

## Assignment $\mathcal{N}^o$ 2

**released:** 03.04.2022 at 18:00      **due:** 08.05.2022 at 13:00

Please upload one zipped file with your answers in a PDF-File and an R script you used to produce them. You only need to upload the file once per group. Make sure that the names of all group members are listed in the PDF.

Install the `networkdata` package<sup>1</sup> in R. Go through the list of network data sets provided and choose one that you think is particularly interesting and suitable for your analyses.

### Task 1: Network Hypotheses

**10 points**

- (a) Describe and visualize the data set using the techniques you have come across in the course. In how far is this different from other networks that you have studied? What might explain the differences? What was your motivation to choose this network?  
(max. 300 words)
- (b) Choose two network theories you have gotten to know (e.g., strength of weak ties, structural holes, structural balance theory, etc.) and come up with two hypotheses that could potentially be tested using the data (or, if applicable, if any additional data need to be collected for testing the hypotheses and how you would do it). Provide theoretical arguments for why there might be evidence for your hypotheses. Note that you don't need to provide the analysis for hypothesis testing.  
(max. 400 words)

### Task 2: Data Analysis

**10 points**

- (a) Apply one community detection algorithm to the dataset you have chosen, provide justifications for why you choose this algorithm, and interpret your findings. What are patterns you find in this network? What are the possible explanations for those patterns?  
(max. 200 words)

---

<sup>1</sup> <https://github.com/schochastics/networkdata>

- (b) Choose two of the descriptive features discussed in your answers to questions 1a and 2a and conduct two conditional uniform graph test using an Erdős-Rényi model with the same (expected) density. Interpret the results.  
(max. 300 words)