

Department of Bioengineering

BE3-HMIB – Modelling in Biology (MiB), Dr Guy-Bart Stan & Dr Tom Ouldridge

Training coursework 6

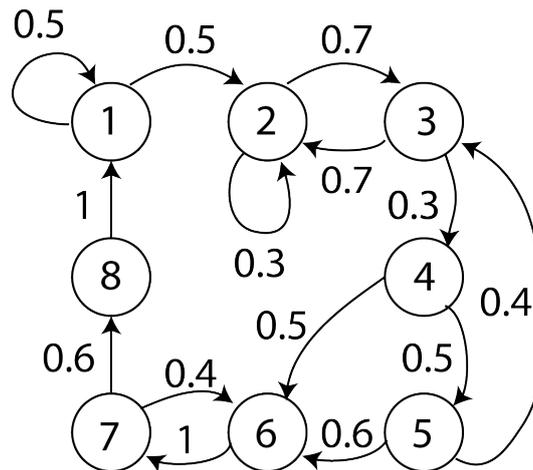


Figure 1: A graphical representation of a discrete time Markov chain.

**Analysis of a discrete time Markov chain**

1. Consider the markov chain illustrated by the transition graph in Fig. 1. Construct the transition matrix  $\mathbf{T}$  in Matlab; don't forget that  $T_{ij}$  is the probability of ending a step in state  $i$ , given that the system starts the step in state  $j$ .
2. Find the probability distribution after 10 steps given an initial starting position of state 2.
3. Find the stationary distribution reached in the long time limit by finding the eigenvector with eigenvalue 1 (the largest eigenvalue). Make sure it is normalised.
4. Find the expected (average) time to reach state 8, given that the system starts in state 1, by using the fundamental matrix method.
5. (Optional) Find the probability that a system starting in state 4 reaches state 2 before it reaches state 1. Again, use the fundamental matrix method.

In this coursework you may need to use the following Matlab commands: `eig`, `eye` and `inv`. You will also need to define matrices, multiply them and access individual components or columns. You can check the Matlab help by using `help COMMAND`.