

CC416 Computer Graphics Solved Examples

1. Colours Transformations

A. Convert the following RGB colour space to its HSI equivalent.

- R=240, G=220, B=150

Solution:

→ Normalize RGB values:

$$r = 0.393, g=0.36, b=0.245$$

→ Calculate the “h” value based on the first given rule. (b<=g)

$$h = \cos^{-1}(0.5*(0.033+0.148) / (0.001089+0.148*0.115)^{0.5}) = \cos^{-1}(0.0905/0.1345) = \cos^{-1}(0.672) = 48^\circ$$

$$s = 1-3*0.245=0.265 \rightarrow S = 0.265*100 = 26$$

$$i = 610/(3*255) = 0.797 \rightarrow I = 0.797*255 = 203$$

B. Convert the following HSI colour space to its RGB equivalent

- H = 28°, S=59.46, I=123

Solution:

→ Normalize “S” and “I” values.

$$i = I/255 = 0.49$$

$$s = S/100 = 0.5946$$

→ Calculate the values of x, y and z.

$$x = 0.49*(1-0.5946) = 0.1986 \text{ (approx.)}$$

$$y = 0.49 * (1+ (0.5946*0.88)/0.84) = 0.49*1.622 = 0.795 \text{ (approx.)}$$

$$z = 3*0.49-(0.1986+0.795) = 0.4764 \text{ (approx.)}$$

→ $h < 2\pi/3$, choose first given rule to calculate the rgb values.

$$b=0.1986, g=0.4764, r=0.795 \rightarrow R = 203, G=121, B=51$$

C. Convert the following CIE XYZ values to their CIE RGB workspace equivalence. (Use D50 as reference)

- X=0.242376740000, Y=0.266921300000, Z=0.497959040000

Solution:

→ Use the following XYZ to RGB matrix

2.3706743 -0.9000405 -0.4706338

-0.5138850 1.4253036 0.0885814

0.0052982 -0.0146949 1.00939

RGB = M * (RGB) =

2.3706743 -0.9000405 -0.4706338 0.2423 0.1012

-0.5138850 1.4253036 0.0885814 * 0.26692 = 0.2986

0.0052982 -0.0146949 1.00939 0.4979 0.4990

R = 0.1012*255 = 25.8 = 26

G = 0.2986*255 = 76.143 = 76

B = 0.4990*255 = 127.24 = 127

2. Bresenham Line Algorithm:

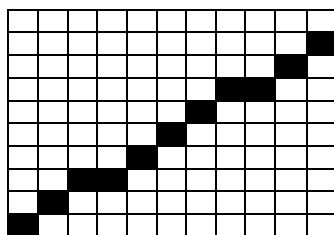
- Calculate the required points to plot the following line using Bresenham's algorithm

(20,10) → (30,18)

Solution:

dx=10, dy=8, P₀=2dy-dx=6

k	P _k	(X _{k+1} , Y _{k+1})
0	6	(21, 11)
1	2	(22, 12)
2	-2	(23, 12)
3	14	(24,13)
4	10	(25,14)
5	6	(26,15)
6	2	(27,16)
7	-2	(28,16)
8	14	(29,17)
9	10	(30,18)



3. Midpoint Circle Algorithm :

- Calculate the required points to plot the following circle using the midpoint circle algorithm.

Radius (r) = 10, Centre = (3, 4)

$P_0=1-r=-9$, Initial Point $(x_0, y_0) = (0,10)$

k	P_k	(X_{k+1}, Y_{k+1})	Other Quadrants	Other Octants	All Points after adding the centres
0	-9	(1,10)	(-1, 10)(1, -10)(-1, -10)	(1,10)(10,1)(-1,10)(10,-1) (1,-10)(-10,1)(-1,-10)(-10,-1)	(4,14)(13,5)(2,14)(13,3)(4,-6) (-7,5)(2,-6)(-7,3)
1	-6	(2,10)	(-2, 10)(2, -10)(-2, -10)	(2,10)(10,2)(-2,10)(10,-2)(2,-10) (-10,2)(-2,-10)(-10,-2)	...
2	-1	(3,10)	(-3, 10)(3, -10)(-3, -10)	(3,10)(10,3)(-3,10)(10,-3)(3,-10) (-10,3)(-3,-10)(-10,-3)	...
3	6	(4,9)	(-4, 9)(4, -9)(-4, -9)	(4,9)(9,4)(-4,9)(9,-4)(4,-9)(-9,4) (-4,-9)(-9,-4)	...
4	-3	(5,9)	(-5, 9)(5, -9)(-5, -9)	(5,9)(9,5)(-5,9)(9,-5)(5,-9)(-9,5) (-5,-9)(-9,-5)	...
5	8	(6,8)	(-6, 8)(6, -8)(-6, -8)	(6,8)(8,6)(-6,8)(8,-6)(6,-8)(-8,6) (-6,-8)(-8,-6)	...
6	5	(7,7)	(-7, 7)(7, -7)(-7, -7)	(7,7)(-7,7)(7,-7)(-7,-7)	...

