SOMAIYA VIDYAVIHAR UNIVERSITY
K J Somaiya College of Engineering

Introduction to Computer Graphics and Visualization

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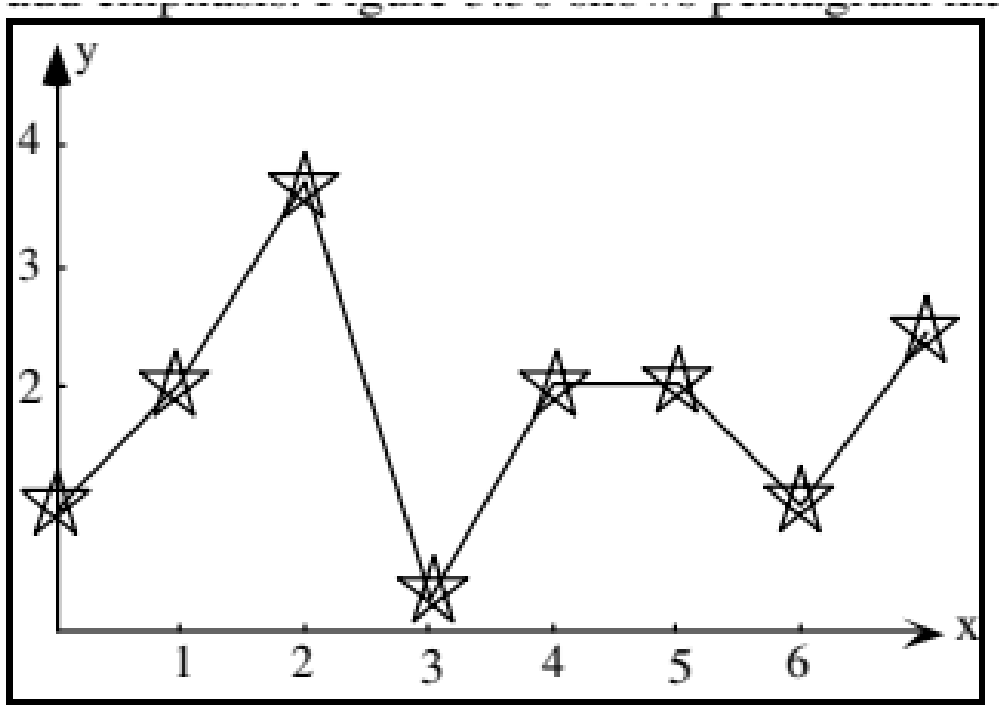
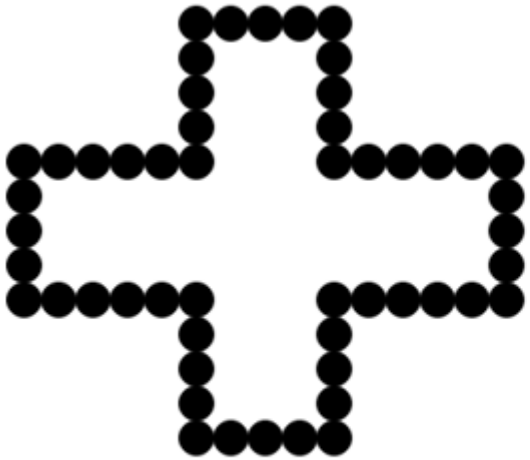
Practice Program: Placing markers for emphasis.

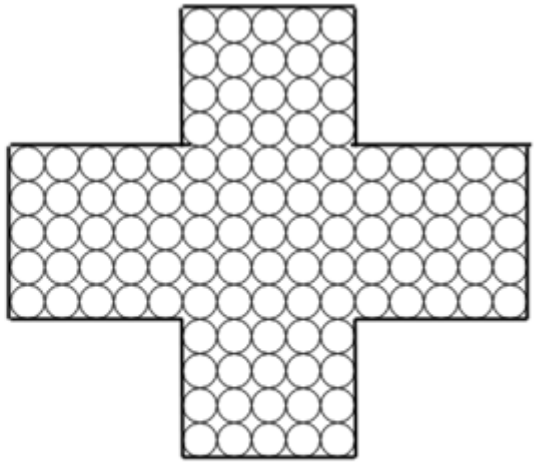


Fill area Primitives

- Area filling is a method or process that helps us to fill an object, area, or image.
- We can easily fill the polygon.
- The polygon filling is defined as filling or highlighting all the pixels.
- The pixels appear inside the polygon shape with any color other than the background color.
- There are two algorithms or methods used to fill the polygon.
  - **Seed Fill Algorithm**
  - **Scan Line Algorithm**



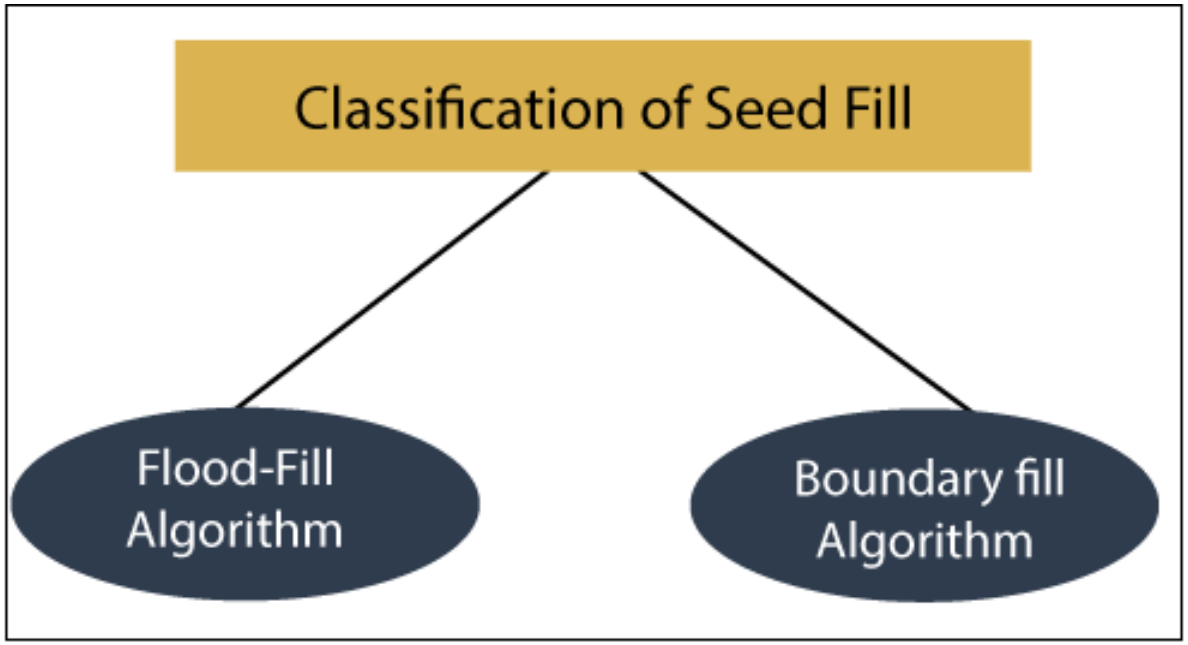
Boundary Filled Region



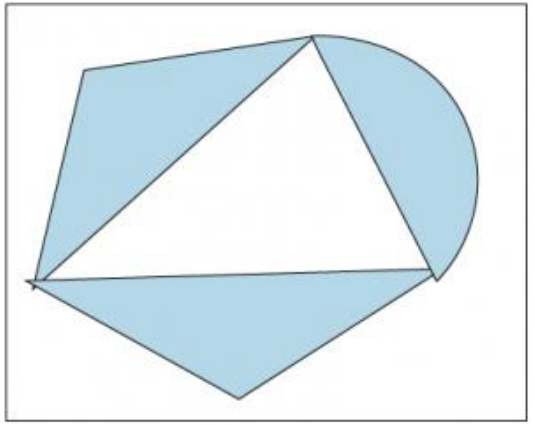
Interior or Flood Filled Region

1. Four connected approaches: In this approach, left, right, above, below pixels are tested.
2. Eight connected approaches: In this approach, left, right, above, below and four diagonals are selected.

Seed Fill Algorithm



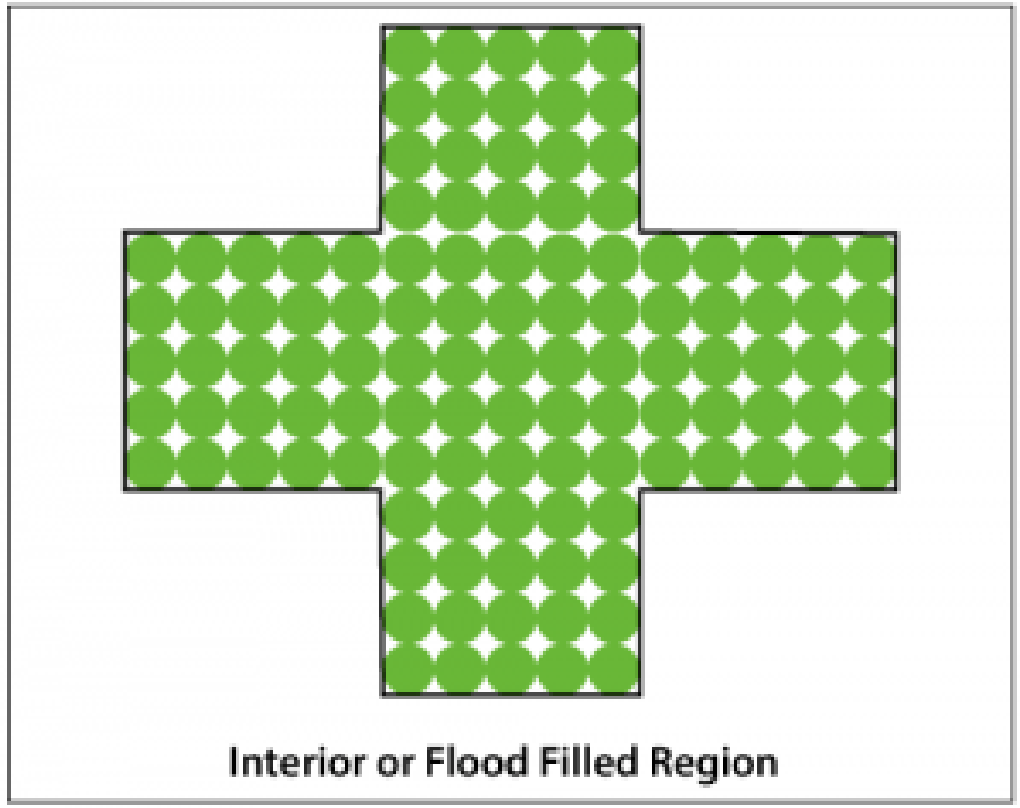
Flood-fill Algorithm



- Flood-fill algorithm helps to define a region in the boundary, attached to a point in the multi-dimensional array.
- It is similar to the bucket tool used in the paint program.
- The stack-based recursive function is used to implement the algorithm.
- In flood -fill algorithm, we replace all the associated pixels of the selected color with a fill color.
- We also check the pixels for a particular interior color, not for boundary color.

Algorithm of Flood-fill

```
Procedure floodfill (x, y,fill_ color, old_color: integer)
    If (getpixel (x, y)=old_color)
   {
    setpixel (x, y, fill_color);
    fill (x+1, y, fill_color, old_color);
     fill (x-1, y, fill_color, old_color);
    fill (x, y+1, fill_color, old_color);
    fill (x, y-1, fill_color, old_color);
     }
}
```


Interior or Flood Filled Region

Advantages of Flood-fill algorithm

- It provides an easy way to fill color in graphics.
- The Flood-fill algorithm colors the whole area through interconnected pixels by a single color.
- The algorithm fills the same color inside the boundary.

Disadvantage

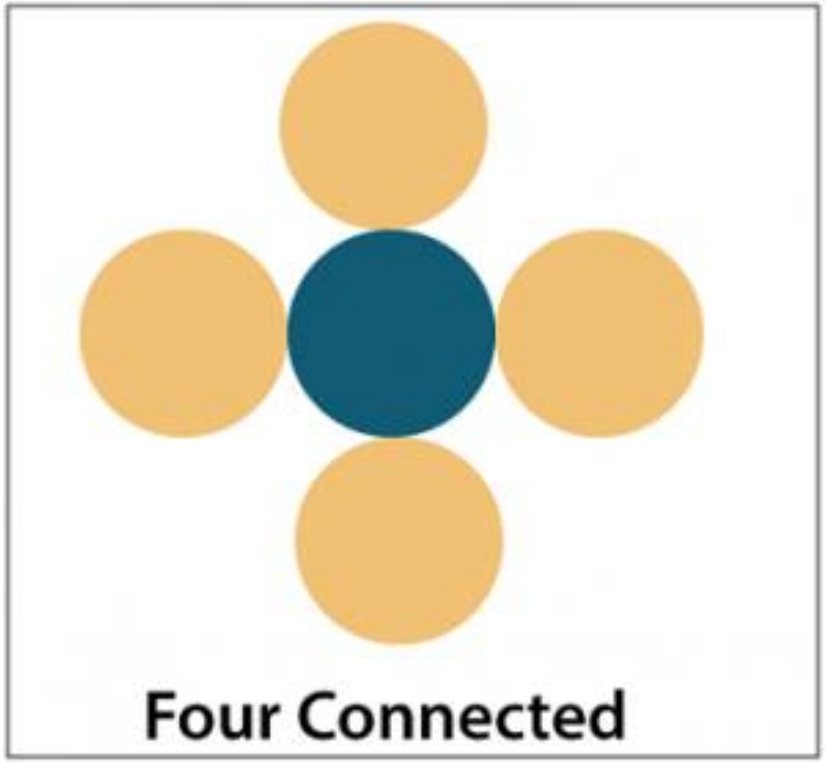
- Very slow algorithm
- May be fail for large polygons
- Initial pixel required more knowledge about surrounding pixels.

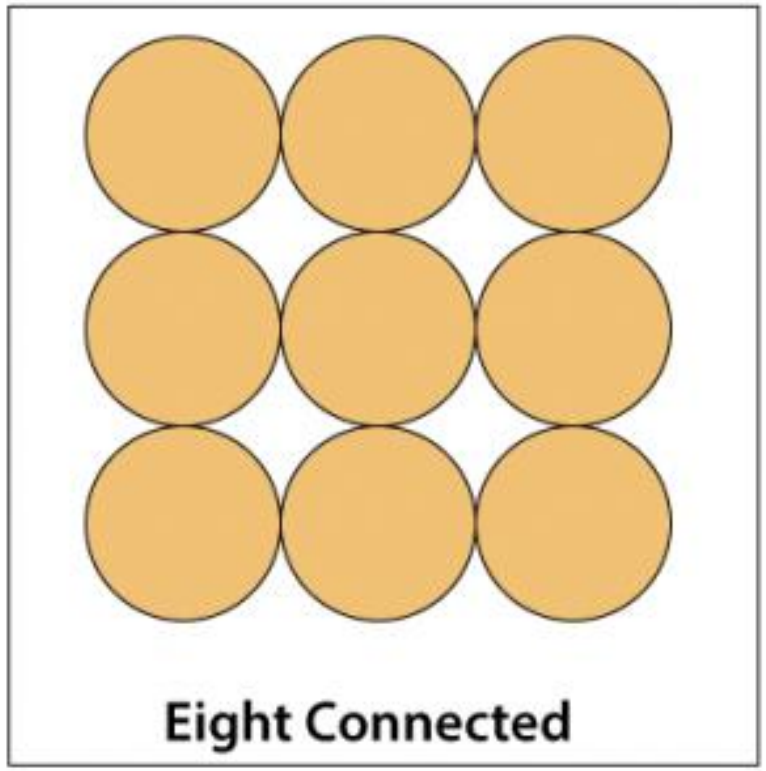
Boundary-fill Algorithm

- It is also known as the **“Edge-fill algorithm.”**
- The boundary fill algorithm is used for area filling.
- To create an attractive painting.
- If the object has a particular boundary in a single color, then the algorithm travels each pixel until it reaches the boundary.


Boundary Filled Region

4-connected and **8-connected** methods





Algorithm of Boundary-fill

Procedure boundary fill (p, q, fill color, boundary)

Step 1: Initialize the boundary of the region.

Step 2: Get the interior pixel (p, q). Now, define an Integer called current pixel and assign it to (p, q).

Current = getpixel (p, q)

Step 3: If

(current pixel != boundary) and (current pixel != fill)

Then

Setpixel(p, q, fill);

Boundary fill (p+1, q, fill, boundary);

Boundary fill (p-1, q, fill, boundary);

Boundary fill (p, q+1, fill, boundary);

Boundary fill (p, q-1, fill, boundary);

Step 4: End;

Problems with Boundary-fill algorithm

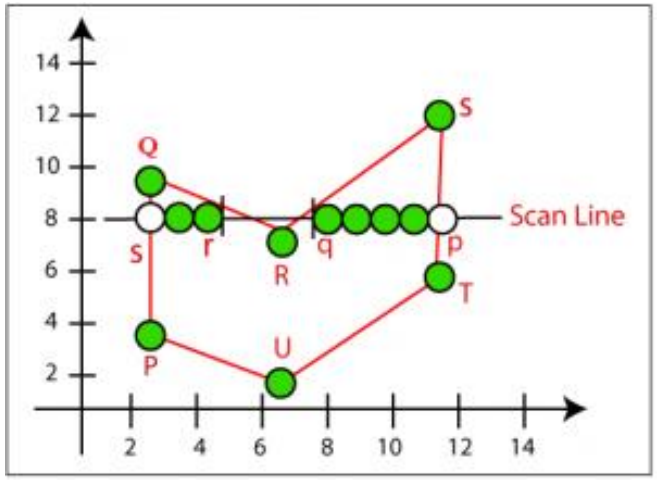
- Sometimes it may not fill all the regions.
- In the 4-connected method, it does not fill corner pixels. Because it only checks the adjacent position of the pixel.

Scan-Line Algorithm

- The Scan-Line Algorithm is an area filling algorithm
- Filling the polygons through horizontal lines or scan lines.
- The scan-line intersects the edges of the polygon, and the polygon is filled between pairs of the intersection.
- The main purpose of this algorithm is to fill color in the interior pixels of the polygon.

Special Cases of Polygon Vertices

- There are two special cases of polygon vertices which are given below:
  - If both lines intersecting at the vertex lies on the same side of the scan line, then we will consider it as two points.
  - If both lines intersecting at the vertex lies on the other side of the scan line, then we will consider it as a single point only.



Algorithm of Scan line polygon-fill

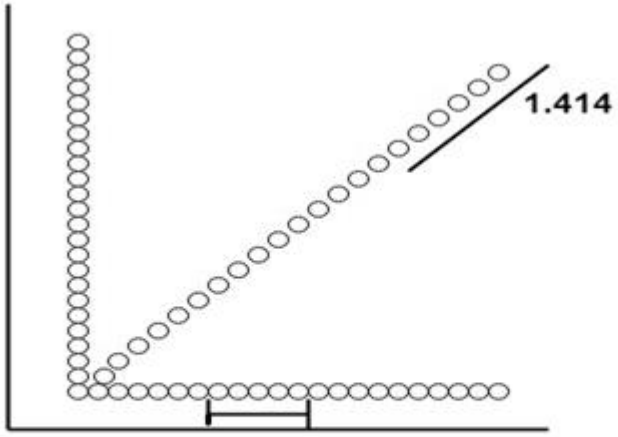
Step 1: Find the intersection points of the scan line that have edges.

Step 2: Now sort the intersection points by increasing the x coordinate from left to right.

Step 3: Now, we perform the pairing of the intersection points and fill the color inside the pixel pairs.

Cons

- 1. Staircase or Jagged: Staircase like appearance is seen while the scan was converting line or circle.
- 2 Unequal Intensity: It deals with unequal appearance of the brightness of different lines. An inclined line appears less bright as compared to the horizontal and vertical line.



Pixels along with horizontal line are 1 unit apart and vertical.
Pixels along diagonal line are 1.414 units.

Thank you