University of Konstanz
Algorithmics Group
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Network Modeling
Winter Term 2013/2014

Assignments $\mathcal{N}^{\underline{o}}$ 10

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Task 1: Statistics in the MoM — 5 points

Let us assume, that we observed a network at two time points t_0 and t_1. When the moment equations are set for the parameter estimation of the objective function, only the statistics of $x(t_1)$ are taken into account. However, we also have the informations at t_0.

(1) Define a new set of statistics for reciprocity and transitivity that account for both $x(t_0)$ and $x(t_1)$.

(2) Which new statistics are particularly interesting and what might they tell you about the emergence of transitive triplets?

Task 2: Maximum Likelihood Estimation — 5 points

Assume again, that we observed a network at two time points t_0 and t_1. Further, assume that β is known for all statistics.

(1) Compute the Maximum Likelihood Estimation of λ.

(2) How would you interpret the result?

Task 3: R: Network Evolution and Parameter Update 10 points

During the last tutorial we introduced the code to simulate the network evolution with RSiena.
Download the data *s50network.zip* from the data section on the lecture homepage. The data set contains two observations of a 50-actor excerpt from the *Teenage Friends and Lifestyle Study*.

Setup the data, such that the networks can be used in RSiena. Include the *outdegree*, *reciprocity* and *transitive Triplet* effects and set the initial value of the parameters to $\beta_{out} = -2.5317$, $\beta_{rec} = 1.1412$ and $\beta_{trans} = 0.5925$ and further the rate parameter $\lambda = 6.1615$.

(1) Approximate the expected value for the statistics with the Monte Carlo Method (Simulate the network evolution 100 times.).

(2) Compare your approximations with the observed values of $x(t_1)$. What do the differences tell you about the β's?

(3) Try to adjust one of the parameters to get better approximations.