Filled Area Primitives :

A standard output primitive in general graphic package is solid color or patterned polygon area. Other kinds of area primitives are available but polygons are easier to process since they have linear boundaries.

2m There are two basic approaches to fill the area on raster system.

1. To fill an area is to determine the overlap intervals for the scan lines that cross the area.

2. Area filling is to start from given interior position and paint outward from this point until we encounter the specified boundary condition.

Scan line approach is used in general graphic packages like circle, polygon, ellipse and other simple curves

Fill method starting from interior point are useful with more complex boundaries and interactive painting system.

Scan line Polygon Fill Algorithm:

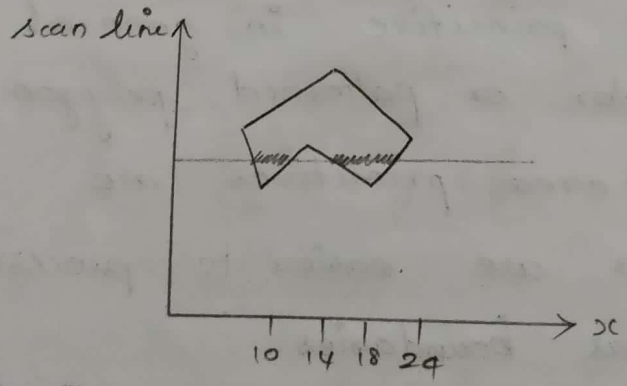
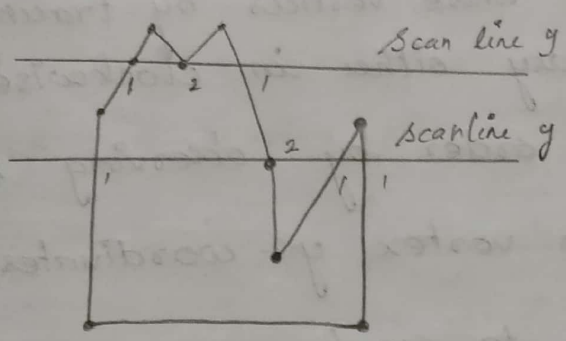


Fig: Interior pixels along a scan line passing through a polygon area.

The above figure illustrates the scanline procedure for solid filling of polygon areas. For each scan line ~~passing~~ crossing the polygon,

area fill algorithm locates the intersecting points of the scanline with polygon edges. These intersection points are then sorted from left to right and corresponding frame buffer positions between the each intersection pair are set to specify fill color.

In figure, the 4 pixel section intersection position with polygon boundaries define two stretches of interior pixels of $x = 10$ to $x = 14$ and from $x = 18$ to $x = 24$.



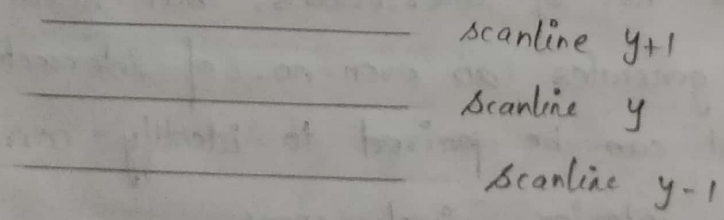
Intersection points along scanline that intersects polygon vertices scanline y generates an odd no. of intersections, but scan line y' generates an even no. of intersection that can be paired to identify correctly the interior pixel spans.

Fig. 2 shows 2 scanline at position y and y' that intersect edge endpoints. Scanline y intersects 5 polygon edges. Scanline y' intersects an even no. of edges although it also passes through

identifies the interior pixel spans. But with scanline y we need to do some additional processing to correct interior points.

For scanline y two intersecting edges sharing a vertex are on opposite sides of the scanline. But for scanline y', two intersecting edges are both above the scanline. Thus the vertices that require additional processing are those that have connecting edges on the opposite sides of the scanline.

We can identify these vertices by tracing around the polygon boundary either in clockwise or counter clockwise order by observing the relative changes in vertex y-coordinates. As we move from edge to next.



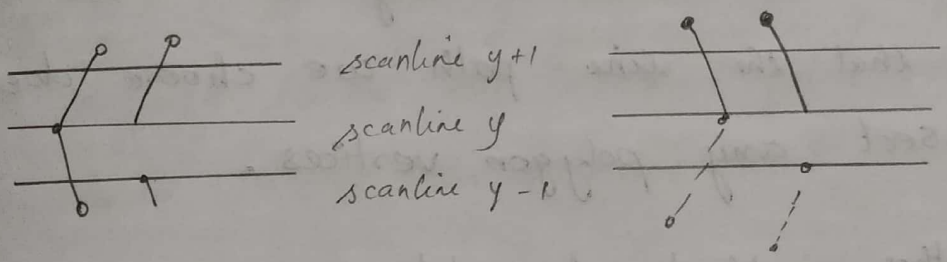
Coherence:

The properties of one part of a scene are related in some way to other parts of the scene so that relationship can be used to reduce processing.

Coherence method often involves incremental calculations applied along a single scan line or between successive scan line.

Note:

Shortning of an edge: when the end point y coordinates of two edges are increasing, the y-value of upper end point for the current edges decrease by 1. When end point y values are monotonically decreasing, we derease the y-coordinate of upper end point of the edge following the current edge.



INSIDE OUTSIDE TEST: 8m.

Polygon is defined as having no self intersection example of standard polygon include triangle, rectangle, octagons decagons,. the component edges of these objects are joint only at the vertices and otherwise the edges have no common point in the plane. Identifying the interior regions of standard polygon is generally a straight forwaid process.

Graphic packages normally use odd-even rule or non-zero ~~binding rule~~ winding number rule to identify the interior regions of an object.

Odd-even rule also called odd-parity rule or even-odd rule. Drawing a line from any position p to a distant point outside the coordinate extends of the object and counting the no. of edge crossing along the line. If no. of polygon edges cross by this line is odd. then p is an interior point otherwise the p is an exterior point.

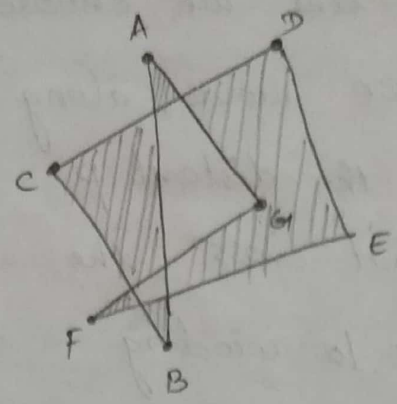
To obtain an accurate edge count we must be sure that the line path we choose does not intersect any polygon vertices.

Another method for defining interior regio is non-zero winding number rule which counts the no. of times, the polygon edges wind around a particular point in the counter clockwise direction. This count is called winding number. On the interior point of an 2D object are defined to be those that have a non-zero value for

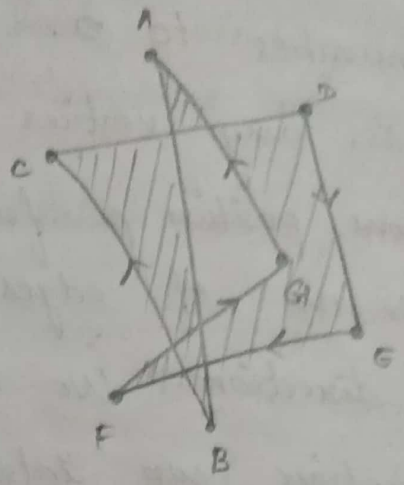
winding number rule to polygons by initializing the winding number to 0. The line we choose must not pass any vertices as we move along the line from position P from the distant P we count the no. of edges that cross the line in each direction. We add 1 to winding number, everytime we intersect the polygon edge that crosses the line from right to left and we subtract one, everytime we intersect edge that crosses from left to right. Final value of winding number after all edge crossing have been counted determine the relative position of P. If winding number is non-zero then P is defined to be an interior point otherwise P is taken to be an exterior point.

For standard polygons and other simple shapes, non-zero winding number rule and odd-even rule give the same results. But for more complicated shapes, two methods may yield different interior and exterior regions.

08:01:2018

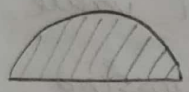


odd even rule



Non-zero winding number rule.

shaded - interior.

 - Elliptical arc interior fill

Scanline fill of curved boundary areas:

Scanline fill of regions with curved boundaries requires more work than polygon filling. Since intersection calculations involves non-linear boundaries for simple curves such as circles or ellipse performing a scanline fill is a straight forward process. We only need to calculate two scanline intersections on the opposite sides of the curves. This is same as generating pixel position along the curve boundary by using midpoint method

we simply fill in by horizontal pixel span between the boundary points on the opposite sides of the curve.

Symmetries between ~~coordinates~~ ~~(between)~~ quadrants (between octants) for are used to reduce the boundary calculations.

Interior region is bounded by the ellipse section and the straight line segment that closes the curve by joining the begning and the ending positions of the arc.

BOUNDARY FILL ALGORITHM: 2M or 4M.

Paint the interior untill reach the boundary.

Another approach to area filling is to start at a point inside the region and paint the interior outward to the boundary.

If the boundary is specified in a single color the fill algorithm proceeds outward pixel by pixel untill the boundary color is encountered. This method is called boundary fill algorithm. It is very useful in interactive painting packages. where interior points are easily selected

4- connected 8- connected.


A boundary fill procedure accepts as input the coordinates of an interior point (x, y), a fill color and a boundary color. Starting from (x, y) the procedure test neighbouring positions to determine whether they are of boundary color if not, they are painted with fill color. and their neighbours are tested. This process continues untill all pixels upto the boundary color for the area have been tested.

Color boundary for boundary fill procedure.

Flood Fill Algorithm: 2M or 4M.

We want to fill in ((or) recolor). the area that is not defined within a single color boundary

Multiple color boundary to represent a

This diagram shows the area bordered by several different color regions. We can paint such areas by replacing the specified interior color instead of searching for a boundary color value. This approach is called flood fill algorithm.

We start from a specified interior point (x,y) and reassign all pixel values that are currently said to a given interior color with a desired fill color. If the area we want to paint as more than one interior color we can first reassign the pixel values so that all interior points have the same color.

In this approach we stack only the begning positions for those pixel spans having the value old color. Starting at the first position of each span the pixel values are replaced until a value other than old color is encountered.

Character Generation :

Overall design style for a set (or family) of characters is called type phase. (or fonts).

Type phase is divided into 2 groups.

1). serif.

2.) sans