Some Definitions and Results

Definition: A **dangling page** is one with no outgoing links.

Definition: A web is **disconnected** if you cannot get from every page to everyother page (ignoring link directions).

Definition: A web is **strongly connected** if you can get from each page to every other page via links.

Definition: A matrix is **column-stochastic** if all entries are non-negative and the entries in each column sum to one.

The matrix for our example web is easily seen to be column-stochastic. For such matrices we have:

Theorem: Any column-stochastic matrix has $\lambda = 1$ as an eigenvalue.
Proof: Let e be the column vector whose entries are all ones. Then the property that the columns of A sum to one is equivalent to the equation $e^T A = e^T$ (think about it!). Transposes give us $A^T e = e$. Therefore $\lambda = 1$ is an eigenvalue of A^T and hence also of A.