

## CPSC 446/546

### Assignment 5

Due 11/29/2021, 11:59 pm

(ideally would have been due 11/19, but set the date after Thanksgiving break for those who need extra time to catch up)

Upload to Canvas as a zip file named *yourfirstname\_yourlastname\_5.zip*.

This assignment requires you to develop visualizations using D3. Do your own coding using code provided with the assignment and examples given in the Scott Murray textbook. **Do not use any code from the internet that you may find that creates visualizations similar to those required in problems.** If we find that code you use for a solution is taken from an internet source, you will receive a zero for the entire assignment.

Be sure to reference d3.js in the same directory, i.e. use this in your html:

```
<script type="text/javascript" src="d3.js"></script>
```

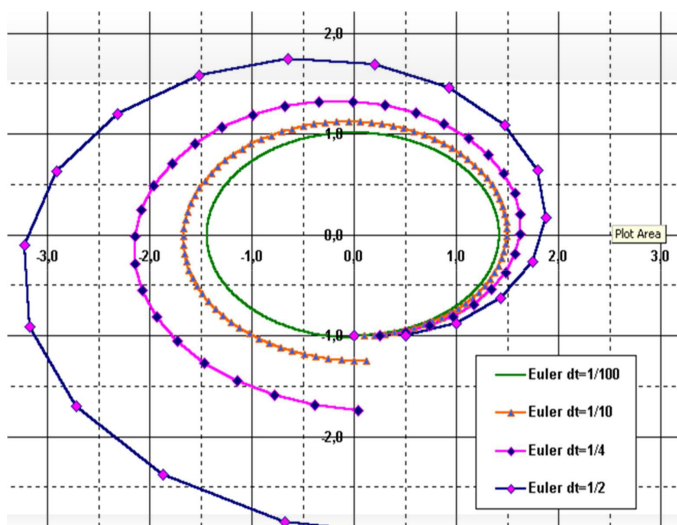
As in previous assignments you may use

<https://developer.mozilla.org/enUS/docs/Web/JavaScript/Reference> or <https://javascript.info/> to do tutorials and look up syntax.

Note that some parts of the questions are for all students and some are additional work for CPSC 546 only.

#### 1. Arrange Spatial Data -- Vectors (25 pts)

a. Produce a plot of Euler integration for the velocity field defined as  $[-y, (1/2)x]$  at each location  $[x,y]$ . Allow the user to enter a step size between 0 and 1.0 using a slider. Show the result as a path with the computed points marked on it as in this example from class:



As in the example, start the path at (0, -1), and show the field for x and y ranging from [-3,-3] to [3,3]. Unlike the example you only need to show one path at a time. You may use a different style to display the background grid .

**(546 ONLY) b.** Produce the same plot for the same field as in part a.), but use 4th order Runge-Kutta integration (equation for  $y(t+dt)$  has same form as  $x$ ):

$$x(t+dt) = x(t) + 1/6*dt*(k_1 + 2k_2 + 2k_3 + k_4)$$

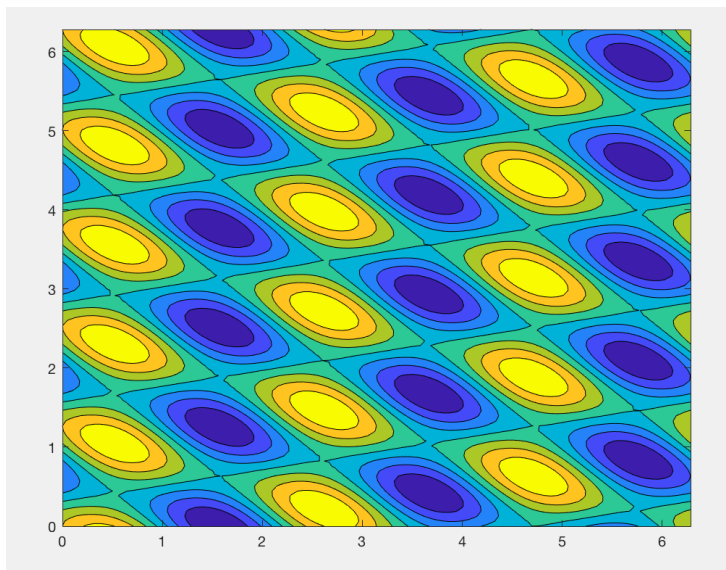
where:

$$k_1 = v_x(t); \quad k_2 = v_x(x(t) + k_1/2)$$

$$k_3 = v_x(x(t) + k_2/2); \quad k_4 = v_x(x(t) + k_3)$$

## 2. Arrange Spatial Data -- Scalars (25 pts)

Use contours computed and displayed in D3 described at <https://github.com/d3/d3-contour> to generate contours (the 2D equivalent of 3D isosurfaces) for the 2D function  $f(X,Y) = \sin(3*X) + \cos(2*X + 5*Y)$ ; shown in this MatLab plot:



Your plot should be square (instead of the aspect ratio shown here), and you can select your own colormap to use.

3. Arrange network data (25 pts) -- A chord diagram shows relationships between categories that are represented as angles on a circle with "ribbons" that connect the categories. The width of the ribbons can represent the magnitude of interaction between the categories.

Sample code for creating chord diagrams is given in  
<https://www.d3-graph-gallery.com/chord.html>

Create a chord diagram for this table of migration data (each row is migration from the "Country"):

Each chord should be colored according to the "source" country, and the countries should be clearly labeled on the diagram.

Country	Austria	Belgium	France	Germany
Austria	0	2 201	7 665	191 269
Belgium	2 540	0	139 529	39 225
France	11 610	141 648	0	215 982
Germany	249 001	33 783	140 948	0

Notes:

For help with chords in D3 also see:

The D3 API: <https://github.com/d3/d3/blob/master/API.md#chords-d3-chord>

Example by Mike Bostock: <https://observablehq.com/@d3/chord-diagram>

4. Geographic visualization (25 pts) The map below is from the Murray book chapter\_14/06\_points.html plotted with points that represent (approximately) each states centroid (from statecentroids.csv that comes with this assignment), instead of cities. Using 06\_points.html and the centroids as a starting point, plot two values for each state (one encoded with color, one with the size of circle) from [www.census.gov](http://www.census.gov). You can choose any data for each state that you like (population, housing etc.) One possibility is taxes collected <https://www.census.gov/content/census/en/data/tables/2020/econ/stc/2020-annual.html>. Some of the centroids aren't very good (such as Michigan), and you can update these manually if you would like.

**(546 only)** Create a second map of the US, but instead of a circle create a glyph for each state that encodes 2 or more data values (e.g. for tax data each state could be colored by total taxes, and the glyph could represent income from types of taxes such as property and income tax.)

