[COLOR MODEL OF LIGHT (CONTINUED)]

CODE:

```
out.H, out.S, out.V   RGB_to_HSV (in.R, in.G, in.B) {
    float max, min, l
    max = Max (in.R, in.G, in.B)      // Max: method to find the maximum
    min = Min (in.R, in.G, in.B)
    l = max - min
    out.V = max
    if (out.V == 0) {   // at V=0, S=0 (black)
        out.S = 0
    }
    else {
        out.S = l / max
    }
    if (out.S == 0) {
        out.H = NaN   // undefined, Not a Number
    }
    else {
        if (in.R >= max) {   // Red dominance, can have -ve/+ve value.
            out.H = ((in.G - in.B) / l) x 60
            if (out.H < 0) {   // if the value is -ve.
                out.H += 360
            }
        }
    }
```

(*) continued

```
else if ( in.G >= max ) { // Green dominant
```

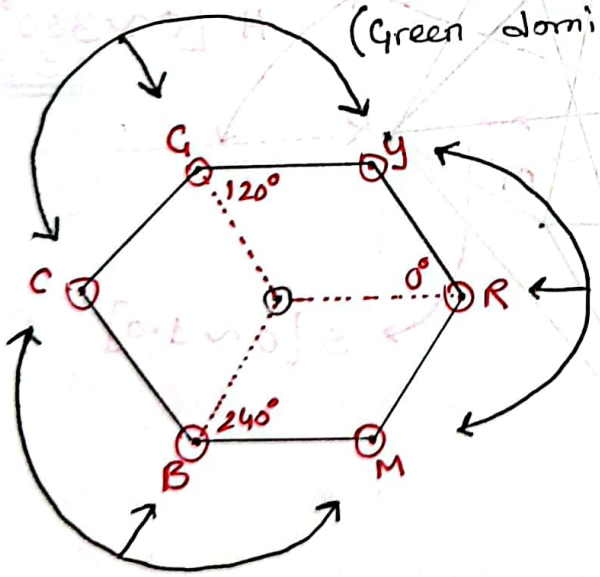
$$out.H = \left(\frac{in.B - in.R}{\ell}\right) \times 60^\circ + 120$$

```
}
else { // Blue dominant
```

$$out.H = \left(\frac{in.R - in.G}{\ell}\right) \times 60^\circ + 240^\circ$$

```
}
}
return out.H, out.S, out.V
}
```

(Green dominant in 60° to 180°)



(Red dominant in -60 to 60°)
OR
300° to 60°

(Blue dominant in 180° to 300°)

Examples :

for (1, 0.3, 0.3) // moderate Red
H = 0°

for (0.6, 0.4, 0.4) // light Red
H = 0°

for (1, 0, 0) // Pure Red
H = 0°

for (0.8, 0.6, 0.4)
H = 30°
for (0.4, 0.3, 0.2)
H = 30°

Both have same Hue but different brightness.

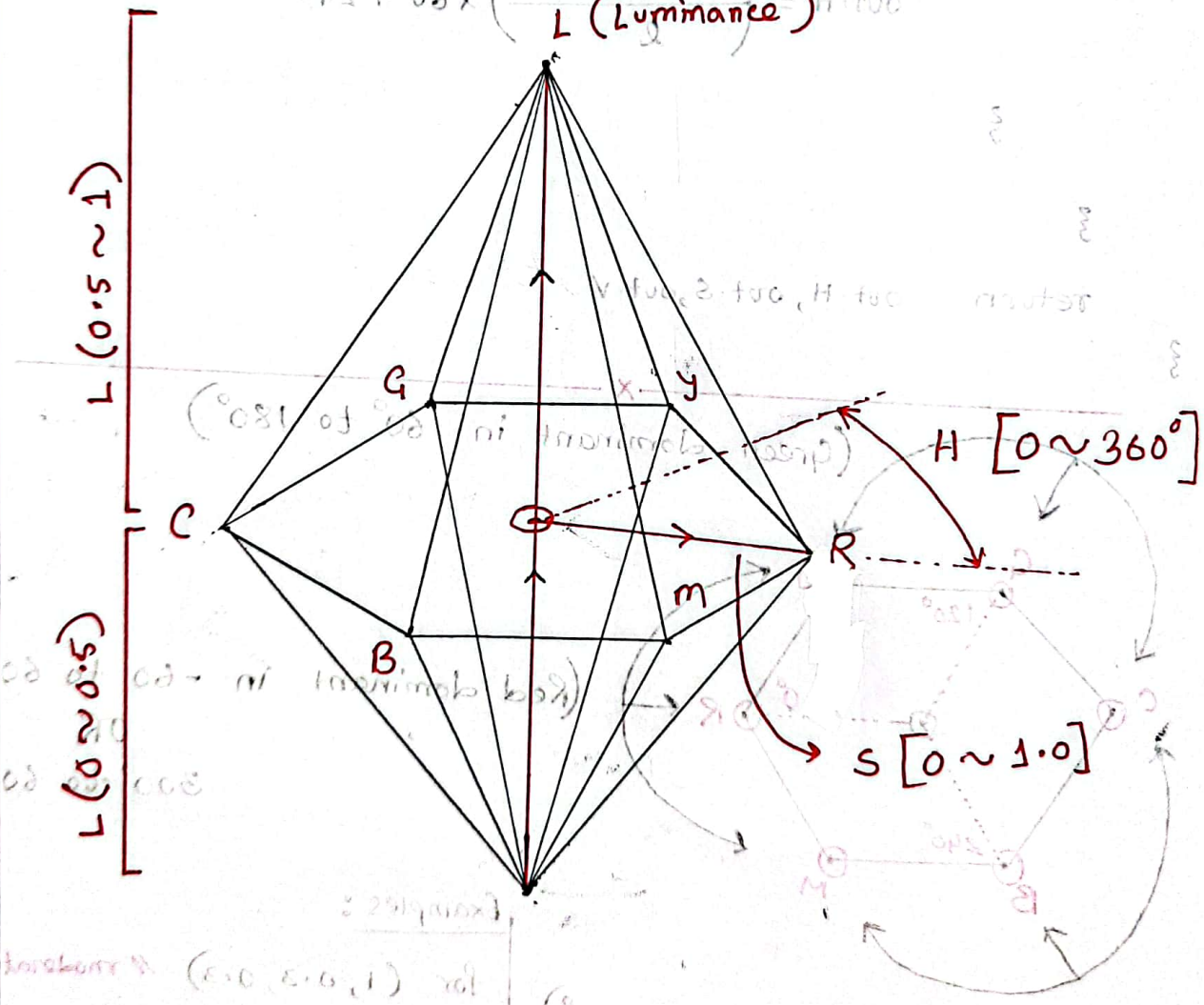
(ii)

HSL / HLS Color model :

H ⟶ Hue

S ⟶ Saturation

L ⟶ Luminance



(RGB to HSL) Conversion

- H: The calculation for Hue is the same as, RGB to HSV,

- $L = \frac{\max(R,G,B) + \min(R,G,B)}{2}$

- $S = \frac{\max(R,G,B) - \min(R,G,B)}{1 + |2L - 1|}$

Q) Convert the following to HSL?

RGB:

HSL:

1) $(0.9, 0.3, 0.6) \longrightarrow$ H = 330°, L = 0.6, S = 0.75

2) $(0.2, 0.3, 0.6) \longrightarrow$ H = 225°, L = 0.4, S = 0.5

3) $(0.5, 0.5, 0.8) \longrightarrow$ H = 240°, L = 0.65°, S = 0.43

(*) (HSV / HSL to RGB conversion)

HSV to RGB

(1) $C = V \times S$ [C is a constant]

(2) $X = C \times \left(1 - \left|\frac{H}{60^\circ} \bmod 2^\circ - 1\right|\right)$

X, the constant is, the same for both.

OR

$X = C \times \left(1 - \left|\frac{H \bmod 120^\circ}{60^\circ} - 1\right|\right)$

(3) $M = V - C$

HSL to RGB

(1) $C = \left(1 - |2L - 1|\right) \times S$

(3) $M = L - C/2$

(*) Now, for the table.

Table

	R'	G'	B'	
1	C	X	0	→ for $(0° \leq H < 60°)$
2	X	C	0	→ for $(60° \leq H < 120°)$
3	0	C	X	→ for $(120° \leq H < 180°)$
4	0	X	C	→ for $(180° \leq H < 240°)$
5	X	0	C	→ for $(240° \leq H < 300)$
6	C	0	X	→ for $(300° \leq H < 360)$

And then,

1. $R = R' + m$
2. $G = G' + m$
3. $B = B' + m$

Q) Convert the following HSV values to RGB ?

$$HSV = \begin{pmatrix} \underline{H} & \underline{S} & \underline{V} \\ 180^\circ & 1 & 0.8 \end{pmatrix}$$

$C = V \times S = 0.8$

$X = C \times \left(1 - \left|\frac{H \bmod 120}{60} - 1\right|\right) = 0.8$

$M = V - C = 0$

for $H = 180^\circ$ we'll use $(180^\circ \leq H < 240^\circ)$

So, $\underset{R'}{[0} \ , \underset{G'}{X} \ , \underset{B'}{C}]$

Ans $R, G, B = (0 \ , 0.8 \ , 0.8)$

Q) Convert the following HSL values to RGB?

$$HSL = (225^\circ, 0.5, 0.4)$$

$$C = (1 - |2L - 1|) \times S = 0.4$$

$$X = C \times \left(1 - \left|\frac{H \bmod 120}{60} - 1\right|\right) = 0.1$$

$$M = L - C/2 = 0.2$$

for 225° we'll use $(180^\circ \leq H < 240^\circ)$

$R' \quad G' \quad B'$

So, $[0, X, C]$

$$(R, G, B) = [0+0.2, 0.1+0.2, 0.4+0.2]$$

$$= (0.2, 0.3, 0.6) \text{ Ans}$$