

## CS/INFO 3300; INFO 5100

### Homework 10

Due 11:59pm Tuesday, November 26

(we will also accept late submissions before 11:59pm on 12/03 with no slipday use)

Goals: Practice using d3 to work with raster drawing functions

Your work should be in the form of an HTML file called `index.html` or `index.htm` with one `<p>` element per problem. 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.v7.min.js"></script>`

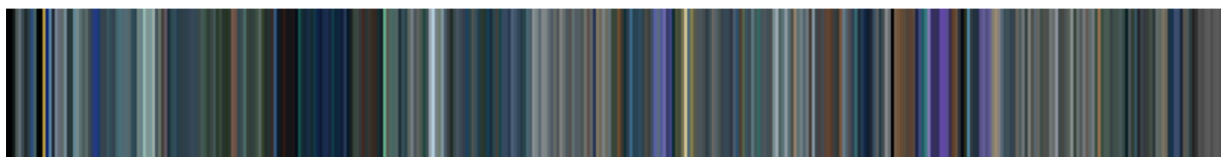
Create a zip file containing your **HTML file and associated data files** (i.e. `movie_barcodes.json`) and upload it to CMS before the deadline. Submissions that do not include data files may be penalized. Your submission will be graded using a Python web server run in a parent directory containing your zip file contents along with many other students' submissions.

**1.** In this assignment, you will create a series of *movie barcodes* using `<canvas>` elements. A barcode uses vertical lines to show the *average color of individual frames of a film*, helping to reveal how color is used by cinematographers to give flavor to a film. This has been a popular subject of online [visualization blogs](#), to the extent that some have even made [publicly available tools](#) for generating them. For this assignment you'll be taking a simpler approach compared to these tools. Your end barcodes will look exactly like this:

**Aladdin (1992)**



**Avatar**



**Dune (2021)**



**Everything Everywhere All at Once**



We have generated a movie barcode dataset for an eclectic set of 32 films, `movie_barcodes.json`. The dataset contains a list of Objects, one for each movie barcode. The relevant properties in each of the barcode Objects are:

```
{
  title:  a _string_ identifying the title of the movie
  bars:   a _list_ of individual color bars, used to fill the barcode's canvas
    [ {
      color:  a hexadecimal color _string_ for that specific color bar
      x: the x integer position of this specific color bar
    } ...
  ]
}
```

You will find 800 individual bars inside of each movie's `bars` list. Your eventual `<canvas>` elements will be 800 pixels in width. This means that you will have a single 1px wide vertical bar for each item in the `bars` array. You'll have 32 individual `<canvas>` elements, one for each movie Object.

There are any number of ways to solve this assignment. For class purposes, we will pick the simplest path that *does not* involve data joins and instead just uses simple loops. You are welcome to use joins if you are confident that you can solve the problem. You will have a choice between two different methods for modifying your canvas. While we suggest that you use the array method, the line method will deliver identical results.

(next page)

( TECHNICAL DATASET DETAILS (feel free to ignore): The dataset was generated by sampling 400 frame images from each movie file. They were sampled evenly over the duration of the film (i.e.  $\text{total\_frames} / 400$  ). For each of those individual frame images, there are any number of strategies for finding the dominant or average color. Though I tried RGB, LAB, and even K-means clustering, averaging XYZ colors gave the nicest looking results. Within each image, I converted each RGB pixel into the XYZ color coordinate space. I then computed the average XYZ value for all the pixels. If you want to try this, you might also consider additional statistical methods such as median. The average was then converted back into a hexadecimal RGB color for use in the dataset. To obtain 800 individual bars, each of the 400 frames was duplicated, making thicker barcode lines. )

## Procedure:

- A.** Begin by creating an asynchronous function and importing the dataset, `movie_barcodes.json`, using `d3.json` and `await`. Make sure that you call your async function.
- B.** In your HTML, create a `<div>` element that will contain all of your barcodes  
(e.g. `<div id="barcodes"></div>` )
- C.** Now iterate through each of the movie Objects in `movie_barcodes` using a `forEach` loop.
- **D.** For each of the movies, create a new `<div>` element to hold that movie's title and canvas.  
Add an `<h5>` element inside of the new `<div>` containing the movie's title (hint: use `.text()` )  
Add a new `<canvas>` element inside of the new `<div>`. Set its width to 800 and height to 100.
- **E.** Obtain a drawing context for the new `<canvas>`.  
You now have two choices for how to draw the barcode onto the movie canvas:
- -- *Option A. Draw vertical lines for each of the bars*  
Using a nested `forEach` loop, begin iterating through the bars array  
For each of the bars, set the `strokeStyle` of the drawing context to the bar's `color`  
For each of the bars, use the context to draw a *vertical line* from top to bottom.  
To determine the x-position of the bar, refer to the bar's `x` property and add 0.5 to it.  
( We add 0.5 so that the 1px wide line properly fills that column of pixels. )  
( If the bars appear to be very light in color, you forgot to add 0.5 )
- -- *Option B. Manually manipulate the pixel array*  
Use the `getImageData` function on the drawing context to get an array of canvas pixels  
Using a nested `forEach` loop, iterate through the bars array within the movie Object.  
For each bar, get a hexadecimal color string from its `color` property. Use the following code to compute `r`, `g`, and `b` values from the hex color string:
- ```
let num = parseInt(color.replace('#', ''), 16);
let r = (num >> 16) & 255;
let g = (num >> 8) & 255;
let b = num & 255;
```
- Get the x-position for this bar using the bar's `x` property  
Using a nested `for` loop, iterate from 0 to 100. This will become your `y` value.  
Within that loop, use array operations to set the pixel array's `r`, `g`, and `b` values for each  
(`x`, `y`) position. This will fill in each bar pixel-by-pixel  
( hint: this approach has three nested loops: one looping through movies, another through bars, and a final one looping through pixels from 0 to 100 )
- Finally, use `putImageData` to paste your pixel array onto each canvas

## REFERENCE:

index.html should look something like this *before* your code runs:

```
<html>
  <head> </head>
  <body>
    <p> #1 </p>
    <div id="barcodes">
      ( This is where content will be added )
    </div>
    <script>
      ( Your code here )
    </script>
  </body>
</html>
```

index.html should look something like this *after* your code runs:

```
<html>
  <head> </head>
  <body>
    <p> #1 </p>
    <div id="barcodes">
      <div>
        <h5>Aladdin (1992)</h5>
        <canvas width="800" height="100">
      </div>
      <div>
        <h5>Avatar</h5>
        <canvas width="800" height="100">
      </div>
      ...
    </div>
    <script>
      ( Your code here )
    </script>
  </body>
</html>
```