

EE 637 Midterm Exam #2
Spring 2001

DATE

1a)

d_{ij}

	1	2	3	4
1	-	300	380	40
2		-	80	260
3			-	340
4				-

- i) minimum distance = 40
ii) clusters to merge are 1 and 4

iii)

i	N_i	μ_i
2	10	16
3	10	20
5 2	20	$2 = \frac{1+3}{2}$

b) d_{ij}

	2	3	5
2	-	80	420
3		-	540
5			-

$$d_{25} = (10+20) \cdot (16-2)$$

$$= 30 \cdot 14$$

$$= 300 + 120 = 420$$

$$d_{35} = (10+20) \cdot (20 - \text{~~16~~ } 2)$$

$$= 30 \cdot 18$$

$$= 300 + 240 = 540$$

- i) minimum distance = 80
 iv) clusters to merge are 2 and 3

iii)

i	N_i	μ_i
5	20	2
6	20	18

c)

$$d_{56} = (20+20)(18-2)$$

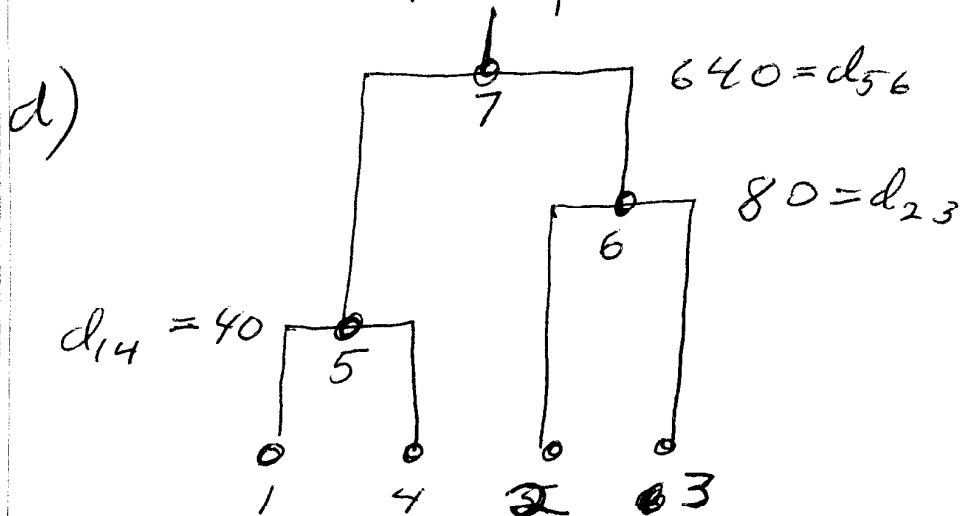
$$= 40 \cdot 16$$

$$= 400 + 240 = 640$$

- i) minimum distance = 640
 ii) clusters to merge are 5 and 6

iii)

i	N_i	μ_i
7	40	10 $= \frac{2+18}{2}$



$$2 a) \quad Y(m, n) = \left(\frac{X(m, n)}{255} \right)^{2.2} \cdot 255$$

$$b) \quad Z(m, n) = 255 \left(\frac{Y(m, n)}{255} \right)^{1/1.8}$$

$$= 255 \left(\frac{X(m, n)}{255} \right)^{\frac{2.2}{1.8}}$$

c) i) The left hand side.

ii) The image will contain contouring due to quantization error because it is stored using linear luminance with 8 bit precision.

iii) The dark regions because small changes in linear luminance represent large changes in contrast in dark regions of the image.

3 a)

$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} \Rightarrow \underline{\text{EE white}}$$

$$b) \quad R \circ \quad \frac{X_R}{X_R + Y_R + Z_R} = \frac{1}{1+0+0} = 1 = x_R$$

$$\frac{Y_R}{X_R + Y_R + Z_R} = \frac{0}{1+0+0} = 0 = y_R$$

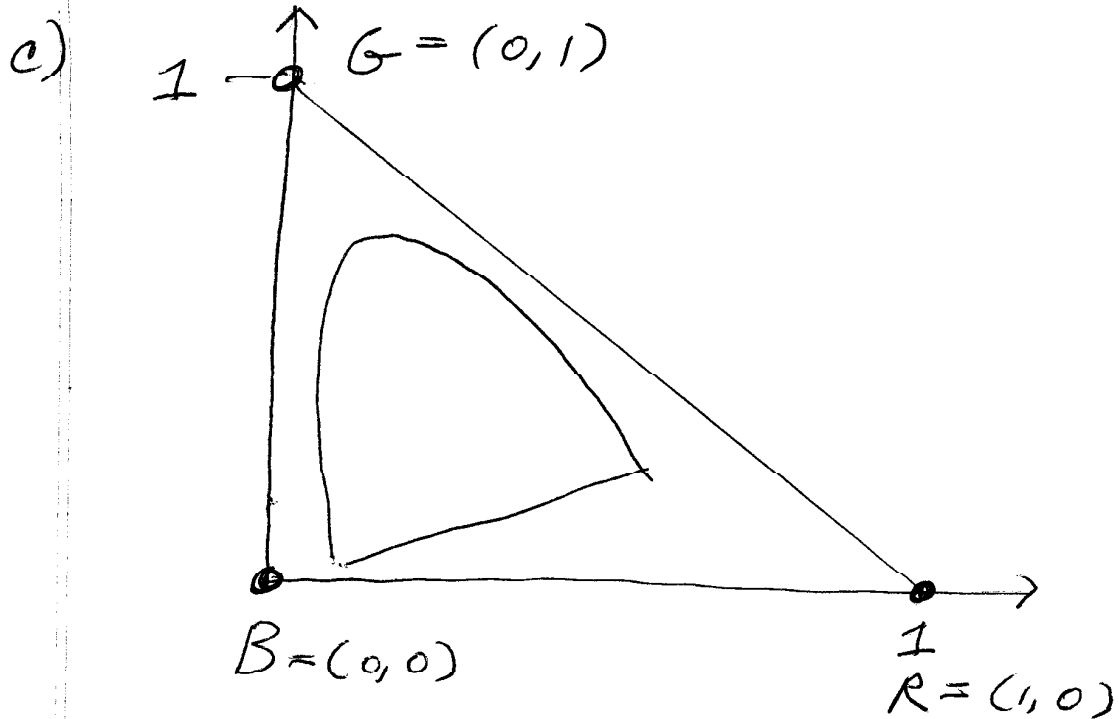
$$G \circ \quad \begin{aligned} x_g &= 0 \\ y_g &= 1 \end{aligned}$$

$$B \circ \quad \begin{aligned} x_b &= 0 \\ y_b &= 0 \end{aligned}$$

$$R \leftarrow (1, 0)$$

$$G \leftarrow (0, 1)$$

$$B \leftarrow (0, 0)$$



d) Any visible color can be displayed!

This is because the chromaticity diagram is contained within the triangular region.

e) No, it cannot be built because the primary colours are not physically realizable!