EA1 Homework Program 1: Page Rank Exploration
Due Friday, Sept. 29, 2023, at **6:00am**

In this homework, you will write a MATLAB program to find some properties of a network based on its hyperlink matrix. You will first create a random hyperlink matrix (i.e. the page connections will be random) of size $N \times N$. Then, you will find how many outgoing and incoming links there are for each page. Finally, you will display the results.

You will be given a code template, so you will not be starting from scratch. At the start of the file, make sure to change the info to your own.

Download the code template, called `hw1_incomplete`, from Canvas, and open it in the MATLAB Editor. Then, perform the following steps:

1. Fill in all missing code, as prompted in the comments in the code (surrounded by ***).
2. Make sure there is a comment above **every** line of code explaining what it is doing. Some lines already have comments, so you can leave those alone. Make sure no *** remain in the comments.
3. Run your code with various values of N and d, and answer the following questions in a comment after your code. It might help to use small values of N at first to make sure your code is working properly, and large values of N to answer the questions.
   (a) In general, does the rank of a page tend to increase with the number of outgoing links from that page?
   (b) In general, does the rank of a page tend to increase with the number of incoming links to that page?
4. Answer the following questions, which are unrelated to the code. Please include these answers in the comment block after your code.

$$\begin{bmatrix} 0 & \frac{1}{2} & \frac{1}{3} & 0 \\ \frac{1}{2} & 0 & \frac{1}{3} & 1 \\ 0 & \frac{1}{2} & 0 & 0 \\ \frac{1}{2} & 0 & \frac{1}{3} & 0 \end{bmatrix}$$

   (a) Given the hyperlink matrix above, how many pages link to page 1?
   (b) Given the hyperlink matrix above, how many pages does page 4 link to?
   (c) Given the hyperlink matrix above and a damping ratio of 0.85, what is the rank of page 4 (to four decimal places)?