Networks and Complexity

Solution 5-3

This is an example solution from the forthcoming book Networks and Complexity.
Find more exercises at https://github.com/NC-Book/NCB

Ex 5.3: Diameter of a specific network [2]

Consider a network consisting of a central hub of degree 9 that connects to 9 nodes of degree 1. Compute the diameter according to both definitions (do not use the approximation, it won't work well for such a small and heterogeneous network)

Solution

If we use the classical definition 'longest shortest path', we get the answer 2, immediately. If we use the average path length definition we note that the distance from the central node to one of the 9 peripheral nodes is 1. The distance from one of the 9 peripheral nodes to one the central node is also 1. and the distance between two peripheral nodes is 2. Sine there are $9 \cdot 8 = 72$ distances between peripheral nodes we get the mean path length

$$D = \frac{9 \cdot 1 + 9 \cdot 1 + 72 \cdot 2}{9 + 9 + 72} = \frac{90 + 72}{90} = 1.8 \tag{1}$$