Assignments $\mathcal{N}^{\underline{o}}$ 7

released: 10.12.2014   **due:** 16.12.2014 at 12:00h

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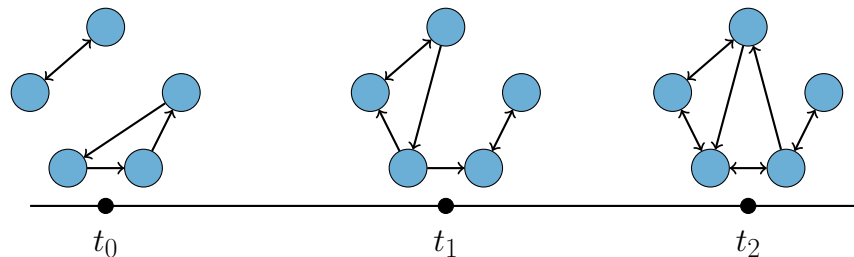
$$P(Y = y) = \binom{M}{y} p^y (1 - p)^{M-y}, \qquad M = \frac{n(n-1)}{2}$$

Estimate p using the Method of Moments and compare the estimate with the one computed using the Maximum Likelihood estimation.
(See slides 73 in `slides_static.pdf`)

Task 2: Estimating the parameter of the SAOM   5 points

A network is observed at 3 time points as shown below

Let us assume we would like to estimate the parameter θ of a SAOM using the MoM. The statistics of the evaluation function are outdegree, reciprocuty and 3-cycles. Given the picture above, specify the system of moment conditions.

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

Let us consider the data collected by Andrea Knecht.

(a) Import the data using the code available at
http://www.inf.uni-konstanz.de/algo/lehre/ws14/nm/local/
data/data.html
and discussed during the tutorial on 03.12.2014.

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

  (b.1) Estimate the model on the Knecht data and provide us with the output

  (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 2 transitive triplets and 2 three-cycles.

(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 or not

    (c.2) Provide us with the output and decide which statements are supported by the data