(1) cyan = 0.40 , Magenta = 0.10, yellow = 0.60 convert CMY colon model into HSV colon model.

$R = 1 - C = 1 - 0.40 = 0.6$

$G = 1 - M = 1 - 0.10 = 0.9$

$B = 1 - Y = 1 - 0.60 = 0.4$

$c_{max} = 0.9$

$c_{min} = 0.4$

difference $= c_{max} - c_{min} = 0.9 - 0.4 = 0.5$

here $c_{max} = G$

$\therefore h = (2 + (b - r)/diff) * 60$

$= (2 + (0.4 - 0.6)/diff\ 0.5)\ 60$

$= 1.6 \times 60 = 96^\circ$

$c_{max} \neq 0$

$\therefore S = diff/c_{max} = 0.5/0.9 = 0.56$

$V = c_{max} = 0.9$

HSV = (96°, 0.56, 0.9)

(2) You are analyzing a digital image pixel described as follows: its red component is exactly half the intensity of its green component and its blue component is one quarter of the green component's intensity. The green intensity is 204 (on a scale from 0 to 255). Using these relationships, first determine the RGB values of the pixel. Then, convert this RGB color to the HLS color model, expressing Hue in degrees, Lightness and saturation as values between 0 and 1.

Green = 204/255 = 0.8

$$\text{Red} = \frac{204}{2} = 102/255 = 0.4$$

$$\text{Blue} = \frac{204}{4} = 51/255 = 0.2$$

RGB = (0.4, 0.8, 0.2)

cmax = 0.8

cmin = 0.2

difference = 0.8 - 0.2 = 0.6

L = (cmax + cmin) / 2

= (0.8 + 0.2) / 2 = 0.5

here cmax = g

$$h = 60 * (2 + (b - r) / diff)$$

$$= 60 (2 + (0.2 - 0.4) / 0.6)$$

$$= 100^{\circ}$$

$$S = diff / (cmax + cmin)$$

$$= 0.6 / (0.8 + 0.2)$$

$$= 0.6$$

HLS = (100°, 0.5, 0.6)

Assignment 3 (NMP)

(3) A 3D point (180, -250, 450) is to be projected onto a projection plane whose center lies at (0, 0, 550). The center of projection (COP) lies somewhere on the line passing through points (2, 1, 0) and (14, 7, 6), exactly 25 units from the point (2, 1, 0) along this line.

a) The coordinates of the COP.

b) The coordinates of the projected point on the projection plane using a general purpose perspective projection matrix.

c) The distance between the projection plane and the COP.

a) P (180, -250, 450)

C_P (0, 0, 550)

A = (2, 1, 0)

B = (14, 7, 6)

$\vec{d} = B - A = (14-2, 7-1, 6-0) = (12, 6, 6)$

$|\vec{d}| = \sqrt{12^2+6^2+6^2} = 6\sqrt{6}$

$$\hat{d} = \left(\frac{12}{6\sqrt{6}}, \frac{6}{6\sqrt{6}}, \frac{6}{6\sqrt{6}}\right) = \left(\frac{2}{\sqrt{6}}, \frac{1}{\sqrt{6}}, \frac{1}{\sqrt{6}}\right)$$

$$COP = A + 25 \cdot \hat{d}$$

$$= (2,1,0) + \left(\frac{50}{\sqrt{6}}, \frac{25}{\sqrt{6}}, \frac{25}{\sqrt{6}}\right)$$

$$= (22.41, 11.21, 10.21)$$

b) $q = COP - (0,0,Z_P)$

$$= (22.41, 11.21, 10.21) - (0,0,550)$$

$$= (22.41, 11.21, -539.79)$$

$q_x = 22.41$, $q_y = 11.21$, $q_z = -539.79$

$Z_P = 550$

$$\begin{bmatrix} 1 & 0 & -22.41/(-539.79) & 550 \cdot \frac{22.41}{-539.79} \\ 0 & 1 & -11.21/(-539.79 & 550 \cdot \frac{11.21}{-539.79} \\ 0 & 0 & -550/(-539.79) & 550 + \frac{550^2}{-539.79} \\ 0 & 0 & -1/(-539.79) & 1 + \frac{550}{(-539.79)} \end{bmatrix} \begin{bmatrix} 180 \\ -250 \\ 450 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} 175.84 \\ -252.08 \\ 448.11 \\ 0.8147 \end{bmatrix} = \begin{bmatrix} 215.83 \\ -309.41 \\ 550.03 \\ 1 \end{bmatrix}$$

$P'(215.83, -309.41, 550.03)$

c) $z_p = 550$

COP at $z = 10.21$

$\therefore$ Distance $= |550 - 10.21|$

$= 539.79$