University of Konstanz
Algorithmics Group
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Network Modeling
Winter Term 2011/2012

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

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Task 1: MLE and Social Selection — 5 points

Let $c : V \to \{A, B\}$ divide the nodes into two disjoint subsets, $V = A \uplus B$. Analogously to $\mathcal{G}(n, p)$ we define a random graph model $\mathcal{G}(n, c, p_1, p_2)$, in which p_1 yields the probability of an edge between nodes of the same class and p_2 yields the probability of an edge between nodes of different classes.

Given c and any observed graph G_{obs}, calculate the most probable parameters under the assumption of $\mathcal{G}(n, c, p_1, p_2)$. Based on this maximum likelihood estimation, how can we quickly assess whether the two distinct classes give rise to the social selection process termed *homophily* (birds of a feather flock together)?

Task 2: Observing Certain Number of Edges — 5 points

Which values of p in the $\mathcal{G}(n, p)$ random graph model imply that

$$P\big(E(G) = m - 1\big) > P\big(E(G) = m\big)$$

for any given number of edges $1 \leq m \leq M := \binom{n}{2}$? What is the underlying trade-off in comparing these probabilities?