

ASSIGNMENT 8 – COMMUNITY DETECTION 1

Released: 17.6.2024

Exercise Session: 27.6.2024

Question 1

Answer or solve the following questions:

- a) Why is edge betweenness a meaningful measure for the computation of clusters in the Girvan-Newman algorithm?
- b) How did we cope with the issue of unbalanced cuts in spectral clustering?
- c) Refer to Slide 27. Prove that the scaled indicator vector x (as defined on Slide 25) fulfills the properties $\mathbf{1}^T x = 0$ and $x^T x = n$.
- d) How can we use spectral clustering also for clustering numeric data? Which steps do we need to take to make that possible?

Question 2

Consider the network visualized in Figure 1 with edge weights indicating node distances. Run **one iteration** (i.e. steps 1–3 according to Slide 12) of the Girvan-Newman algorithm. What are the resulting clusters of the first iteration?

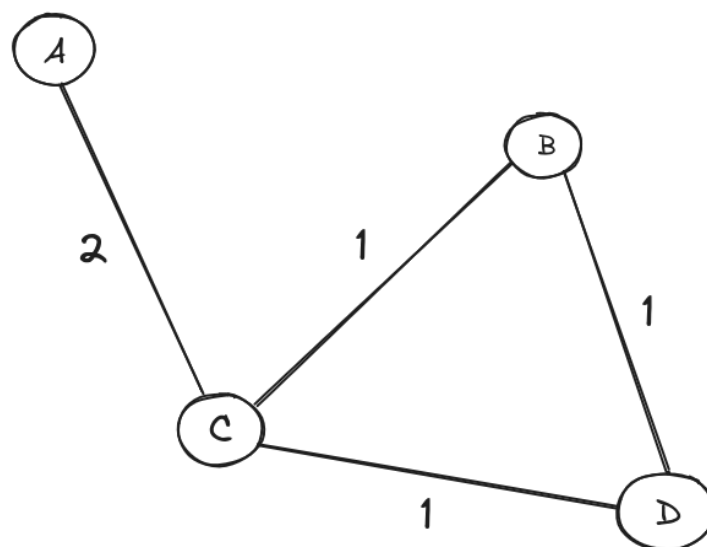


Figure 1: Example network.

Question 3

Implement the spectral clustering algorithm for a given network for general $k \geq 2$ as shown on Slide 30. You can use the technical suggestions given on Slide 31. Your implementation should take as input a `networkx` object and a value of $k \geq 2$.