## Week 3

1. The spectrum of color $C_1 = (X_1,Y_1,Z_1)$ and $C_2 = (X_2,Y_2,Z_2)$ are given by $s_1(\lambda)$ and $s_2(\lambda)$ respectively. Let the color formed by multiplications of the spectrums $s_1$ and $s_2$ be $s_3$, i.e. $s_3(\lambda) = s_1(\lambda) * s_2(\lambda)$. Is it true that the XYZ coordinate corresponding to $s_3$, denoted by $C_3$, is $(X_1X_2,Y_1Y_2,Z_1Z_2)$? Justify your answer with calculations.

2. The color gamut of a printer is given by triangle ABC on the chromaticity chart where $A = (0.15, 0.65)$, $B = (0.6, 0.3)$ and $C = (0.15, 0.125)$. The color gamut of a monitor is given by triangle DEF on the chromaticity chart where $D = (0.2, 0.05)$, $E = (0.55, 0.4)$ and $F = (0.05, 0.55)$. How many sides does the polygon that represents all the colors that can be produced *both* by the printer and the monitor have? Find the coordinates of all the vertices of this polygon.

3. $C_1$ and $C_2$ are colors with chromaticity coordinates $(0.3, 0.18)$ and $(0.6, 0.3)$ respectively. In what proportions should these colors be mixed to generate a color $C_3$ of chromaticity coordinates $(0.5, 0.26)$? If the luminance of $C_3$ is $90$, what are the luminance of $C_1$ and $C_2$?

4. When we mix blue paint with yellow paint we get green. But when we project blue light on yellow light, we get brown. How do you explain this contradiction?

5. What is the complementary wavelength of a color with chromaticity coordinate $(0.5, 0.2)$? What is the chromaticity coordinates of this wavelength?

6. Consider a display with white point (0.3,0.3) and luminance of white of 270 lumens. The 2D color gamut is given by R=(0.6,0.3), G=(0.2,0.6) and B=(0.1,0.1). Find the 3x3 color matrix for the device. What is the XYZ value of input (0.1, 0.2, 0.5) on this device?

7. In a traffic light, one can just change the color of the same light to indicate stop, slow and go. But why do we have three lights in a row (or column) instead of a single light? Whom does it help?

8. Camouflage is usually achieved by exploring metamerism. In world war II it was often observed that some people could see objects hidden by camouflage rather consistently. Can you guess who were these individuals?