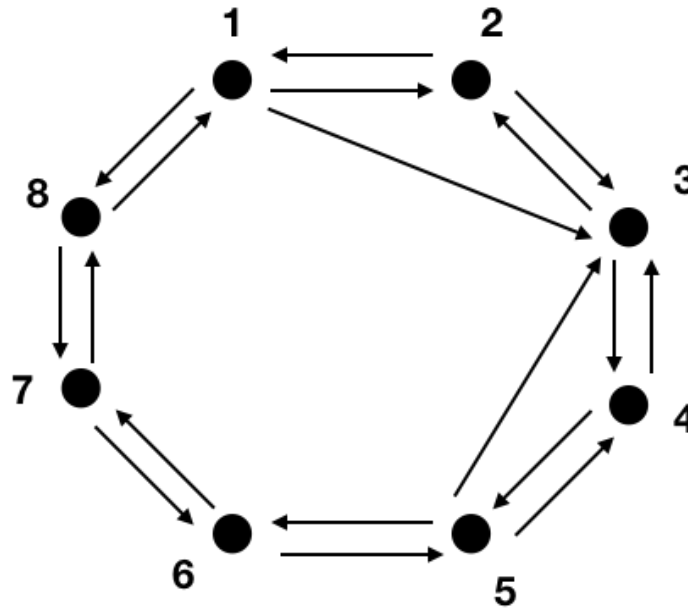


CS/ECE/ME532 Period 14 Activity

Estimated time: 30 minutes for Q1 and 30 minutes for Q2.

1. A ring-like network of links between web pages is shown below.

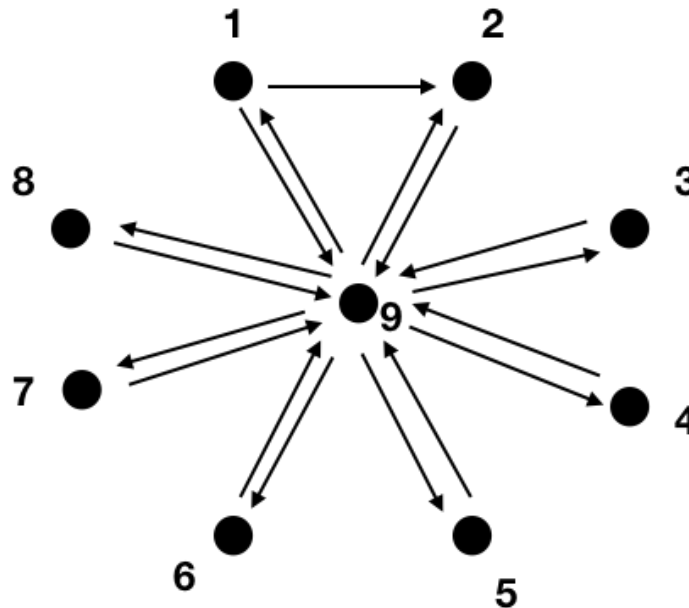


- a) Find the unweighted adjacency matrix for this network.
- b) Find the weighted adjacency matrix for this network. Note that the entries in each column of the weighted adjacency matrix are nonnegative and sum to one. Such a matrix is called a column stochastic matrix.
- c) Suppose the entries of a vector \mathbf{b} sum to one. It is easy to show that the entries of $\mathbf{A}\mathbf{b}$ also sum to one since each column of the weighted adjacency matrix \mathbf{A} sums to one. The PageRank algorithm thus uses the power method without normalizing the length of the vector at each iteration. Each iteration gives a new vector with positive entries that sum to one. Find the estimate of the PageRank vector after

one iteration using an initial vector $\mathbf{b}_0 = \frac{1}{8} \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix}$. The initial vector \mathbf{b}_0 gives equal importance to all pages.

- d) Find the estimate of the PageRank vector after 1000 iterations of the power method using an initial vector $\mathbf{b}_0 = \frac{1}{8} \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix}$. A skeleton script is available. You will need to enter the adjacency matrix into the code.
- e) Do any nodes seem to be more important than other nodes? Explain.

2. A hub-like network of links between web pages is shown below.



- a) Find the unweighted adjacency matrix for this network.
- b) Find the weighted adjacency matrix for this network.
- c) Find the estimate of the PageRank vector after one iteration using an initial vector $\mathbf{b}_0 = \frac{1}{9} \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix}$.
- d) Find the estimate of the PageRank vector after 1000 iterations of the power

method using an initial vector $\mathbf{b}_0 = \frac{1}{9} \begin{bmatrix} 1 \\ 1 \\ \vdots \\ 1 \end{bmatrix}$.

- e) Are any nodes more important than other nodes? Explain.
- f) Experiment with the number of iterations of the power method that are needed to find an answer that is correct to three decimal places.