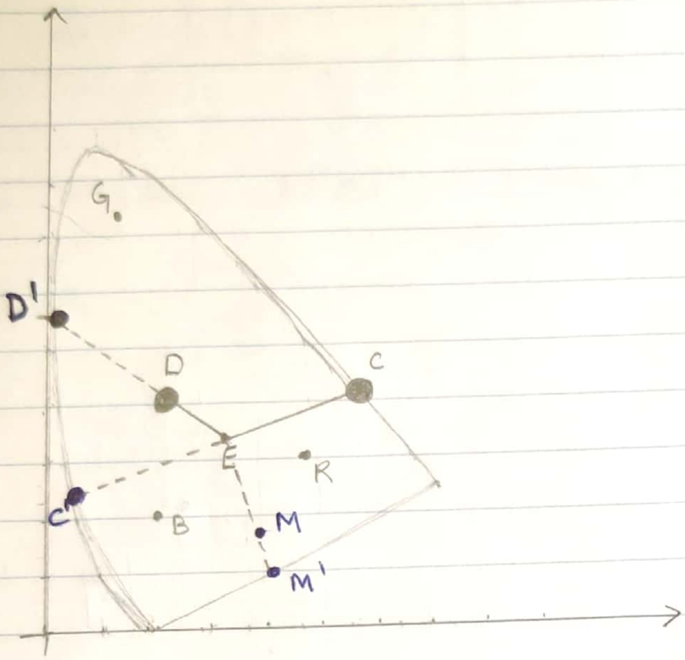
CSCI-576 Assignment II Theory Part:

Question 1: Color Theory:



(i) The dominant wavelength of D is represented as D' in the above diagram (around 500nm).

(ii) No. All colors do not have a dominant wavelength. Some colors (like purples) do not have dominant wavelength because the intersecting line drawn from the equiluminous point E through such a color meets the boundary at the flat part. (Eg: a color M in the above digram).

(iii) The complimentary to the color C is represented as C' in the above figure. (Blue).

(iv) Equal proportions of RGB (255, 255, 255) from color space map to equiluminous point E upon projection into the chromaticity space.

Question 2: Color Theory:

- Given:

$$Z = \left[\frac{(1-x-y)}{y}\right] Y$$

We know that $x+y+z=1$

$\Rightarrow 1-x-y=z.$

$$R.H.S := \left[\frac{z}{y}\right] Y$$

$$= \left[\frac{\left(\frac{Z}{X+Y+Z}\right)}{\left(\frac{Y}{X+Y+Z}\right)}\right] Y$$

(Given a color value (X, Y, Z), the normalized values:

$$x = \frac{X}{X+Y+Z}$$

$$y = \frac{Y}{X+Y+Z}$$

$$z = \frac{Z}{X+Y+Z}$$
)

$$= \left[\frac{Z}{Y}\right] Y$$

$$= Z$$

$$= L.H.S$$

Q.E.D.

- The algorithm might work effectively in most cases. The nearest color in printer's gamut might be the most similar color to the original color.

- The algorithm performs better with cartoon images since it has a constant color tone. In the real image, due to varying color tones, the difference between the original image color and the nearest color chosen will get enlarged throughout the image (because different tones might map to the same color in this algorithm).

- Improvement: instead of choosing one nearest color, you can choose, say 4, nearest colors and mix them up (something like nearest neighbour averaging), to represent the original color.

Question 3: Entropy Coding

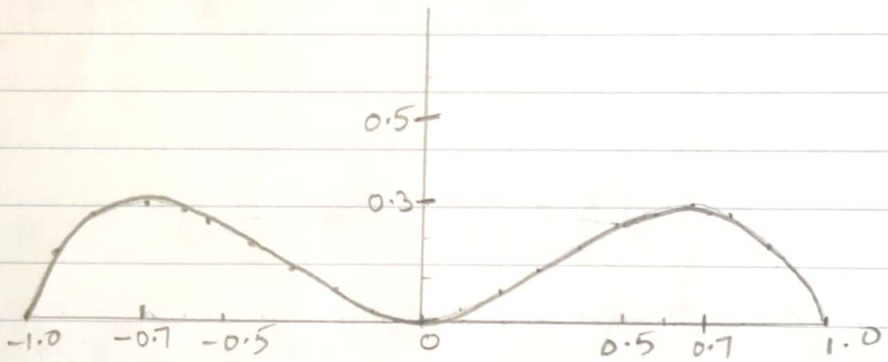
Given: $S = \{X, Y\}$
$P(X) = x^k \quad P(Y) = 1 - x^k$

- Entropy function $H = -\Sigma p_i \log p_i$

$$\boxed{H = -\left[x^k \log x^k + (1-x^k)\log(1-x^k)\right]}$$

When $K = 2$

$$H = -\left[x^2 \log x^2 + (1-x^2)\log(1-x^2)\right]$$



- H is minimum when $x = 0$ or $x = 1$.

- The entropy is minimum when the probability of one of the symbols is 1 and the other is 0.

Consider

$P(X) = 0$ $\quad\quad$ $P(Y) = 1$

$\boxed{x^k = 0}$ $\quad\quad$ $1 - x^k = 1$

$\boxed{x^k = 0.}$

Substituting $x^k = 0$ in H, $H = 0$ (minimum).

Similarly, $H = 0$ when $x^k = 1$.

- The entropy is maximum when $H = 0.7$

- The entropy is said to be maximum, when all probabilities are equal.

$$x^k = 1 - x^k$$

$$2x^k = 1$$

$$x^k = 1/2$$

$\boxed{x = \sqrt[k]{1/2}}$ is when H is maximum