

Problem 5: Walking Around - Solution

We can solve this problem easily by determining the stationary distribution on the network. For an aperiodic, strongly connected, undirected graph, the expected return time T_{ii} to an initial state s_i is given by the relation

$$\mathbb{E}[T_{s_i, s_i}] = 1/\pi_{s_i}, \quad (1)$$

where π_{s_i} indicates the stationary distribution of the graph, given by the solution of the linear system

$$\pi P = \pi. \quad (2)$$

In the case of a simple random walk on a network (as we consider in the exercise), this expression for π simplifies to the expression

$$\pi_{s_i} = \frac{d_{s_i}}{2|E|}. \quad (3)$$

Using this relation, we see that the only quantities we need to evaluate this expression, are the degree d_{s_i} , and the total number of edges $|E|$. Both can be easily extracted from the given information. In the end, it comes down to importing the data in a correct way, and the making a simple calculation and outputting the answer in a correct way.