United Technical College, Bharatpur, Chitwan

Lab 7

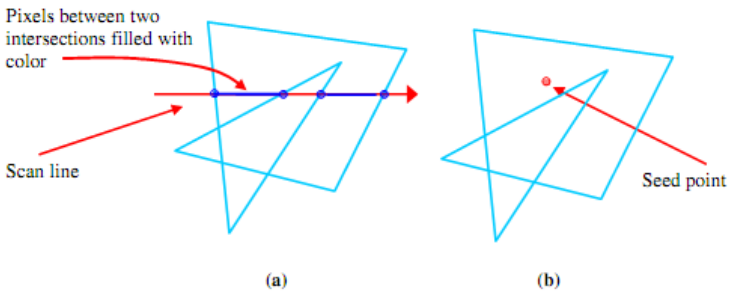
Scan Line Algorithm

Date Assigned: Dec 26, 2022	Date Due: Jan 06, 2023

Introduction:

Scan line algorithm and seed fill algorithm

Two basic approaches are followed in area filling on raster systems. In the first approach overlap intervals for scan lines that cross the area are determined per scan line. Remember that a scan line is a horizontal line of pixels that can be plotted on the display device when the electron beam traverses the display area horizontally during one horizontal retrace. Second approach begins with an interior point and fills the area moving outward from this point until the boundary condition is reached. An algorithm following the first approach is classified as scan line algorithm and that falling under second class is called seed fill algorithm. Simple objects such as polygons, circles etc. are efficiently filled with scan line fill algorithms and more complex regions use the seed fill method. The scan line algorithm is mostly used in general graphics packages.



Let us begin with scan line polygon fill algorithm. Notice that polygons can be as simple as a triangle and could be as complicated as the one shown in Figure below.

These are self intersecting polygons. We broadly keep the polygons in one of the three categories (i) convex (ii) concave (iii) self intersecting. Mathematically, a self intersecting polygon is concave. You will deal with such polygons in greater details for the purpose of area filling.

C++ Coding:

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

//Declaration of class point
class point
{
   public:
   int x,y;
};

class poly
{
   private:
      point p[20];
      int inter[20],x,y;
      int v,xmin,ymin,xmax,ymax;
   public:
      int c;
      void read();
      void calcs();
      void display();
      void ints(float);
      void sort(int);
};
```

```
void poly::read()
{
   int i;
   cout<<"\n\t SCAN_FILL ALGORITHM";
   cout<<"\n Enter the no of vertices of polygon:";
   cin>>v;
   if(v>2)
   {
      for(i=0;i<v; i++) //ACCEPT THE VERTICES
      {
         cout<<"\nEnter the co-ordinate no.- "<<i+1<<" : ";
         cout<<"\n\tx"<<(i+1)<<"=";
         cin>>p[i].x;
         cout<<"\n\ty"<<(i+1)<<"=";
         cin>>p[i].y;
      }
      p[i].x=p[0].x;
      p[i].y=p[0].y;
      xmin=xmax=p[0].x;
      ymin=ymax=p[0].y;
   }
   else
      cout<<"\n Enter valid no. of vertices.";
}
//FUNCTION FOR FINDING
void poly::calcs()
{ //MAX,MIN
   for(int i=0;i<v;i++)
   {
      if(xmin>p[i].x)
      xmin=p[i].x;
      if(xmax<p[i].x)
      xmax=p[i].x;
      if(ymin>p[i].y)
      ymin=p[i].y;
      if(ymax<p[i].y)
      ymax=p[i].y;
   }
}
//DISPLAY FUNCTION
void poly::display()
{
   int ch1;
   char ch='y';
   float s,s2;
   do
   {
```

```
      cout<<"\n\nMENU:";
      cout<<"\n\n\t1 . Scan line Fill ";
      cout<<"\n\n\t2 . Exit ";
      cout<<"\n\nEnter your choice:";
      cin>>ch1;
      switch(ch1)
      {
         case 1:
            s=ymin+0.01;
            delay(100);
            cleardevice();
            while(s<=ymax)
            {
               ints(s);
               sort(s);
               s++;
            }
            break;
         case 2:
            exit(0);
      }

      cout<<"Do you want to continue?: ";
      cin>>ch;
   }while(ch=='y' || ch=='Y');
}

void poly::ints(float z) //DEFINE FUNCTION INTS
{
   int x1,x2,y1,y2,temp;
   c=0;
   for(int i=0;i<v;i++)
   {
      x1=p[i].x;
      y1=p[i].y;
      x2=p[i+1].x;
      y2=p[i+1].y;
      if(y2<y1)
      {
         temp=x1;
         x1=x2;
         x2=temp;
         temp=y1;
         y1=y2;
         y2=temp;
      }
      if(z<=y2&&z>=y1)
      {
```

```
        if((y1-y2)==0)
        x=x1;
        else // used to make changes in x. so that we can fill our polygon after cerain distance
        {
           x=((x2-x1)*(z-y1))/(y2-y1);
           x=x+x1;
        }
        if(x<=xmax && x>=xmin)
        inter[c++]=x;
     }
   }
}

void poly::sort(int z) //SORT FUNCTION
{
   int temp,j,i;

      for(i=0;i<v;i++)
      {
         line(p[i].x,p[i].y,p[i+1].x,p[i+1].y); // used to make hollow outlines of a polygon
      }
      delay(100);
      for(i=0; i<c;i+=2)
      {
         delay(100);
         line(inter[i],z,inter[i+1],z);  // Used to fill the polygon ....
      }
}

int main() //START OF MAIN
{
   int cl;
   initwindow(500,600);
   cleardevice();
   poly x;
   x.read();
   x.calcs();
   cleardevice();
   cout<<"\n\tEnter the colour u want:(0-15)->"; //Selecting colour
   cin>>cl;
   setcolor(cl);
   x.display();
   closegraph(); //CLOSE OF GRAPH
   getch();
   return 0;
}
```

Output: