University of Konstanz
Algorithmics Group
V. Amati / J. Lerner/ D. Schoch

Network Modeling
Winter Term 2013/2014

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

released: 11.12.2013 **due:** 17.12.2013, 12:00h

Task 1: Assumptions in SAOM — 3 points

Consider the assumptions of the SAOM. Give at least two examples where one of the assumption seems implausible.

Task 2: Exponential random variable — 3 points

Let T be an exponential random variable with probability density function

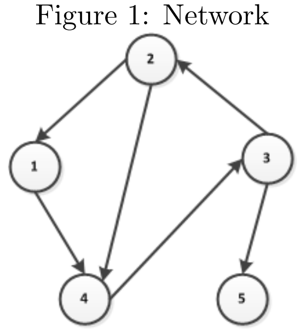
$$f_T(t) = \lambda\, e^{-\lambda t} \quad \lambda > 0,\ t > 0,$$

where λ is the rate parameter. Prove the memoryless property of T.

Task 3: Transition probabilities — 4 points

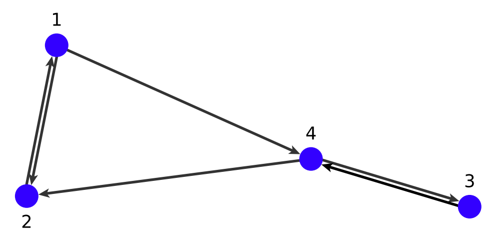
Consider the following network with 5 nodes.

Figure 1: Network



Let us assume that Actor 4 has the opportunity to change one of his outgoing ties. His decision is based on an objective function including outdegree, recipriocity, transitive and three-cycle effects with parameters $\beta_{out} = -1.5$, $\beta_{rec} = 2.5$, $\beta_{tran} = 0.8$ and $\beta_{cyc} = -0.1$. Compute the transition probabilities for Actor 4.

Task 4: R: Transition probabilities **10 points**



Write the following two functions in R:

(1) The function *netstats* should return the outdegree and the number of reciprocal dyads for an actor i. The arguments should be an adjacency matrix A and an actor id i. The output should be a two dimensional vector with the asked statistics.

(2) The function *objfct* should return the vector of probabilities of all possible changes that an actor i can make. The arguments should be an actor id i, an adjacency matrix A and a vector β of the statistical parameters for outdegree and reciprocal dyads.

Create the adjacency matrix of the shown network and set $\beta = (-1, 1.2)$. Perform a microstep for actor 4, i.e. calculate the tie change probabilities and flip the tie to actor j^* with the highest probability. Afterwards, calculate the tie change probabilities for j^* to all other actors. Report the adjacency matrix after the first microstep and the vector of probabilities for j^*.

Send your R-Script to `david.schoch@uni-konstanz.de`