CS-E5740 Complex Networks, Answers to exercise set 6

Marco Di Francesco, Student number: 100632815

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Problem 1

a) Look at figure 1.

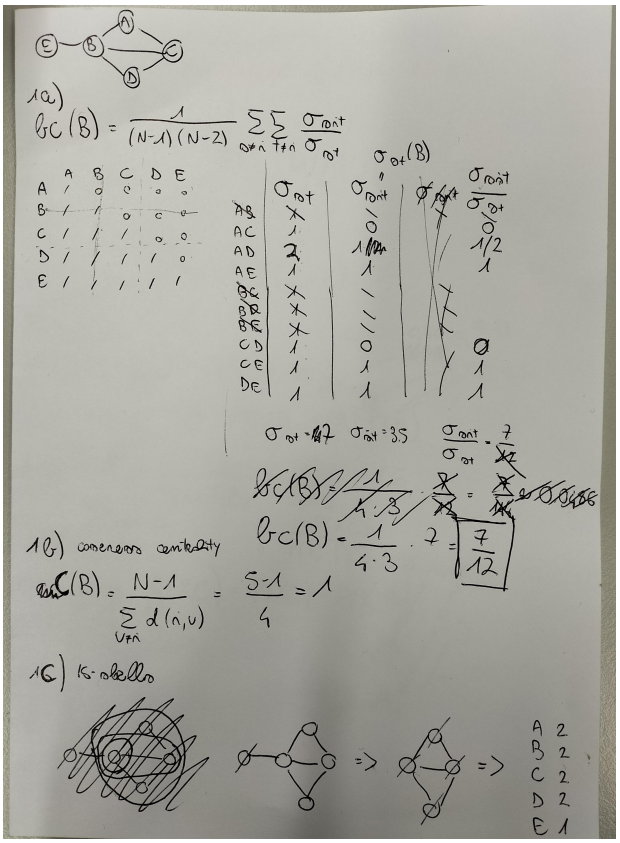

Figure 1: Exercise 1a

b) Look at figure 2.

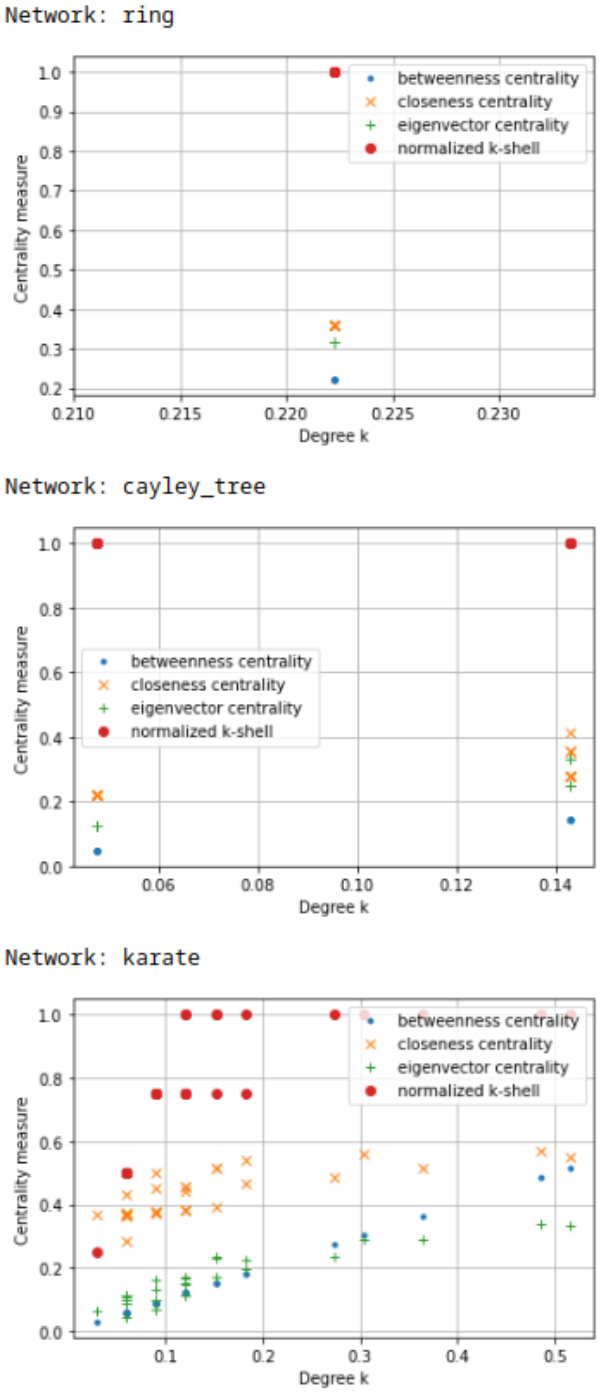

Figure 2: Exercise 1b

c) Look at figure 3.

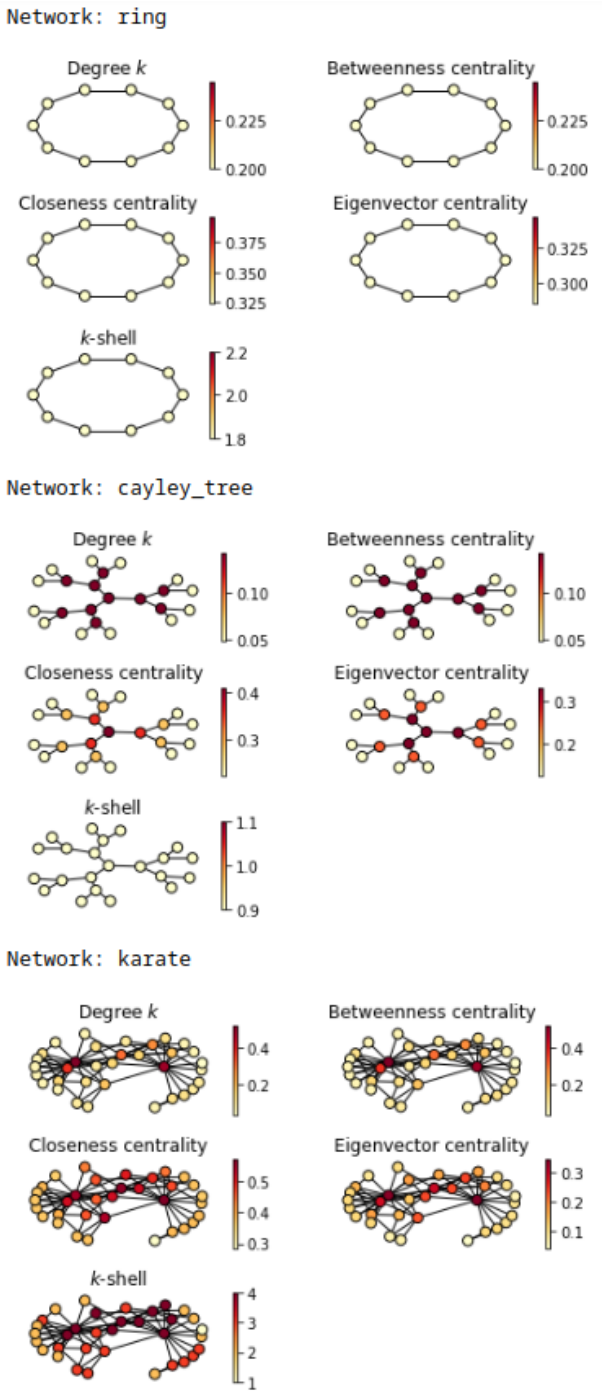

Figure 3: Exercise 1c

d) Because the few neighbors it has connect it to hubs, making it close to all other nodes.

Problem 2

a) Look at figures 4 and 5.

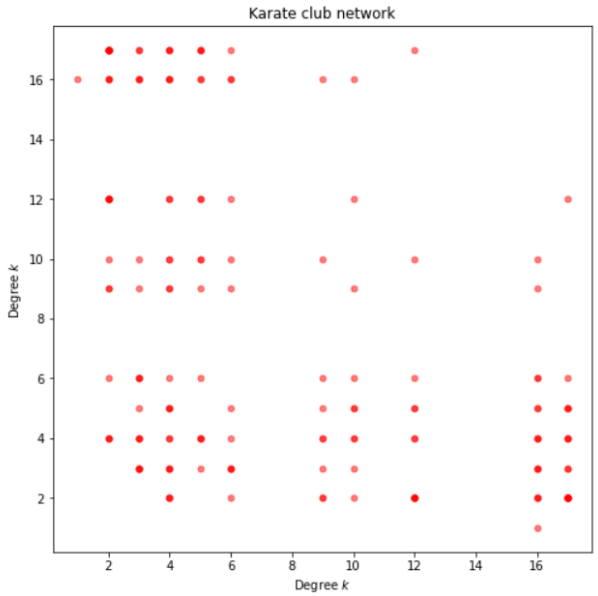

Figure 4: Exercise 2a plot 1

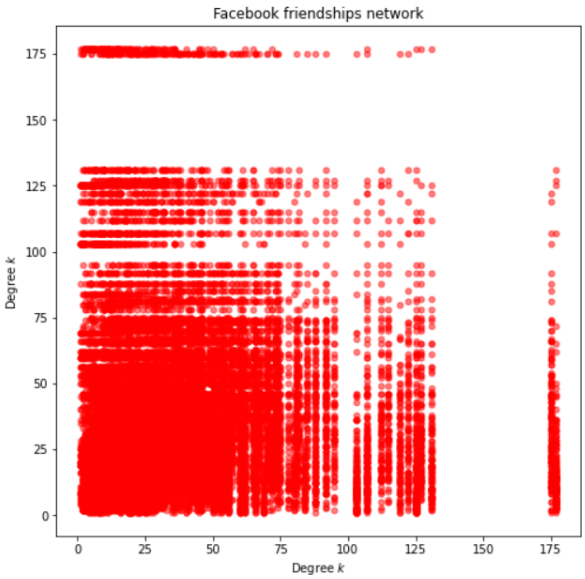

Figure 5: Exercise 2a plot 2

b) Look at figure 6. The extra information that we get with the heatmap is that most nodes have small degree, so the heatmap shows the high values in the bottom left corner, while the scatter plot just overlaps them and loses the concentration.

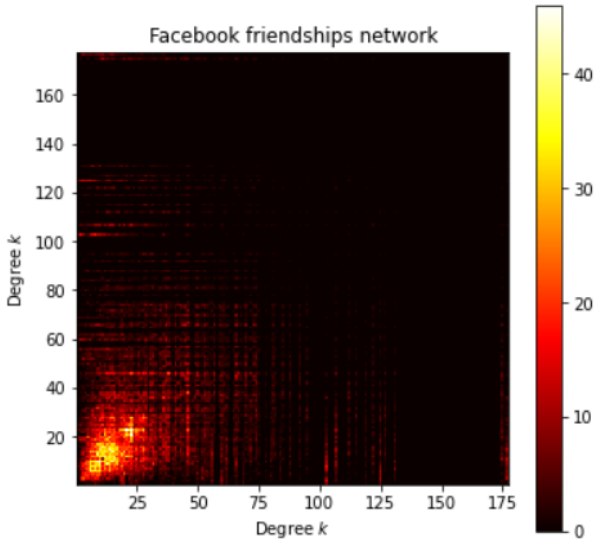

Figure 6: Exercise 2b

c) This does not hold for the Zachary carate club network. This specific structure as explained in the paper where was published is an example of community structure, and given that there are 2 not well connected groups (or communities) this lowers the assortativity coefficint.

- Own assortativity for Karate club network: -0.4756130976846136
- NetworkX assortativity for Karate club network: -0.47561309768461413
- Own assortativity for Facebook friendships network: 0.05598478476592967
- NetworkX assortativity for Facebook friendships network: 0.055984784765930475

d) Look at figure 7. In this network the $\langle k_{nn} \rangle$ does not increase monotonically with k. This is because the network is not perfectly assortative, so for instance it has some nodes with small degree connected with hubs with very high degree. An example can be users with few friends connected with people with a lot of friends, making it disassortative.

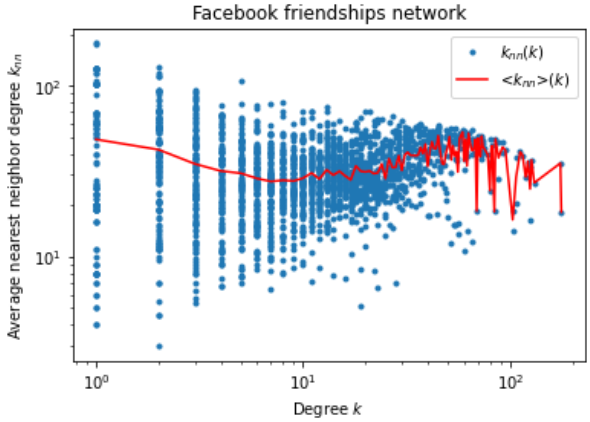

Figure 7: Exercise 2d

Problem 3

Look at figure 8.

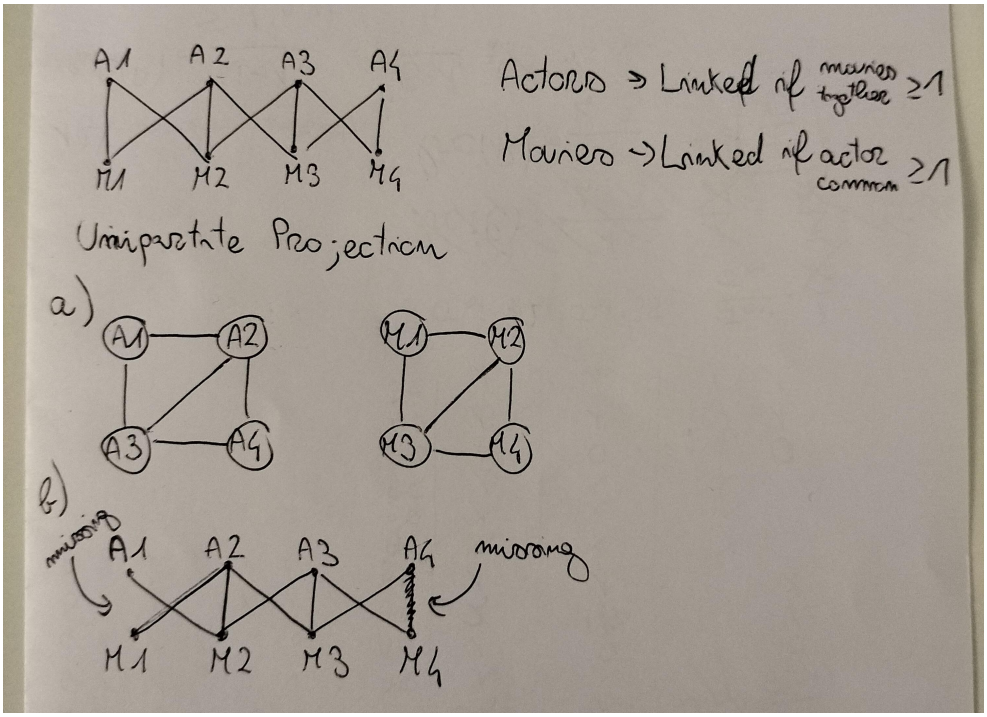

Figure 8: Exercise 3 part a and b