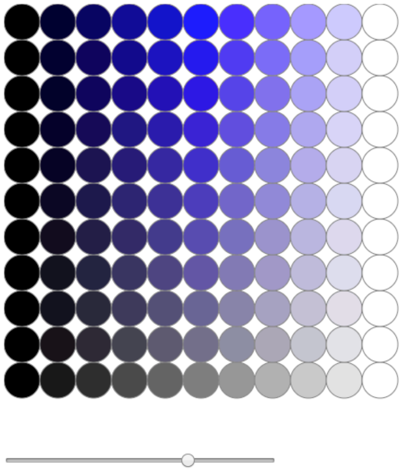
CS/INFO 3300; INFO 5100
Homework 6
Due 11:59pm **Tuesday** March 26

Goals: Practice creating widgets and other interactive elements using d3. Get a bit more experience working with color in d3. Explore an example integrating a canvas and image.

Your work should be in the form of an HTML file called index.html with one <p> element per (sub)problem. Wrap any SVG code for each problem in a <svg> element following the <p> element(s). For this homework we will be using d3.js. **In the <head> section of your file, please import d3 using this tag:**

```
<script src="https://d3js.org/d3.v5.min.js"></script>
```

Create a zip archive containing your HTML file plus **ALL associated data files** and upload it to CMS before the deadline. You will be penalized for missing data files or non-functional code.



1. For this problem, we will be making use of a color space available in d3, HSL. Unlike traditional HSV (hue, saturation, value), HSL (hue, saturation, lightness) acts more like a perceptual scale that accurately accounts for how individuals perceive color luminosity. You will design an interactive tool for exploring different colors.

A. In a <p> tag, place a **square SVG element** 500px in height and width. In a <script> tag, First write code which creates a single array containing Objects. Each object should have a "**saturation**" property (i.e. key/value pair) ranging in value from **0 to 100** and a "**lightness**" variable also **ranging from 0 to 100**, evenly spaced in **multiples of 10 (including 0 and 100)**. Every combination of saturation and lightness ought to be represented in the array, which will give you a total of **121 objects** in your array.

B. Create a function, **showCircles(hue)** that uses the d3 "**data join**" (i.e. selectAll(), data(), enter(), attr(), and style() functions) to create or modify one circle for each object in the list. Set the **radius of each circle to 20** and give each circle a **1px grey stroke**. Set the location of each circle to **create a grid based on the associated values: lightness for x, saturation for y, with centers 40px apart** so that the circles barely touch each other. Set the fill of each circle to an **HSL color specified by the circle's lightness and saturation, and the hue value passed to the function**. You may want to use d3.hsl() to create the color. **Check out the d3-color documentation** (hint: be careful of the range of values d3 expects for hsl's parameters).

C. Add a **slider input** so the user can choose a **hue**. This slider should range in value from **0 to 360 with a step size of 1**. Use d3 to attach an event listener functions to the "**input**" event for the slider to call your **showCircles** function with the **current hue value of the slider**.

2. For this problem you will make use of a **template provided with the assignment PDF**. Open **hw6_template.htm** in a plain text editor. **Copy the entire file’s contents into your submission file after Problem 1**. It contains a <p> tag for the problem, some <svg> elements to use when you code, and some helper functions already nested in a <script> tag. **All of your changes to this template should occur in the marked section in the middle of the <script> tag**. **Make sure you include nighthawks.png in your final submitted ZIP file**.

The goal of this problem is to create an interactive tool that allows you to find the average color of a region of an image (in this case the painting, *Nighthawks,* by Hopper). The template includes a helper function that gives you a 2-d array of the RGB values for the pixels in the image. The script will automatically load the image and then run the imgLoaded function.

A. Create a d3 **2-dimensional brush that extends over the entire 800x437px region** of the #container <svg> element. Create an empty function, "**brushed**", which will trigger on the "**brush**" and "**end**" events of your brush. Using d3’s .call() function, install your brush into the **#brush <g> element** inside of this <svg>. Verify that your brush works before you proceed using "console.log(d3.event.selection);"

B. Inside of your "**brushed**" function, **compute the average color of all of the pixels contained within that brush using the LAB color space**. We use LAB rather than RGB because it will produce a more useful average color. First, use **d3.event.selection** and some **C-style for loops** to go through **all of the pixels that lie within the brushed region** (hint: brush selections may not start on integers, yet array indices **must** be integers to work). For each individual pixel, **use d3.rgb and d3.lab to convert the RGB pixel values to LAB color space values**. As you go through the pixels, **keep a running total of L, A, and B values** of pixels so that you can later compute averages. Once you have finished looping through the pixels, **create a variable "averageColor" which contains a d3.lab color object for the average color of all of the pixels in the brushed region** (hint: divide your running totals by the total number of pixels).
Using .attr, **assign this new color to the "fill" attribute of the #color element in the template**.

C. The template also contains a **#label <text> element**. Use this element to provide printed output on the average color. Using d3.lab’s hex function, c**hange the text of the #label tag to show the hexadecimal web color value for the average color you found** (e.g. #1A3933). The black text color might be hard to read if the average color is darker. So, also **adjust the "fill" attribute of this <text> element** so that it is "**white**" if the L value of the average color is **below 50** and "**black**" if it is **above 50**.

Example:

#1a3933
#85c3a9