FACULTY OF ENGINEERING & TECHNOLOGY

BCS -504 Computer Graphics & Multimedia

Lecture-24

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➤ **GOURAUD SHADING**

Gouraud shading

This Intensity-Interpolation scheme, developed by Gouraud and usually referred to as Gouraud Shading, renders a polygon surface by linear interpolating intensity value across the surface. Intensity values for each polygon are coordinate with the value of adjacent polygons along the common edges, thus eliminating the intensity discontinuities that can occur in flat shading.

Each polygon surface is rendered with Gouraud Shading by performing the following calculations:

1. Determining the average unit normal vector at each polygon vertex.

2. Apply an illumination model to each vertex to determine the vertex intensity.

3. Linear interpolate the vertex intensities over the surface of the polygon.

At each polygon vertex, we obtain a normal vector by averaging the surface normals of all polygons staring that vertex as shown in fig:
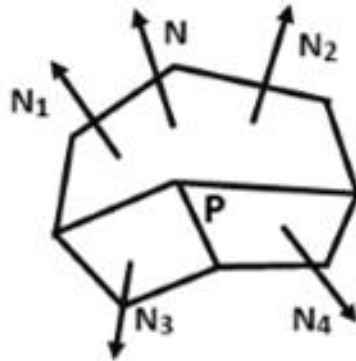

Fig: The normal vertex at vertex V is calculated as the average of surface normal for each polygon sharing the vertex.

Thus, for any vertex position V, we acquire the unit vertex normal with the calculation

$$N_V = \frac{\sum_{k=1}^{n} N_k}{\left|\sum_{k=1}^{n} N_k\right|}$$

Once we have the vertex normals, we can determine the intensity at the vertices from a lighting model.

Following figures demonstrate the next step: Interpolating intensities along the polygon edges. For each scan line, the intensities at the intersection of the scan line with a polygon edge are linearly interpolated from the intensities at the edge endpoints. **For example:** In fig, the polygon edge with endpoint vertices at position 1 and 2 is intersected by the scanline at point 4. A fast method for obtaining the intensities at point 4 is to interpolate between intensities I_1 and I_2 using only the vertical displacement of the scan line.
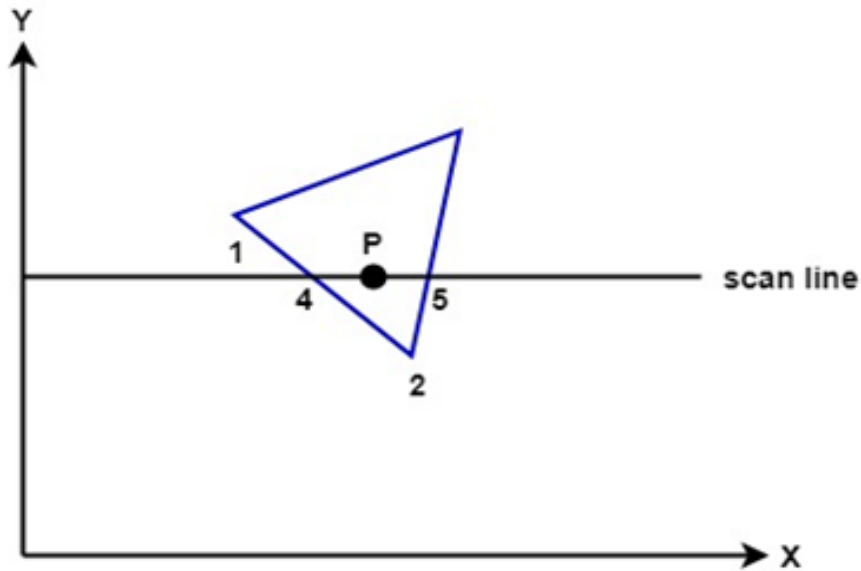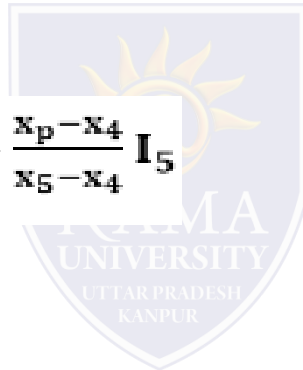
Gouraud shading

Fig: For Gouraud Shading, the intensity at point 4 is linearly interpolated from the intensities at vertices 1 and 2. The intensity at point 5 is linearly interpolated from intensities at vertices 2 and 3. An interior point P is then assigned an intensity value that is linearly interpolated from intensities at position 4 and 5.

$$I_4 = \frac{y_4 - y_2}{y_1 - y_2} I_1 + \frac{y_1 - y_4}{y_1 - y_2} I_2$$

Gouraud shading

Similarly, the intensity at the right intersection of this scan line (point 5) is interpolated from the intensity values at vertices 2 and 3. Once these bounding intensities are established for a scan line, an interior point (such as point P in the previous fig) is interpolated from the bounding intensities at point 4 and 5 as

$$I_P = \frac{x_5 - x_p}{x_5 - x_4} I_4 + \frac{x_p - x_4}{x_5 - x_4} I_5$$

Incremental calculations are used to obtain successive edge intensity values between scan lines and to obtain successive intensities along a scan line as shown in fig:
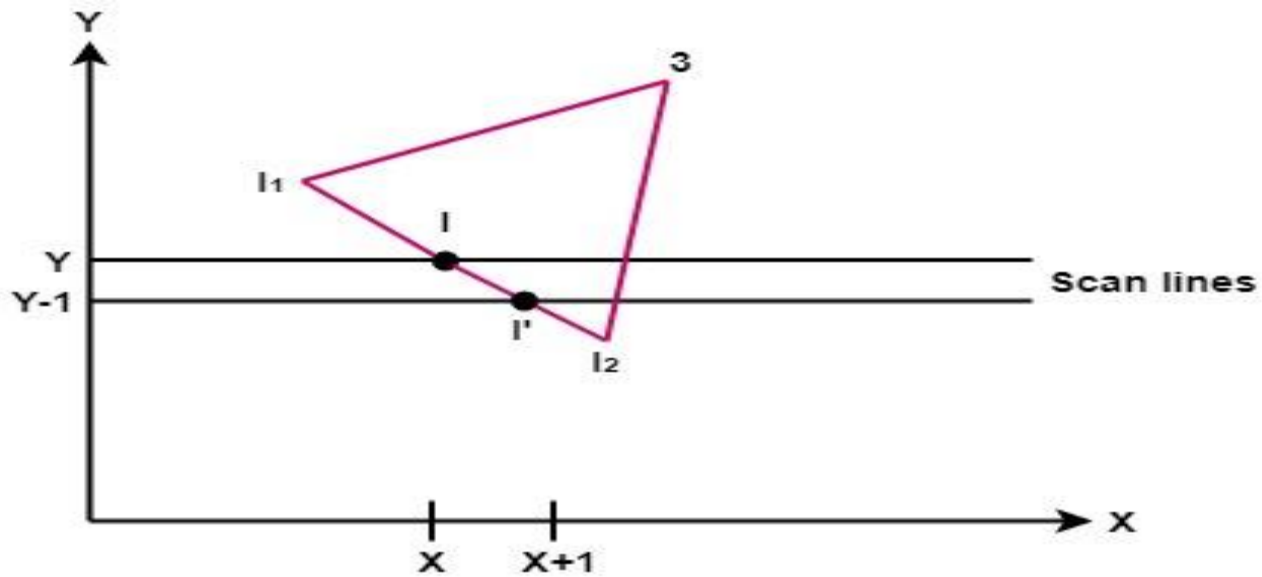
Fig: Incremental Interpolation of intensity value along a polygon edge for successive scan lines.

MUTIPLE CHOICE QUESTIONS:

Sr no	Question	Option A	Option B	OptionC	OptionD
1	An application program is …………...in the system memory along with a graphics package	input	stored	both a & b	none of these
2	Graphics commands in the application program are translated by the graphics package into a display file stored in the …………..	system memory	destop memory	application memory	none of these
3	Display file is used by display processor to refresh the …………	destop	screen	application	All of these
4	The display processor in random scan system is also known as display processing unit or a …………..	graphics controlized	graphics collection	graphics controller	All of these
5	In this system graphics platform are drawn on …………. by directing the electron beam along the component times of the picture	rapid scan system	raster scan system	random scan system	none of these

REFERENCES

- http://www.engppt.com/search/label/Computer%20Graphics