

Assignments \mathcal{N}^o 1 - PART II

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Task 1: Planted Partition Model

4 points

We take a planted partition model to explain a social network of observed friendship relationships among a group of boys and girls. More precisely, we assume a partition of the actor set into girls and boys $V = V_1 \uplus V_2$, and restrict the intra group parameters to be equal, i.e. $p_{11} = p_{22}$. Consequently, we have only two parameters: one to control for intra group density and one to control for inter group density. Calculate the maximum likelihood estimate of these two parameters and explain what these parameters might tell us about *social selection*.

Task 2: Efficient Generation of Random Graphs

6 points

We introduced efficient algorithms to sample random graphs from the $G(n, p)$ and preferential attachment models.

- (a) Provide a modification of the efficient $G(n, p)$ algorithm such that we are able to draw loop-free, undirected graphs from the planted partition model.
- (b) Provide a modification of the efficient preferential attachment algorithm such that edges can be introduced with a probability that is proportional to any linear weighting of in-degree d_G^- and out-degree d_G^+ . That is, we want to randomly select target node w when introducing edge e into graph G with a probability proportional to $\alpha \cdot d_G^-(w) + (1 - \alpha) \cdot d_G^+(w)$, where $\alpha \in [0, 1]$.