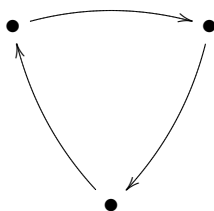


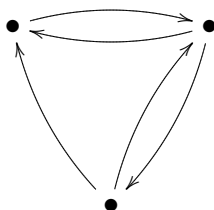
DISCRETE MATHEMATICS, EXERCISES SHEET 4

- (1) Let M and N be row stochastic square matrices of the same size.
- (a) Show that the product MN is a row stochastic matrix.
 - (b) For $0 \leq p \leq 1$ prove that $pM + (1 - p)N$ is a row stochastic matrix.
- (2) Consider the following directed graphs

(a)



(b)



(These are the graphs from Exercise Sheet #1, Problem 2.) For each graph, do the following. Recall the adjacency matrix W and the associated stochastic matrix \bar{W} . Work out the modified stochastic matrix W_p , where $0 \leq p \leq 1$. Calculate the invariant measure of W_p . Does the ranking of webpages in the associated model of the web depend on p ?