

CDS 301 Spring 2013
Scientific Information and Data Visualization

Homework Assignment 3 - Answer

Assignment Date: February 19, 2013

Due Date: February 12, 2013

1 (40). Lexicographic Order

Because of the regularity of a uniform grid, the sampling points in a high dimensional data domain can be stored in a 1-D array, whose index is arranged in the so called lexicographic order. Given a 2-D data domain with sampling number $N_x=100$ and $N_y=100$

- (1) If the sampling point is at $n_x=36$ and $n_y=70$, what is its lexicographic order index? (7036)
- (2) If a sampling point has a lexicographic order index of 3120, what are the ordering indices of n_x and n_y in the 2-D domain? (20, 31)

Answer:

1. $i=36+70*100=7036$
2. $n_y = 3120 / 100 = \text{int}(31.2)=31$
 $n_x = 3120 - n_y*N_x = 3120 - 31*100 = 20$

2 (30). RGB color system

Look up at the RGB color cube, what are the colors of the following RGB vectors?

- (1) [1,1,1]: white
- (2) [1,0,0]: red
- (3) [0,1,1]: cyan
- (4) [0,0,0]: black
- (5) [0.5,0.5,0.5]: grey level in the middle between full bright and full dark

3 (40). RGB and HSV conversion (using Listing 3.2 and Listing 3.3)

(1) For blue color, $[R,G,B] = [0,0,1]$, calculate its corresponding $[H,S,V]$ vector values [2/3, 1, 1]

(2) For a color of $[H, S, V] = [1/2, 1, 1]$, calculate its corresponding $[R, G, B]$ vector values.

[0, 1, 1]

Answer:

- (1) $\max = \max(R,G,B) = 1$
 $\min = \min(R,G,B) = 0$
 $\text{diff} = \max - \min = 1$
 $V = \max = 1$
 $S = \text{diff}/\max = 1$
Since $B = \max$, $H = 4 + (R-G)/\text{diff} = 4$, $H=4/6=2/3$
Therefore, $(H, S, V) = (2/3, 1, 1)$

- (2) $\text{huecase} = (\text{int})(h*6) = (\text{int})(3) = 3$
 $\text{fract} = 6*h - \text{huecase} = 3 - 3 = 0$

$$lx = v*(1-s) = 1(1-1)=0$$

$$ly = 1 * (1-1*0)=1$$

$$lz=v*(1-s(1-\text{frac}))=1*(1-1(1-0))=0$$

Since huecase=3, R=lx=0, G=ly=1, B=v=1

Therefore, (R, G, B) = (0,1,1)