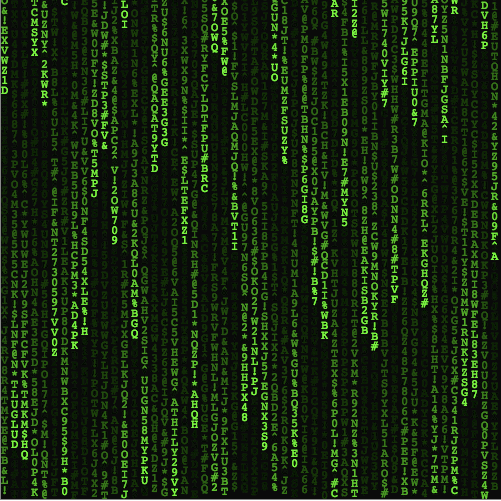
Graphics Lab

**You can do this lab solo or in pairs.**

In this lab, we’ll explore (relatively simple but fun) graphics effects inspired by movies, and ask ourselves, “How do they do that?”

Part A: The Matrix

In *The Matrix* (1999), the good guys can observe everything that happens in the “matrix” by watching a “digital rain” display of flowing green characters (see <http://en.wikipedia.org/wiki/Matrix_digital_rain>), like that shown in the figure below. How do they do that? We don’t know the exact answer, but in fact, simulating this kind of display can be done with just a few lines of Javascript. In this exercise, we’ll take a look at this code and think about ways in which we can alter and manipulate the display along various dimensions.



To begin, go to the following web site:

<http://cog.cs.drexel.edu/ci101/graphics/>

Click the “Scripts…” drop-down and select “Matrix” from the menu, which should fill the left-hand pane with the relevant Javascript code. Clicking “Run” will start the simulation, which generates the digital-rain display on the right-hand Javascript canvas. You may edit the Javascript and re-click “Run” at any time to see the results of your changes to the code. (Clicking “Stop” stops the simulation, naturally.) Note that a few variables and functions have already been defined for you, as noted above the Javascript text area.

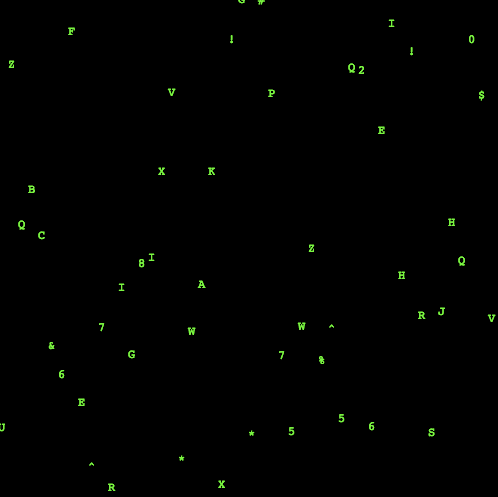
(1) Your first task is to understand the code as best you can. Most importantly, what is the role of the array **columnY**? What happens to the elements of **columnY** in the **step()** function? Please summarize in 2-3 sentences.

(2) Next, how does this code create the fading rain effect, such that the rain droplets leave a trail as they fall? Hint: It may help to look over the details of possible colors in CSS, which applies to a Javascript canvas as well: <http://www.w3schools.com/cssref/css_colors_legal.asp>

(3) Let’s say you want to change the display such that the “rain” falls in a more orderly way, with one droplet slightly ahead of the previous one, as shown in the figure below. What (single) line of code needs to be replaced to make this happen? What should the new line of code look like?



(4) Now let’s say you want to change the display such that the “rain” doesn’t leave a trail, as in the figure below. What line of code needs to be replaced to make this happen? What should the new line of code look like?



(5) Now let’s say you want the droplet characters to consist of *only* numeric characters (0-9), without alphabetic characters (A-Z) or other characters, as in the figure below. What line of code needs to be replaced to make this happen? What should the new line of code look like?



(6) Now let’s say you want to change the direction of the rain such that the droplets rise instead of fall, as in the figure below. This time, you will need to change more than one line of code. What lines of code need to be changed to make this happen? What should the new lines of code look like?



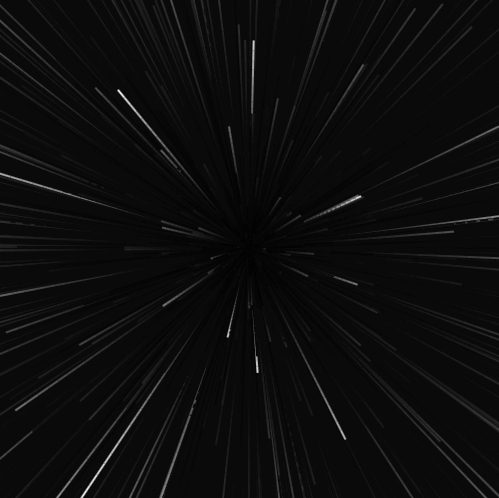
Part B: Star Wars

Manyspace-based movies such as *Star Wars* include effects of flying through a star field, like that shown below. How do they do that? Click the “Scripts…” drop-down and select “Space” from the menu to show the code for this exercise.



(7) Again, your first task is to understand and explain the code. What is the basic idea behind the animation? In particular, what is happening to each star over time? Please summarize in 2-3 sentences.

(8) Let’s say you want to change the stars to show a trail, as if jumping into hyperspace, as shown below. What (single) line of code needs to be replaced to make this happen? What should the new line of code look like?



(9) Let’s say, for some strange reason, you want the stars to appear as alphabetic characters—the capital letters “A” through “Z”—as shown below. Each “star” is a random letter, and stays the same letter until it reaches the edge of the screen and is reset. (The letters do not need to change size over time.) This change involves several modifications throughout the code. Change your program in this way and submit your entire program as the solution to this problem. Hint: You’ll need to add a field to the “star” structure so that your letter for a particular star stays the same as it moves.



**What to Turn In**

You should submit answers to each of the questions above. Please be sure to answer all parts of each question!