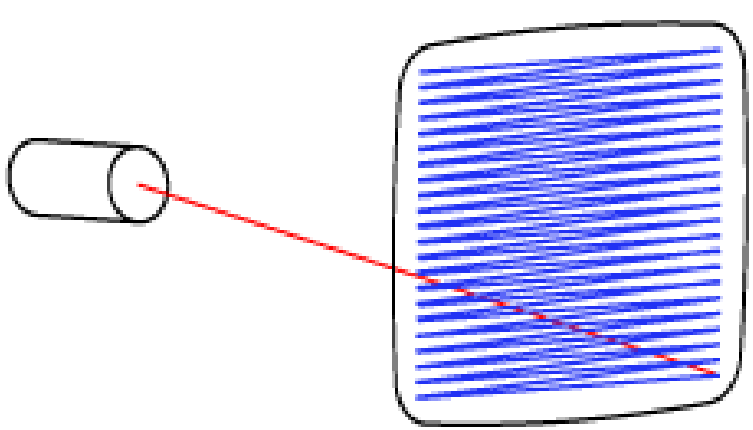
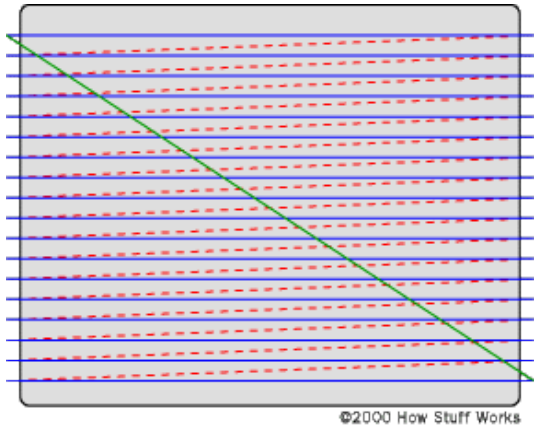
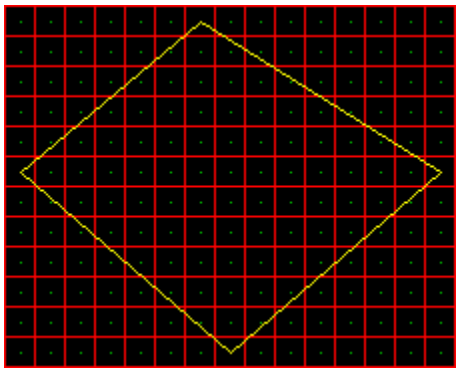
70's: Polygon Scan Conversion

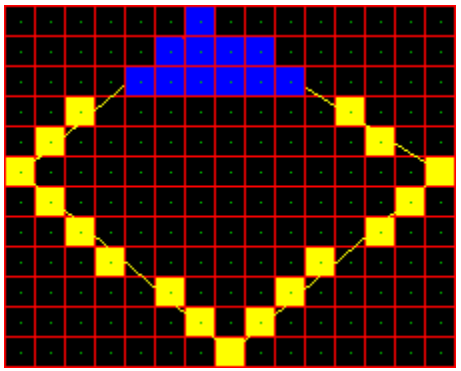
- Raster scan display became available.
- It consists of a number of scan lines from top to bottom, and each scan line consists of a number of dots. In other words, a screen consists of N x M pixels, where N is the number of rows and N is the number of columns.

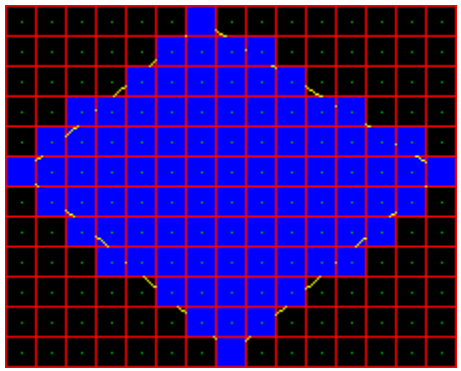




- When a polygon shape in 3D space is projected on to the display plane, a process is called rasterization that fills all pixels covered by the polygon, in a line by line fashion, as illustrated below:







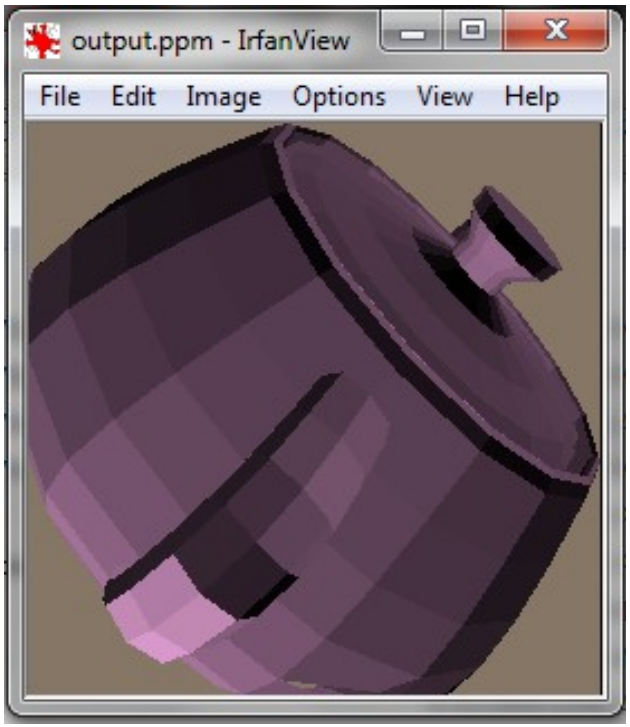
- Assume a scene consists of K objects, O_0, O_1, ……, O_{k-1}, and each object O_i is modeled by N_i polygons. A polygon scan conversion graphics algorithm will process them in the following style (called the object-precision method):

```
for each object Oi, i = 0, ……, K-1
    for each polygon Pj in object Oi, j = 0, ……, Nj
    {
        project polygon on to the image plane;
        fill the pixels covered by the polygon
            with proper shading;
    }
```

- In order to display each polygon with the proper shading under a given illumination condition, a shading model is employed. The most popular shading model used in computer graphics is the Phong illumination model that is an approximation of physical model.

- In order to display only visible polygons, a process, called hidden surface removal, is applied. The most popular hidden surface removal technique is the Z-buffer algorithm.

- Examples of polygon scan conversion images:



- By generating shading values at vertices of polygons, and then interpolating them cross each polygon, images with smooth shading can be produced very efficiently: