

## Assignments $\mathcal{N}^o$ 11

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### Task 1: ERGMs and SAOMs

5 points

Let  $x(t_0)$  and  $x(t_1)$  be two observations of a network at two time points  $t_0$  and  $t_1$  and  $v$  a binary attribute (e.g. gender). We consider a stochastic actor-oriented model for undirected ties assuming that the initiative is two-sided and the choice is dictatorial.

Consider an evaluation function based on edges, reciprocity, and homophily with respect to  $v$ . Is there an ERGM which is the limiting distribution of this SAOM?

### Task 2: SAOMs and undirected ties

5 points

During the lecture we have defined SAOMs for undirected network. We distinguished between one- and two-sided initiative and several choice mechanisms (dictatorial, mutual and compensatory). Provide examples of relationships that can be modeled by different combinations of the initiative and choice mechanisms.

### Task 3: Modeling undirected ties – R task

10 points

Let us consider the data collected by A. Knecht and analyse the network evolution assuming that there is a friendship tie between two pupils  $i$  and  $j$  if and only if  $i$  and  $j$  nominated each other as a friend.

- (a) Import the four adjacency matrices and the demographic characteristics of the actors and prepare the data for the analysis:
  - (a.1) Symmetrize the adjacency matrices using the function `symmetrize` in the R package `sna`. Use the '`strong`' rule.

- (a.2) Inspect the RSiena report and check that the conditions for applying the SAOMs are fulfilled.
  
- (b) Estimate models whose evaluation function is specified by outdegree, transitivity, homophily with respect to gender and similarity with respect to the delinquency behaviour and the decision process is determined by
  - (b.1) one-sided initiative and dictatorial choice
  - (b.2) one-sided initiative and mutual choice
  - (b.2) two-sided initiative and compensatory choice
  
- (c) For each model:
  - (c.1) interpret the parameters
  - (c.2) evaluate the goodness of fit of the models.