Lecture Introduction to Network Science
Prof. Dr. David B. Blumenthal
Dr. Anne Hartebrodt
Fabian Woller

BIONETS

Assignment 4 – Centrality Measures

Released: 13.5.2024 Exercise Session: 23.5.2024

Question 1 – Centrality measure ranges

We discussed several notions of node centrality measures in the lecture. Based on their definition, can you give upper and lower bounds for the values that the following centrality measures can take on a directed network?

a) (In-/Out-) Degree centrality

b) Eigenvector centrality

c) PageRank centrality

d) Closeness centrality

Question 2 – Eigenvector and PageRank transition matrix

Consider the network visualized in Figure 1.

a) Give the transition matrix used for the computation of Eigenvector centrality.

b) Give the transition matrix used for the computation of PageRank centrality using $d = 0.5$.

c) Using the transition matrix from a), can we expect the power iteration process in Eigenvector centrality computation to converge to meaningful values? Why or why not?

d) Using the transition matrix from b), can we expect the power iteration process for PageRank centrality computation to converge to meaningful values? Why or why not?

Question 3 – Betweenness centrality implementation

Implement the calculation of betweenness centrality of a node in a given network. Use the recursive computation of $\sigma_{s,t}$'s for counting shortest paths as described on Slide 30.

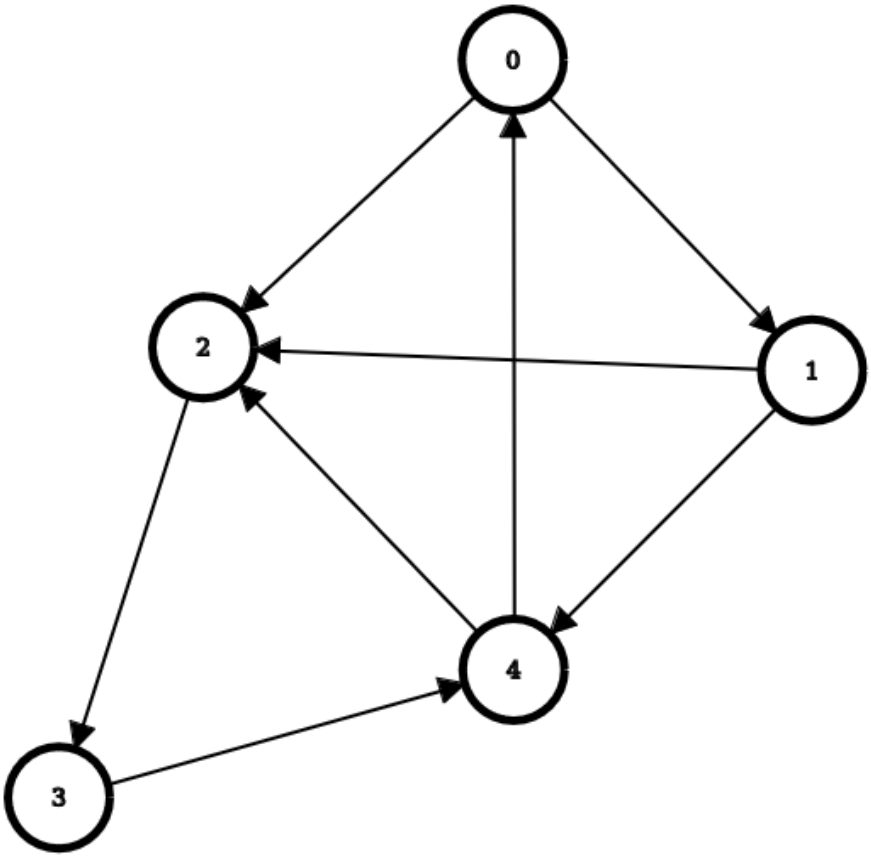

Figure 1: Example network.