(Group) HW3

Network Analytics, MSc BA

Submission by **23 February**

Programming: You are allowed to consult on the programming part with your colleagues and on the web but the final code has to be written and debugged entirely on your own. You have to search for the appropriate functions in NetworkX/numpy/scipy yourselves.

1. (15 points) The exercise is on detecting communities in two networks
   i. The small Zachary Karate Club network with known community ground-truth
   ii. The who-talks-to-whom network of HW 2 (**underlying undirected** graph where you put an edge if there is a directed link in either direction between two nodes)

For both these networks, you may have to use the networkx functions to go back and forth between edge_list format and adjacency matrix format depending on which community detection package and method you are using. Trying out various graph layouts might help gain some insight.

(a) Calculate the community structure using the networkx `girvan_newman` algorithm and the Louvain `community` package (that finds best modularity partition via some fast heuristics.) Note that the class data is in a 0-1 matrix format. You may want to transform it to adjlist format → write to file and →reread, or read each line and add one edge at a time.

(b) Plot the communities you obtained with different communities in different colors, and for best effect to give insight. *(Hints: http://perso.crans.org/aynaud/communities/api.html; http://ryancompton.net/2014/06/16/community-detection-and-colored-plotting-in-networkx/)*

Based on your work in (a) and (b), and the context of the two datasets, write a report on (i) possible reasons for the differences in the two communities detected by the two algorithms, (ii) and possible explanation and insight into the communities based on the two algorithms

2. (15 points) *The following data shows the evolution of a slice of European banking over time. You are not required to use any formal model, but by plotting wisely and some analysis and reflection extract some insight into the propagation of economic shocks.*

   The dataset *bis_links.csv* contains data of the banking system from [from_id] country has an exposure of value [value] to entities in [to_id] country at date [net_id]. Extract insight into the propagation of economic shocks.