Week #8:
How can printers and computers talk to each other?
RGB vs. CMYK

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http://math.ucsb.edu/~kgracekennedy/Spring2013_4A.html

Instructions: Print out this page or come get a copy from in front of my office, and write
directly on it. Use the back if necessary to justify work.

Recall that pixels are described using the RGB color model. A pixel on your computer is like a little box
of color made by a combining different amounts of red (r), green (g), and (b) blue ranging from intensity 0
to intensity 100. (Instead of 0 to 255, we will work in terms of percent of maximum intensity to make our
calculations easier.) The color of a given pixel is described in a vector

\[
\vec{v} = \begin{pmatrix} r \\ g \\ b \end{pmatrix}.
\]

Black is the absence of color, so \( r = g = b = 0 \). White would have full intensity of all colors, so \( r = g = b = 100 \).

However, printers use the CMYK color model. Using this model, color is described in terms of cyan (equal
parts blue and green), magenta (equal parts red and blue), and yellow (equal parts green and red). The K refers
to a key color, usually black.

Problem 8.1. Write the primary colors of the RGB color scheme: red (\( \vec{r} \)), green (\( \vec{g} \)), and blue (\( \vec{b} \)).

\[
\vec{r} = \begin{pmatrix} r \\ g \\ b \end{pmatrix}, \quad \vec{g} = \begin{pmatrix} r \\ g \\ b \end{pmatrix}, \quad \vec{b} = \begin{pmatrix} r \\ g \\ b \end{pmatrix}.
\]

Problem 8.2. Write the primary colors of printing using the RGB color scheme: cyan (\( \vec{c} \)), magenta (\( \vec{m} \)), and yellow (\( \vec{y} \)).

\[
\vec{c} = \begin{pmatrix} c \\ g \\ b \end{pmatrix}, \quad \vec{m} = \begin{pmatrix} c \\ g \\ b \end{pmatrix}, \quad \vec{y} = \begin{pmatrix} c \\ g \\ b \end{pmatrix}.
\]

Problem 8.3. According to these models, can printers print the same colors that computers can describe? Why or why not?

Problem 8.4. Can we save money by eliminating one of the cartridges (\( \vec{c}, \vec{m}, \) or \( \vec{y} \)) in order to make a cheaper,
more efficient printer?

Problem 8.5. Would you be interested in buying my red green yellow printer? Give a mathematical reason
for why or why not.