

1 What is the degree distribution p_k of this network?

For the single node connected to $N-1$ degree one nodes ($k=N-1$)

$$p_k = \frac{1}{N}$$

For the $N-1$ degree one nodes ($k=1$)

$$p_k = \frac{N-1}{N}$$

For all other k s

$$p_k = 0$$

2 What is the probability q_k that moving along a randomly chosen link we find at its end a node with degree k ?

If $k=1$

$$q_1 = \frac{N-1}{N}$$

If $k=N-1$

$$q_{N-1} = \frac{1}{N}$$

If $k \neq 1$ or $k \neq N-1$

$$q_k = 0$$

3 Calculate the degree correlation coefficient r for this network. Use the expressions of $e_{\{kk'\}}$ and $P(k'|k)$ calculated in HOMEWORK 7.1.

The textbook shows that

$$r = \frac{\sum_{kk'} \frac{kk'(e_{kk'} - q_k q_{k'})}{\sum_{k'} k'^2 q_{k'} - [\sum_{k'} k' q_{k'}]^2}$$

Simplifying the equation we get

$$r = -\frac{1}{N-1}$$

4 Is this network assortative or disassortative? Explain why.

This network is disassortative since the hubs avoid each other, linking instead to small-degree nodes. The star network looks like a hub and spoke network, which is a characteristic of disassortative networks. Furthermore, $r < 0$, supporting its disassortative nature.