UNIVERSITY OF KONSTANZ
ALGORITHMICS GROUP
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Network Modeling
Winter Term 2012/2013

Assignments $\mathcal{N}^{\underline{o}}$ 3 - PART II

released: 05.12.2012 **due:** 11.12.2012, 10AM

Task 1: ERGMs revisited — 5+x points

In the lecture we have considered general ERGMs $(\mathcal{G}, P)$ where $\mathcal{G}$ is the set of all undirected, loopless graphs with vertex set $V = \{1, \ldots, n\}$. For this final exercise sheet on static graph models, we turn to another (artificial) class of ERGMs by restricting the graphs in $\mathcal{G}$ (as defined above) to have exactly m edges. That is, the new ERGMs are defined on a set of graphs that all have the same (fixed) number of edges, $0 \leq m \leq \binom{n}{2}$.

(a) What does this imply for the basic formula of the ERGM probability function?

(b) What kind of adjustment is needed with regard to the (Gibbs) sampling strategy?

(c) What goes wrong, when proving the Hammersley-Clifford theorem (first part)?

Moreover, the most simple ERGM (all graphs are equally likely) – and still all graphs have exactly m edges – provides a counter example to the second part of the Hammersley-Clifford theorem. Can you explain why? (extra points!)