

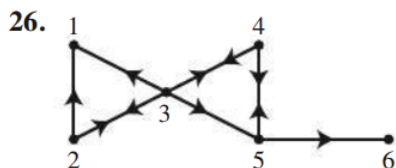
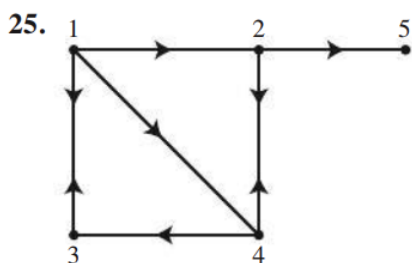
### MATLAB Exploration #4 for MATH 1554

For each MATLAB assignment, follow the step-by-step formatting guidelines we provided. You will be graded on completeness, following directions, proper usage of comments, and overall readability of your code and published .pdf submission. We recommend `format shortG`

For Week 13: MATLAB #4 - Google matrix - for Problems 25 and 26 shown below:

Find the google matrix  $G$  for the link diagram and indicate the PageRank for each page. In the comments explain the meaning of  $G^k(3, 2)$  the entry of  $G^k$  in row 3 and column 2, the meaning of  $G^k(3, \cdot)$  the 3rd row of  $G^k$ , and the meaning of  $G^k(\cdot, 2)$  the second column of  $G^k$ , in the context of webpages.

In Exercises 25 and 26, consider a set of webpages hyperlinked by the given directed graph. Find the Google matrix for each graph and compute the PageRank of each page in the set.



Also, for each google matrix  $G$ , find and indicate in the comments the smallest  $k$  such that every entry of  $G^k$  is within four significant digits to  $\Pi$ , as in Theorem 1 (Page L10-18). Using appropriate comments in your MATLAB code, interpret the meaning of the value of  $\lim_{k \rightarrow \infty} G^k(i, j)$ , in the context of webpages.

#### THEOREM 1

If  $P$  is a regular  $m \times m$  transition matrix with  $m \geq 2$ , then the following statements are all true.

- There is a stochastic matrix  $\Pi$  such that  $\lim_{n \rightarrow \infty} P^n = \Pi$ .
- Each column of  $\Pi$  is the same probability vector  $\mathbf{q}$ .
- For any initial probability vector  $\mathbf{x}_0$ ,  $\lim_{n \rightarrow \infty} P^n \mathbf{x}_0 = \mathbf{q}$ .
- The vector  $\mathbf{q}$  is the unique probability vector which is an eigenvector of  $P$  associated with the eigenvalue 1.
- All eigenvalues  $\lambda$  of  $P$  other than 1 have  $|\lambda| < 1$ .