# CHAPTER 4 HW

DANIEL HANNA

4.2) Rec 709 matrix:

$$\begin{bmatrix} Y \\ C_b \\ C_r \end{bmatrix} = \begin{bmatrix} .213 & .715 & .072 \\ -.117 & -.394 & .511 \\ .511 & -.464 & .047 \end{bmatrix} \begin{bmatrix} R' \\ G' \\ B' \end{bmatrix} + \begin{bmatrix} 16 \\ 128 \\ 128 \end{bmatrix}$$

Plug & Chug for [128 128 128], [255 255 255], [100 00]:
to get (using matrix calculator function on graphing calculator)

$(R'G'B')_1 = [44 \quad 128 \quad 128]$

$(R'G'B')_2 = [271 \quad 128 \quad 128]$

$(R'G'B')_3 = [37 \quad 116 \quad 179]$

4.4) For 4:4:4, there are 3 bytes per pixel
For 4:2:0, there are $1 + 1/2 = 1.5$ bytes per pixel
For 4:2:2, there are $1 + 1/2 + 1/2 = 2$ bytes per pixel

4:4:4 Total $= 1920 \times 1080 \times 60 \times 10 \times 3$
$= 3.7325 \times 10^9$ bits/sec

4:2:0 Total $= 1920 \times 1080 \times 60 \times 10 \times 1.5$
$= 1.8662 \times 10^9$ bits/sec

4:2:2 Total $= 1920 \times 1080 \times 60 \times 10 \times 2$
$= 2.4883 \times 10^9$ bits/sec

4.5) $1.3 \times 1920 \times 1080 + 2 \times 0.6 \times 960 \times 540$

(Luminance Section; Chrominance Section; x2 for Cb, Cr; 1/2(1920×1080))

$= 3317760$ bits

4.6) $MAD = \frac{1}{A} \sum_{i=0}^{N-1} \sum_{j=0}^{M-1} |S_1[x,y] - S_2[x,y]|$

Means do row by row subtraction

$= \frac{1}{16}(1+1+1+1+2+2+1+2+1) = \frac{12}{16} = 0.75$

4.8) $PSNR = 10 \log_{10}\left(\frac{A^2 S_{MAX}}{\sum_{x=0}^{x-1} \sum_{y=0}^{y-1} (e[x,y]^2)}\right) = 10 \log_{10}\left(\frac{255^2}{1}\right) = 48.13$ dB for $x_1, y_1$

$= 10 \log_{10}\left(\frac{255^2}{9}\right) = 38.59$ dB for $x_1, y_2$