University of Konstanz
Algorithmics Group
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Network Modeling
Winter Term 2012/2013

Assignments $\mathcal{N}^{\underline{o}}$ 1 - part i

released: 31.10.2012 **due:** 07.11.2012, 13:30h
(solutions can be handed over at the beginning of the lecture)

Task 1: Structural Balance — 3 points

Let Δ the set of undirected triangle graphs, in which each edge is either labeled positive or labeled negative — that is, instead of being present or not, each of the three edges is either positive or negative. Define a random graph model on Δ, such that all of the following conditions hold at the same time:

(1) all balanced graphs are more probable than unbalanced ones

(2) all edges are pairwise independent

(3) every edge depends on the two others

Task 2: Valid Probability Spaces — 2 points

Use the binomial theorem to show that $\mathcal{G}(n,p)$ is indeed a valid random graph model, i.e. $\sum_{G\in\mathcal{G}} P(G) = 1$.

Task 3: Expected Number of Motifs — 4 points

Again, consider the $\mathcal{G}(n,p)$ random graph model:

(a) What is the expected number of edges?

(b) What is the expected number of triangles?

(c) What is the expected number of induced k-circles?
[induced k-circle: k nodes whose incident edges form a circle *without* shortcuts]