The incremental calculation of x intercepts along an edge for successive scan lines can be expressed as:

$$x_{k+1} = x_k + \frac{\Delta x}{\Delta y}$$

Calculations performed in graphics algorithm typically take advantage of various "coherence" properties of a scene that is to be displayed.

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

Coherence methods often involve incremental calculations applied along a single scan line or between successive scan lines.

Inside-Outside Tests

In area-filling algorithms, graphics processes often need to identify interior regions of objects. But, it is not always clear which regions of the 'xy' plane we should call "interior" and which regions we should designate as "exterior" to the object. Graphics packages normally use either the odd-even rule or the non-zero winding number rule to identify interior regions of an object. i.e.

1) odd parity rule or odd-even rule or even-odd rule
2) Winding Number Method (Non-zero winding Number Rule)

1. Even-odd Rule (odd parity or odd-even)

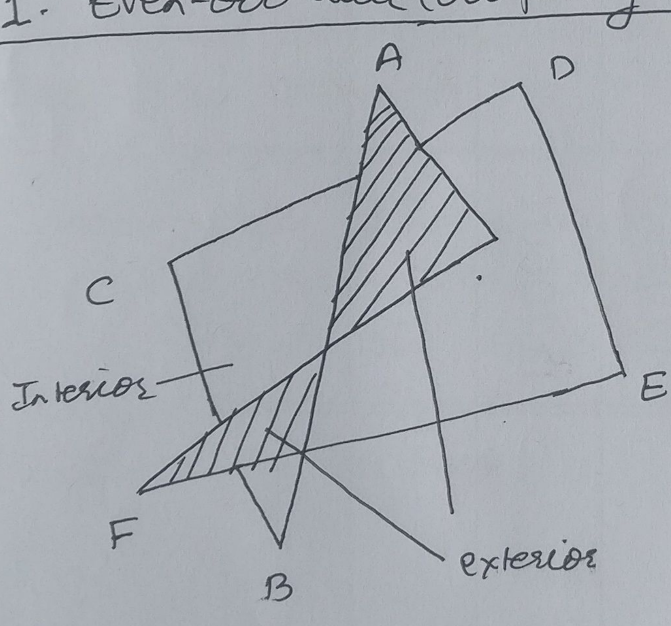

Fig. a
Odd Even rule

Here we apply a line from any position 'p' to a distant point outside the coordinate extents of the object and counting the number of edge crossing along the line. If the number of

Polygon edges crossed by this line is odd, then P is an interior point. Otherwise, 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. Above figure shows the interior and exterior regions obtained from the odd-even rule for a self-intersecting set of edges. The scan-line polygon fill algorithm discussed in previous topic is an example of area filling using the odd-even rule.

2. Nonzero winding number rule:

This methods counts the number of times the polygon edges wind around a particular point in the counterclockwise direction. This count is called the winding number and the interior points of a two-dimensional object are defined to be those that have a non-zero value for the winding number. We apply the nonzero winding number rule to polygons by initializing the winding number to 0 and ~~[illegible]~~ again imagining a line drawn from any position P to a distant point beyond the coordinate extents of the object. The line we choose must not pass through any vertices.

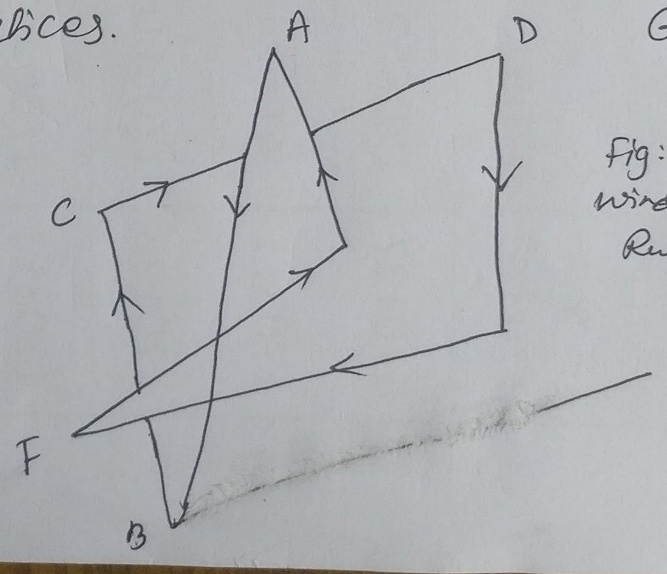

Fig: Nonzero winding number Rule.

~~Scan-fill~~

Scan-Line Fill of Curved Boundary Areas:

The intersection calculations in curved boundaries involve nonlinear boundaries. For simple curves such as circles or ellipses, performing a scan-line fill is a straightforward process: We only need to calculate the two scan-line intersection on opposite sides of the curve. This is same as generating pixel position along the curve boundary, and we can do that with the midpoint method. Then we simply fill in the horizontal pixel spans between the boundary points on opposite sides of the curve.

Similar methods can be used to generate a fill area for a curve section. An elliptical arc: The interior region is bounded by the ellipse section and a straight-line segment that closes the curve by joining the beginning and ending positions of the arc. Symmetrices and incremental calculations are exploited whenever possible to reduce compilations

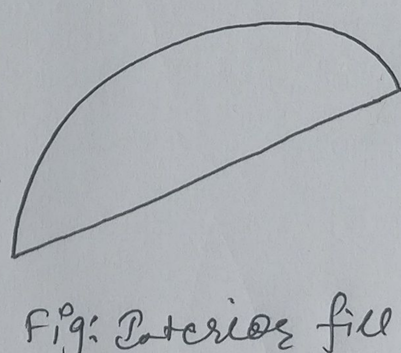

Fig: Interior fill of an elliptical arc.