

# HW6 Graphics Theoretical

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May 4, 2024

**Question 1:** A standard linear filter has issues properly handling sharp transitions from high to low Luminance, a bilateral filter considers the difference in luminance as part of the weight. However, this requires renormalization, as the total difference in luminance between neighboring pixels and the center pixel can vary from very large to very small.

**Question 2:** The mapping of values to their normalized components does not impact all colors uniformly. E.g taking  $(r, g, b, a)$  to  $(r/d, g/d, b/d, a)$  does not have a uniform effect on the perception of the color in the image. Moreover, any mapping will have a bias towards high / low values. If a pixel has extremely high / low values, normalization of all values will force the normal, non dark colors to be shifted towards their lighter / darker variants.

**Question 3:** This question seems in some way subjective. For me, a pixel is a single element of a screen that can represent a fixed (usually small) number of color channels. A pixel has no set size, it is the single unit used to divide the screen into a region. For example, consider how  $1920 \times 1080p$  monitors can be extremely large or extremely small. If we knew an associated pixel density *and* a resolution, we could determine how big a pixel is. As an abstraction, a pixel is an array of values containing associated 'color space' data – and its size is determined by the types of data used to store it and the number of said values.

**Question 4:** (a) This first matrix will take a given value and turn it into the value of the pixel directly above it. Effectively this shifts the image down by one pixel. (b) This second matrix will take a given region and weight the vertical pixels from the center slightly higher than the neighboring pixels. It is a blur that captures changes in the vertical direction the most. (c) This third matrix will take a given region and negatively contribute the pixels above it and positively contribute the pixels below it.

**Question 5:**

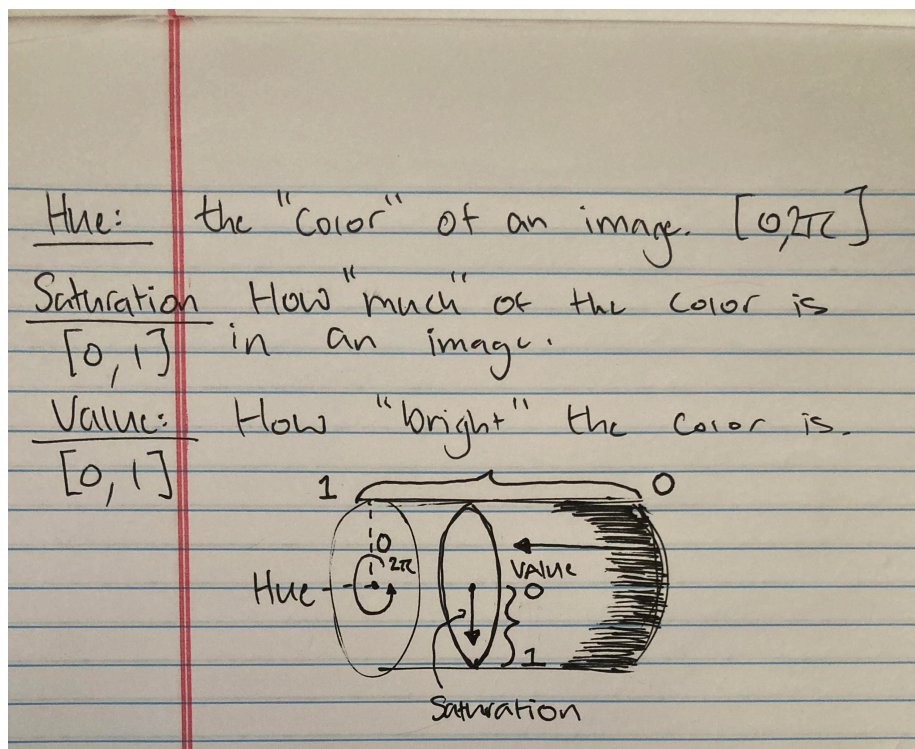


Figure 1: