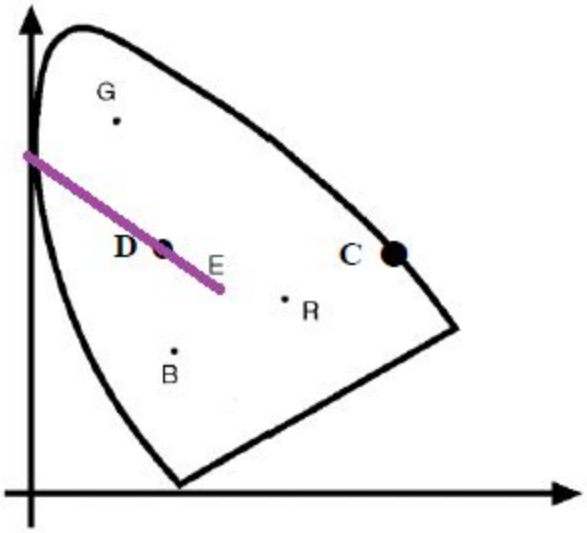
Assignment-2

I. Color Theory:

1.a) In the image alongside find the dominant wavelength of color D. show this wavelength



In the image, the line represented using purple color is the dominant wavelength of D. To calculate the exact value we need to extrapolate the line ED to intersect with the Y-axis.

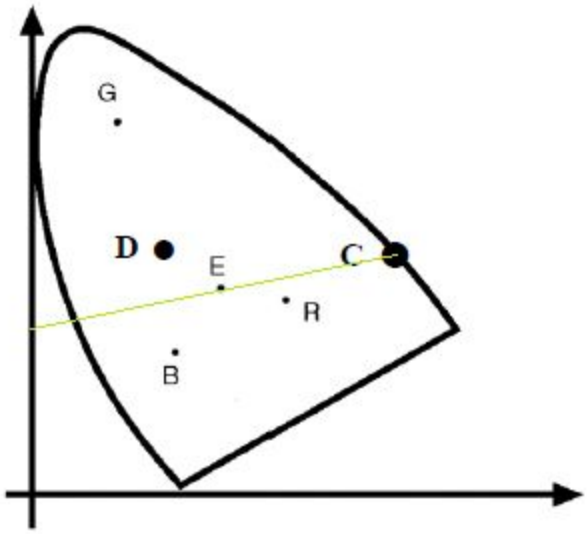
The dominant wavelength for D would be somewhere around 500 nm.

1.b) Do all colors have dominant wavelength? Explain your reasoning.

All colors does not have the dominant wavelength.

Spectral colors like green, orange, red all have dominant wavelength, whereas we don't see dominant wavelengths for non-spectral colors like gray, black and pink.

1.c) Find the color which is complementary to the color C and plot its location. What colors in the three dimensional RGB color space map to the equi luminous point E upon projection into the 2D chromaticity space.



When we extrapolate the line traversing through CE we get get a line which intersects the Y-axis. That line is represented using the “Yellowish Green” color in the image shown above.

The complementary color for C would be “Blue” and color at E is “White”, as all the colors intersect at this point.

Generic Compression:

Consider a communication system that gives out only two symbols X and Y. Assume that the parameterization followed by the probabilities are P(X) = x^2 and P(Y) = (1 - x^2)

2.a) Write down the entropy function and plot it as a function of x

$H = -\sum_{i=1}^{N} P(i) \log_2 P(i)$

$H = - [P(x) \log_2 P(x) + P(y) \log_2 P(y)]$

$H = - [x^2 \log_2 x^2 + (1-x^2) \log_2 (1-x^2)]$

2.b) From your plot, for what value of x does the Entropy become a minimum?

The entropy will become minimum when we have the following values:

x = -1 , x = 0 or x = 1

2.c) Although the plot visually gives you the value of x for which the entropy is minimum, can you now mathematically find out the values(s) for which the entropy is a minimum?

When x = -1

$H = - [x^2 \log_2 x^2 + (1-x^2) \log_2(1-x^2)]$

$H = - [1 \log 1 + 0 \log 0]$

$H = 0$

When x = 0:

$H = - [x^2 \log_2 x^2 + (1-x^2) \log_2(1-x^2)]$

$H = - [0 \log 0 + (1 - 0) \log 0]$

$H = 0$

When x = 1:

$H = - [x^2 \log_2 x^2 + (1-x^2) \log_2(1-x^2)]$

$H = - [1 \log 1 + 0 \log 0]$

$H = 0$

2.d) Can you do the same for the maximum, that is can you find out value(s) of x for which the value is a maximum?

When H = 1, we can say that entropy is maximum:

When x = 0.72,

$H = - [x^2 \log_2 x^2 + (1-x^2) \log_2(1-x^2)]$

$H = - [0.5184 \log_2(0.5184) + 0.4816 \log_2(0.4816)]$

$H = 0.99$ (roughly equals to 1)

Image Dithering:

3.a) Zoomed image: