Transformation

Q. A cube defined by 8 vertices A(0,0,0), B(2,0,0), C(2,2,0), D(0,2,0), E(0,0,2), F(2,0,2), G(2,2,2), H(0,2,2). Find the final co-ordinates after it is rotated by 45 degree around a line joining the points (2,0,0) and (0,2,2).

Q. Calculate the position of a triangle P[2,4,1], Q[4,6,1], and R[2,6,1] after the reflection about a line x-2y=-4.

Q. A mirror is placed such that it passes through (2,0) and (0,2). Find the reflected view of a triangle with vertices (3,4), (5,5) and (4,7) in this mirror.

Q. A mirror is placed vertically such that it passes through the points(10,0) and (0,10). Find the reflected view of triangle ABC with co-ordinates A(5,50), B(20,40), C(10,70).

Huffman Coding

What do you understand by compression techniques? Let $A=\{a_1 \ldots\ldots a_6\}$ and frequency(a_i)={45,13,12,16,9,5}, calculate the codeword length and entropy for the set using Huffman coding compression technique

Illumination

Q.1. The position vectors for the vertices of a triangular surface are given by $P_1 = (1,1,1)$, $P_2 = (0,2,1)$, and $P_3 = (0,0,1)$. Assume viewer position = (1,2,5), $k_a = 0.7$, $k_{diff} = 0.9$, $k_{spec} = 0.6$, n = 10. White ambient intensity = 0.1, white point light position = (1,1,5) with intensity of 0.5. Illuminate a triangle using the Phong model where the intensity at the centroid of the triangle is P = (0.333,1,1).

The following assumes a white object (r,g,b) = (1,1,1)

Because the light is white, the intensity will be the same for each colour channel (r,g,b)

Ambient $I_a k_a = 0.1(0.7) = 0.07$

Diffuse $N = (P_1-P_3) \times (P_2-P_3)$

$= (1,1,0)^T \times (0,2,0)^T$

$= (0,0,1)^T$

$L = (1,1,5)^T - (0.333,1,1)^T$

$= (0.164,0,0.986)^T$ (normalized)

$I_i k_{diff}(N \cdot L) = 0.5(0.9)(0.986) = 0.444$

Specular $R = 2N(N \cdot L) - L$

$= 2(0,0,1)^T[0.986] - (0.164,0,0.986)^T$

$$= (-0.164,0,0.986)$$

$$V = (1,2,5)^T - (0.333,1,1)^T$$

$$= (0.160,0.239,0.958)^T \quad \text{(normalized)}$$

$$R \cdot V = 0.971$$

$$I_i k_{spec}(R \cdot V)^n = 0.5(0.6)(0.971)^{10}$$

$$= 0.5(0.6)(0.745)$$

$$= 0.224$$

Total $I = 0.07 + 0.444 + 0.224$

$$= 0.738$$

Q.2. Calculate the pixel color value at the centroid P of the triangle whose vertices are A(0,3,5), B(6,10,23) and C(8,2,15). The color values at A,B and C are 0,12,63 respectively. Use the Gouraud technique for interpolation.

Q.3. Three points on a shiny metallic surface is given X(3,0,5), Y(16,0,7) and Z(10,0,10). The light vector is L=-i+2j-k and the viewing vector is given by V=i+1.5j+0.5k. Assuming that there is only one object and that is illuminated by a single light source, calculate the resultant intensity. Take k_d=0.5, k_a=0.3 and the same for specular reflection W(theta) is 0.85. The value of n for pecular reflection is 5. Assume Ia=1, I1=10, and neglect any intensity attenuation.

.3. The position vectors for the vertices of a triangular surface are given by P1(20,0,0), (0,20,0) and P3(0,0,20). A point light source is at P(0,0,40). Find the intensities at the vertices the quadrilateral, if the ambient light intensity is 1 and the directional light intensity is 20. sume k_a= k_d=0.3. Neglect any intensity attenuation and specular effect.
o calculate the intensity at the centroid of the triangle using the Phong model.