COLLEGE OF ENGINEERING & TECHNOLOGY
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Course : Computer Graphics
Course No. : CC416
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Sheet I
Colors Transformation
(All the colors workspaces in this sheet are references to D50 white)

1. Convert the following CIE XYZ values to CIE RGB workspace. Write down the resulting (R,G,B) colors.

   a. X=1.00000000000, Y=1.00000000000, Z=1.00000000000
   b. X=0.242376740000, Y=0.266921300000, Z=0.497959040000

2. Convert the following CIE RGB values to CIE XYZ workspace. Write down the resulting XYZ colors and the x, y coordinates.

   a. R=0.3, G=0.7, B=0.5
   b. R=0.2, G=0.8, B=0.7

3. Convert the following RGB colors to their HSI equivalents.

   a. R=240, G=220, B=150
   b. R=125, G=125, B=125

4. Convert the following HSI values to their RGB equivalents.

   H = 28°, S=59.46, I=123

5. Convert the following RGB values to their HSI equivalents.

   R = 10, G=10, B=100

Hints & Rules:

RGB To XYZ Matrix

0.4887180	0.3106803	0.2006017
0.1762044	0.8129847	0.0108109
0.0000000	0.0102048	0.9897952

XYZ to RGB Matrix

2.3706743	-0.9000405	-0.4706338
-0.5138850	1.4253036	0.0885814
0.0052982	-0.0146949	1.00939

RGB to HSI

Each normalized H, S and I components are then obtained by,

$$h = \cos^{-1}\left\{\frac{0.5\cdot[(r-g)+(r-b)]}{[(r-g)^2+(r-b)(g-b)]^{1/2}}\right\}$$

$$h = 2\pi - \cos^{-1}\left\{\frac{0.5\cdot[(r-g)+(r-b)]}{[(r-g)^2+(r-b)(g-b)]^{1/2}}\right\}$$

$$s = 1 - 3\cdot\min(r,g,b)$$

$$i = (R+G+B)/(3\cdot 255)$$

For convenience, h, s and i values are converted in the ranges of [0,360], [0,100], [0, 255], respectively by: $H = h\times 180/\pi$; $S = s\times 100$ and $I = i\times 255$.

HSI to RGB

$h = H\cdot\pi/180$; $s = S/100$; $i = I/255$

$x = i\cdot(1-s)$

$$y = i\cdot\left[1+\frac{s\cdot\cos(h)}{\cos(\pi/3-h)}\right]$$

$z = 3i-(x+y)$;

when $h < 2\pi/3$, $b = x$; $r = y$ and $g = z$.

when $2\pi/3 \le h < 4\pi/3$, $h = h - 2\pi/3$, and $r = x$; $g = y$ and $b = z$.

when $4\pi/3 \le h < 2\pi$, $h = h - 4\pi/3$, and $g = x$; $b = y$ and $r = z$.

The result r, g and b are normalized values which are in the ranges of [0,1], therefore, they should be multiplied by 255 for displaying.