

Name:
Student number:

CEG4311 Image Processing
Fall 2007
Quiz 2, November 13, 2007
Closed book – no notes or books

Question

Three colors are defined as follows in terms of the CIE XYZ primaries:

$$[Q_1] = 1.25[X] + 1.0[Y] + 0.25[Z]$$

$$[Q_2] = 0.2[X] + 0.6[Y] + 0.2[Z]$$

$$[Q_3] = 0.5[X] + 0.5[Y] + 1.5[Z]$$

Compute and identify with *correct notation* the XYZ chromaticities of $[Q_1]$, $[Q_2]$ and $[Q_3]$ and plot them on the XYZ chromaticity diagram below. Indicate clearly on the diagram the chromaticities of *all* colors that can physically be synthesized using linear combinations of $[Q_1]$, $[Q_2]$ and $[Q_3]$ with *positive* coefficients. Show the chromaticity coordinates of the color $[P] = 0.5[Q_1] + 0.4[Q_2] + 0.3[Q_3]$ on the diagram.

$$[Q_i] = Q_{ix}[X] + Q_{iy}[Y] + Q_{iz}[Z] \quad g_i = \frac{Q_i}{Q_{ix} + Q_{iy} + Q_{iz}} \quad i=x,y,z$$

For $[Q_1]$ $Q_{1x} + Q_{1y} + Q_{1z} = 1.25 + 1.0 + .25 = 2.5$; $g_{1x} = \frac{1.25}{2.5} = 0.5$ $g_{1y} = \frac{1}{2.5} = 0.4$ $g_{1z} = \frac{.25}{2.5} = 0.1$

For $[Q_2]$ $Q_{2x} + Q_{2y} + Q_{2z} = 1.0$; $g_{2x} = .2$ $g_{2y} = .6$ $g_{2z} = .2$

For $[Q_3]$ $Q_{3x} + Q_{3y} + Q_{3z} = 2.5$; $g_{3x} = \frac{.5}{2.5} = .2$ $g_{3y} = \frac{.5}{2.5} = .2$ $g_{3z} = \frac{1.5}{2.5} = 0.6$

$$[P] = ((.5)(1.25) + (.4)(.2) + (.3)(.5))[X] + ((.5)(1) + (.4)(.6) + (.3)(.5))[Y] + ((.5)(.25) + (.4)(.2) + (.3)(1.5))[Z]$$

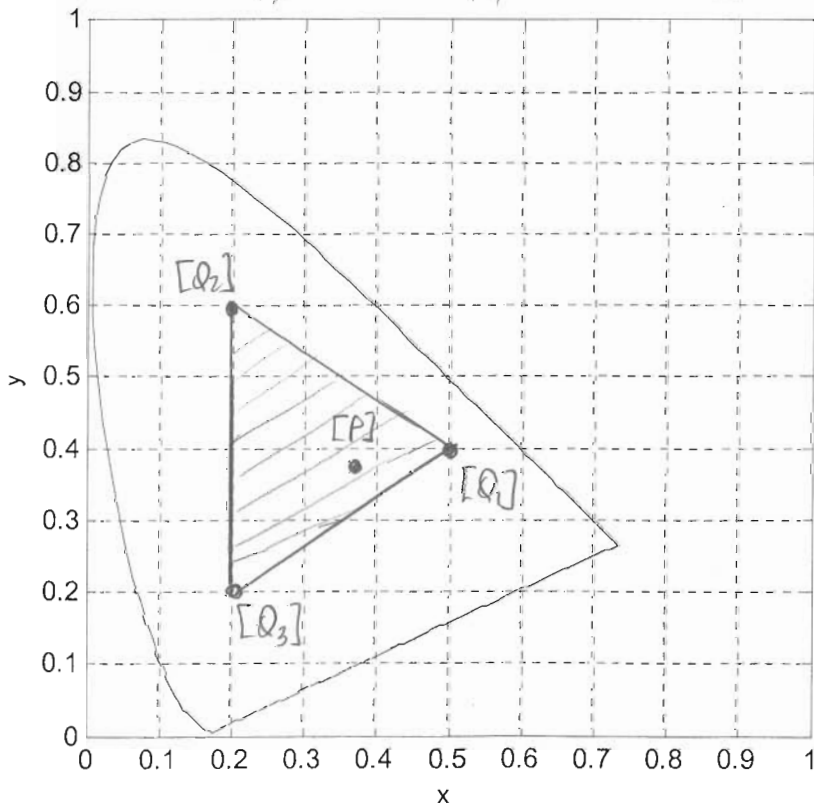
$$= 0.855[X] + 0.89[Y] + 0.655[Z]$$

$P_x \qquad P_y \qquad P_z$

$$P_x + P_y + P_z = 2.4$$

$$P_x = \frac{.855}{2.4} = 0.356$$

$$P_y = \frac{.89}{2.4} = 0.371$$



use other side if needed