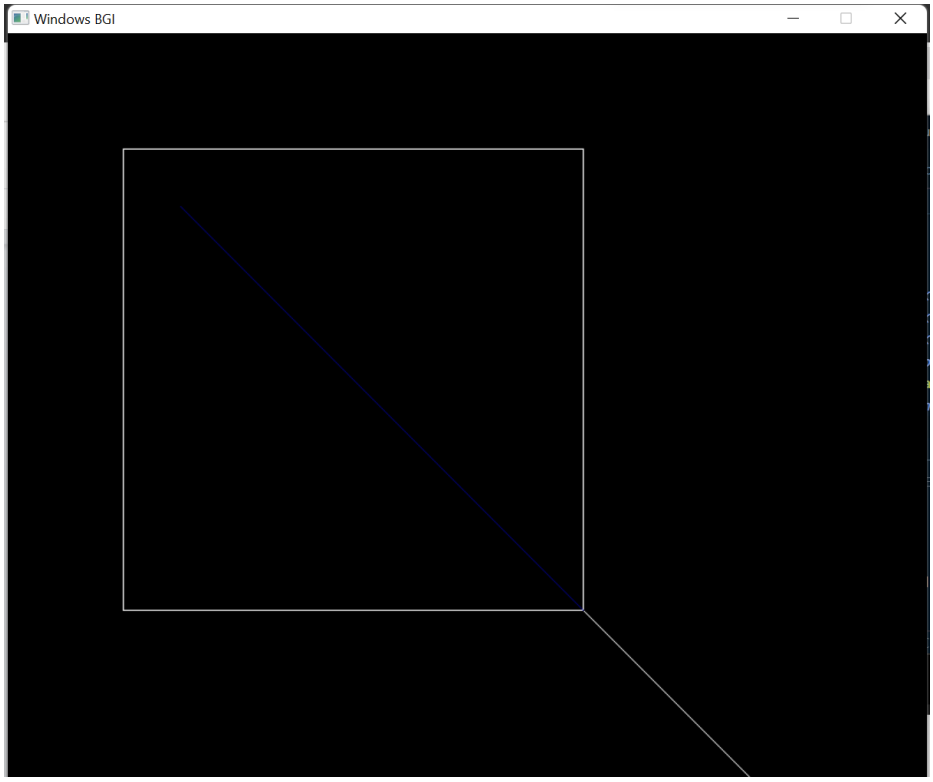
7. Implement Line Clipping approach using Cohen Sutherland

```
#include <bits/stdc++.h>
#include <graphics.h>

using namespace std;
int main()
{
    int t;
    initwindow(800, 800);
    double xmin, xmax, ymin, ymax;
    cout << "Enter xmin xmax ymin ymax\n";
    cin >> xmin >> xmax >> ymin >> ymax;
    rectangle(xmin, ymin, xmax, ymax);
    cout << "No of lines:";
    cin >> t;
    while (t--)
    {
        double x1, y1, x2, y2;
        cout << "Enter x1,y1 x2,y2\n";
        cin >> x1 >> y1 >> x2 >> y2;
        line(x1, y1, x2, y2);
        double slope = (y2 - y1) / (x2 - x1);
        int arr1[4] = {0}, arr2[4] = {0}; // TBRL
        if (x1 > xmax)
            arr1[2] = 1; // Right
        if (x1 < xmin)
            arr1[3] = 1; // Left
        if (y1 > ymax)
            arr1[0] = 1; // Top
        if (y1 < ymin)
            arr1[1] = 1; // Bottom
        if (x2 > xmax)
            arr2[2] = 1;
        if (x2 < xmin)
            arr2[3] = 1;
```

```
        if (y2 > ymax)
            arr2[0] = 1;
        if (y2 < ymin)
            arr2[1] = 1;
        cout << "Region codes are\n";
        cout << "For x1,y1\n";
        for (int i = 0; i < 4; i++)
            cout << arr1[i];
        cout << "\nFor x2,y2\n";
        for (int i = 0; i < 4; i++)
            cout << arr2[i];
        int flag = 1;
        for (int i = 0; i < 4; i++)
        {
            if ((arr1[i] & arr2[i]) == 1)
            {
                cout << "\nClipping not possible\n";
                flag = 0;

                break;
            }
        }
        if (flag)
        {
            cout << endl;
            if (arr1[2])
            {
                y1 += slope * (xmax - x1);
                x1 = xmax;
            }
            if (arr1[3])
            {
                y1 += slope * (xmin - x1);
                x1 = xmin;
            }
            if (arr1[0])
            {
                x1 += (ymax - y1) / slope;
```

```
                y1 = ymax;
            }
            if (arr1[1])
            {
                x1 += (ymin - y1) / slope;
                y1 = ymin;
            }
            if (arr2[2])
            {
                y2 += slope * (xmax - x2);
                x2 = xmax;
            }
            if (arr2[3])
            {
                y2 += slope * (xmin - x2);
                x2 = xmin;
            }
            if (arr2[0])
            {
                x2 += (ymax - y2) / slope;
                y2 = ymax;
            }
            if (arr2[1])
            {
                x2 += (ymin - y2) / slope;
                y2 = ymin;
            }
        }
        cout << "Coordinates of clipped lines are:";
        cout << "(" << x1 << "," << y1 << ")";
        cout << "(" << x2 << "," << y2 << ")" << endl;
        setcolor(1);
        if (flag)
            line(x1, y1, x2, y2);
    }
    getch();
    closegraph();
}
```

```
tabis@LAPTOP-4D7ISNT3 MINGW64 ~/OneDrive/Desktop/cg_pracs
$ ./prac7.exe
Enter xmin xmax ymin ymax
100 500 100 500
No of lines:1
Enter x1,y1 x2,y2
150 150 700 700
Region codes are
For x1,y1
0000
For x2,y2
1010
Coordinates of clipped lines are:(150,150)(500,500)
```

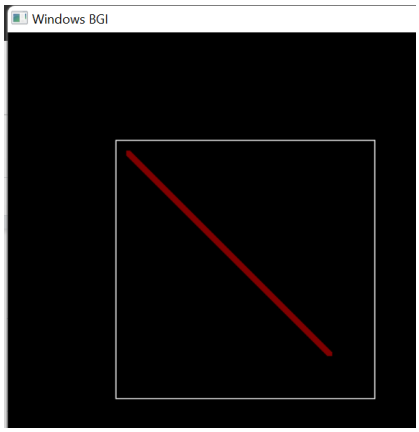


8. Implement Line Clipping approach using Liang Barsky / Cyrus Beck

```
#include <bits/stdc++.h>
#include <graphics.h>

using namespace std;
int xy[4];

void LiangBarsky(float x1, float y1, float x2, float y2) {
  float p[5], q[5];  // left-1 right-2 bottom-3 top-4
  p[1] = x1 - x2, p[2] = x2 - x1, p[3] = y1 - y2, p[4] = y2 - y1;
  q[1] = x1 - xy[0], q[2] = xy[1] - x1, q[3] = y1 - xy[2], q[4] = xy[3] - y1;
  float u1 = 0, u2 = 1;
  for (int i = 1; i < 5; i++) {
    if (p[i] < 0) {
      float r = q[i] / p[i];
      u1 = max(r, u1);
    }
    if (p[i] > 0) {
      float r = q[i] / p[i];
      u2 = min(u2, r);
    }
  }
  if (u1 > u2) {
    cout << "Line is out of clipping window";
    return;
  }
  cout << u1 << " " << u2 << endl;
  float x11 = x1 + u1 * (x2 - x1);
  float x12 = x1 + u2 * (x2 - x1);
  float y11 = y1 + u1 * (y2 - y1);
  float y12 = y1 + u2 * (y2 - y1);
  cout << "\nClipped Line is: (" << x11 << "," << y11 << ") , (" << x12 << "," << y12
<< ")\n\n";
  setcolor(4);
  setlinestyle(0, 0, 6);
  line(x11, y11, x12, y12);
}
```

```
int main() {
  initwindow(800, 800);
  cout << "Enter xmin xmax ymin ymax" << endl;
  cin >> xy[0] >> xy[1] >> xy[2] >> xy[3];
  rectangle(xy[0], xy[2], xy[1], xy[3]);
  cout << "Enter Line Coordinates" << endl;
  float x1, y1, x2, y2;
  cin >> x1 >> y1 >> x2 >> y2;
  setcolor(1);
  setlinestyle(0, 0, 4);
  line(x1, y1, x2, y2);
  LiangBarsky(x1, y1, x2, y2);
  getch();
  return 0;
}
```

```
tabis@LAPTOP-4D7ISNT3 MINGW64 ~/OneDrive/Desktop/cg_pracs
$ ./prac8.exe
Enter xmin xmax ymin ymax
100 340 100 340
Enter Line Coordinates
110 110
300 300
0 1

Clipped Line is: (110,110) , (300,300)
```



9. Implement Line Clipping approach using Mid-Point Subdivision

```
#include <bits/stdc++.h>
#include <graphics.h>
using namespace std;
#define XWMIN 100
#define XWMAX 500
#define YWMIN 100
#define YWMAX 500

int calcCode(int x, int y)
{
    int code = 0;
    if (x < XWMIN) // left
        code |= 1;
    else if (x > XWMAX) // right
        code |= 2;
    if (y < YWMIN) // top
        code |= 4;
    else if (y > YWMAX) // bottom
        code |= 8;
    return code;
}
void clipLine(int &xc1, int &yc1, int &xc2, int &yc2, int x1, int y1, int x2, int y2)
{
    int xc11, yc11, xc12, yc12, xc21, yc21, xc22, yc22;
    int code1 = calcCode(x1, y1), code2 = calcCode(x2, y2);
    if (x1 == (x1 + x2) / 2 && y1 == (y1 + y2) / 2)
    {
        xc1 = x1;
        xc2 = x2;
        yc1 = y1;
        yc2 = y2;
        return;
    }
    if ((code1 | code2) == 0)
    {
        // completely inside
```

```
        xc1 = x1;
        yc1 = y1;
        xc2 = x2;
        yc2 = y2;
        return;
    }
    else if ((code1 & code2) != 0)
    {
        // completely outside
        xc1 = -1;
        yc1 = -1;
        xc2 = -1;
        yc2 = -1;
        return;
    }
    // clipping candidate
    clipLine(xc11, yc11, xc21, yc21, x1, y1, (x1 + x2) / 2, (y1 + y2) / 2);
    clipLine(xc12, yc12, xc22, yc22, (x1 + x2) / 2, (y1 + y2) / 2, x2, y2);
    if (xc21 == xc12 && yc21 == yc12)
    {
        xc1 = xc11;
        yc1 = yc11;
        xc2 = xc22;
        yc2 = yc22;
    }
    else if (xc11 == -1 && xc21 == -1 && yc11 == -1 && yc21 == -1)
    { // first point invalid
        xc1 = xc12;
        xc2 = xc22;
        yc1 = yc12;
        yc2 = yc22;
    }
    else
    { // second point invalid
        xc1 = xc11;
        xc2 = xc21;
        yc1 = yc11;
        yc2 = yc21;
```

```
    }
}
int main()
{
    initwindow(800, 800);
    int x0, y0, x1, y1;
    cout << "Enter first point: ";
    cin >> x0 >> y0;
    cout << "Enter second point: ";
    cin >> x1 >> y1;
    rectangle(XWMIN, YWMIN, XWMAX, YWMAX);
    line(x0, y0, x1, y1);
    int xc1, yc1, xc2, yc2;
    clipLine(xc1, yc1, xc2, yc2, x0, y0, x1, y1);
    if (xc1 != -1 && yc1 != -1 && xc2 != -1 && yc2 != -1)
    line(xc1, yc1, xc2, yc2);
    cout << xc1 << " " << yc1 << "   " << xc2 << " " << yc2 << endl;
    getch();
    return 0;
}
```

```
tabis@LAPTOP-4D7ISNT3 MINGW64 ~/OneDrive/Desktop/cg_pracs
$ ./prac9.exe
Enter first point: 50 70
Enter second point: 25 70
-1 -1   -1 -1
```