

Algorithms and Applications in Social Networks

HW #2

Instructions: Implementation should be done using Python and NetworkX library. Please submit your code in .py files (file per question) or .ipynb file (Jupyter Notebooks).

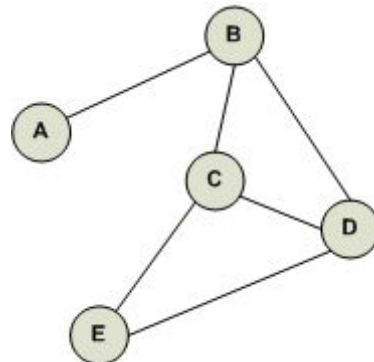
The theoretical part of the question should be submitted in a PDF file.

Do not forget to write IDs of all members in the team (pair). Submit only once per team!

Please ZIP all files together, name the file HW2_<student_id>.zip and upload it to Moodle.

Question #1:

- Implement Newman-Girvan algorithm for non-overlapping communities. The algorithm should receive a network and parameter k (number of communities) and return the communities.
- Run this algorithm on the biggest connected component of the following dataset: <https://bit.ly/2KLHN60> (with $k=3$)
Each line of the file represents an edge between two nodes.
- (Manually) Find how to split the following network into 2 non-overlapping communities using the above algorithm:



Build a dendrogram of each split.

Question #2:

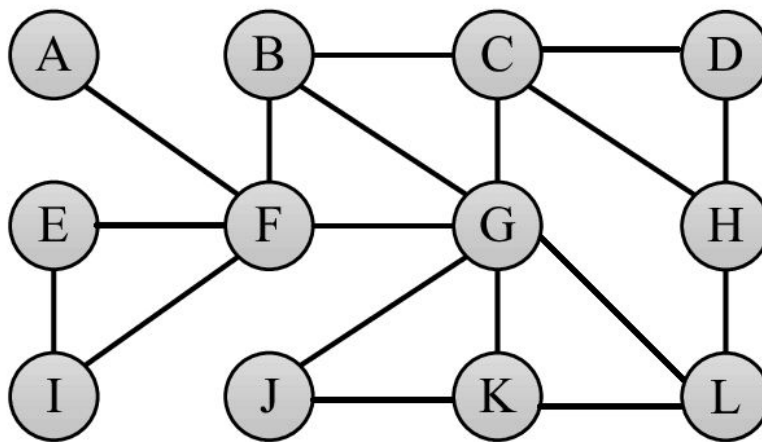
There are 20 people, all of them connected to each other. 18 connections are removed. Prove that the graph is still connected.

Question #3:

A group of n people are connected to each other, and using 2 ways of communications – phone and mail. Prove that they can decide to use only one of these two ways and still all of them will be reachable to each other (not necessarily directly connected)

Question #4:

- Implement k-clique communities detection algorithm. The algorithm should receive a network and parameter k (size of clique) and return the communities.
- Run this algorithm on the biggest connected component of the following dataset: <https://bit.ly/2KLHN60> (with k=4)
- (Manually) Find how to split the following network into overlapping communities using the above algorithm and k=3:



- (Manually) Find the central node in the given graph.