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Algorithmics Group
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Network Modeling
Winter Term 2015/2016

Assignments № 7

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Task 1: Method of Moments — 5 points

Suppose that 10 undirected, simple, loopless graphs were generated from a $\mathcal{G}(30, p)$. The following table shows the number of edges y_i in each graph

	g_1	g_2	g_3	g_4	g_5	g_6	g_7	g_8	g_9	g_{10}
y_i	37	40	35	32	39	34	25	28	41	32

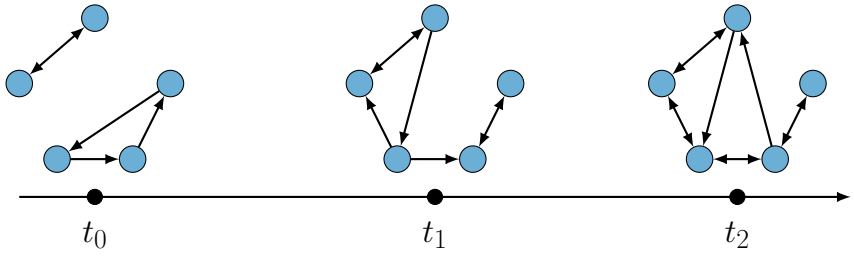
Let Y be a random variable describing the number of edges within $\mathcal{G}(30, p)$ such that:

$$P(Y = y) = \binom{M}{y} p^y (1-p)^{M-y}, \qquad M = \frac{n(n-1)}{2}$$

Estimate p using the Method of Moments and compare the estimate with that computed using the Maximum Likelihood estimation.
(See slide 130 in `slides_static.pdf`)

Task 2: Estimating the parameter of the SAOM — 5 points

A certain relation was observed over a set of 5 actors at three time points. The observed networks are represented in the picture below



Let us assume that the network evolution is explained by outdegree, reciprocuty and 3-cycles.

Given the picture and the specification of the evaluation function, specify the system of moment conditions that should be solved in order to estimate the parameter θ of the SAOM with the MoM.

Task 3: Chain probability in R **10 points**

Let us consider the data collected by Andrea Knecht.

(a) Import the data collected by Andrea Knecht and available at `http://algo.uni-konstanz.de/lehre/ws15/nm/local/data/data.html`. Load the data in RSiena.

(b) Specify a SAOM based on the following statistics: outdegree, reciprocity, transitivity and 3-cycles.

(b.1) Estimate the model

(b.2) Which effects are significant and how would you interpret them?

(b.3) Compute the contribution to the evaluation function associated to a tie that reciprocates another tie, closes 4 transitive triplets and 2 three-cycles. Interpret the result.

(c) Consider the following three statements:

i. Girls are more active in friendship

ii. Boys are more popular in friendship

iii. Friendship between pupils having the same gender is more likely

(c.1) Specify a SAOM in order to test if these statements are supported by the data.

(c.2) Which statements are supported by the data?