

ASSIGNMENT 9 – COMMUNITY DETECTION 2

Released: 24.6.2024

Exercise Session: 4.7.2024

Question 1

Answer the following questions:

- a) Which “weaknesses” do the two clustering algorithms from last week’s lecture possess in contrast to this week’s methods?
- b) Describe in your own words the key idea of modularity and how it overcomes one of the weaknesses mentioned in a).
- c) How can we use modularity for community detection? How did we use it in this lecture?
- d) Describe in your own words the key idea of the label propagation algorithm (LPA).
- e) Which possible variations of LPA did we discuss?

Question 2

Consider the undirected network visualized in Figure 1. The numbers to the top left of the nodes correspond to the respective node labels.

- a) Run LPA using the synchronous label update and the 0-1-hop neighborhood.
- b) Run LPA using the asynchronous label update and the 1-hop neighborhood.
- c) Find independent node sets that partition the given network. Run LPA using the 1-hop neighborhood and the semi-synchronous label update based on your defined independent node sets.

Question 3

Use `networkx`’s library to obtain a clustering from the Girvan-Newman algorithm with a modularity value of at least τ . That is, your program should take as input an undirected network and a threshold value τ , compute the Girvan-Newman clustering and select the first clustering hierarchy with a modularity value of at least τ . Plot the resulting clustering.

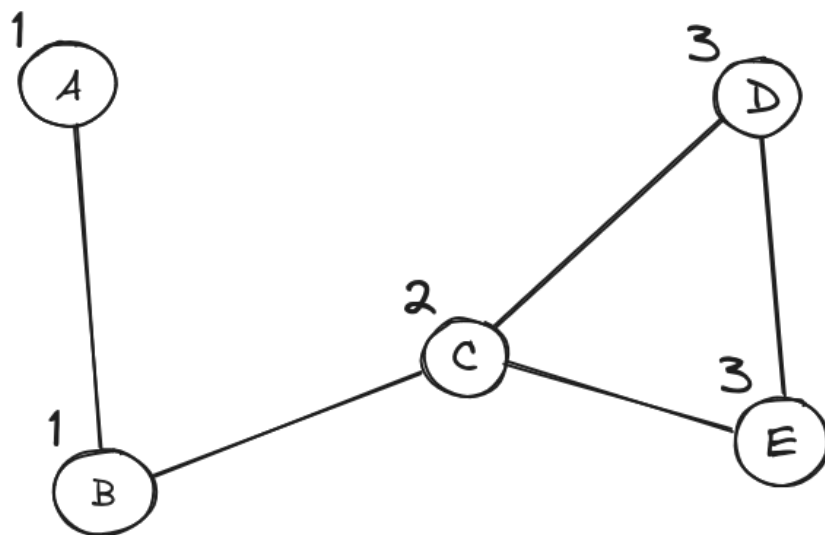


Figure 1: Example network.