Network Science
Autumn 2022
Problem class 4

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1. How many distinct matchings are generated by the configuration model for a degree sequence with total degree, K?

2. Consider the set of graphs with N nodes generated by the configuration model with a specified degree sequence. Assess the claim that p_{ij}, the probability that nodes i and j are linked, is at most $k_i k_j / (K - 1)$. Provide explanations for the specific cases where $k_i = 1$ and $k_i = 2$, and then provide a more general argument for cases with $k_i > 2$ (e.g. using Markov's inequality).

3. In problem sheet 6, you were asked to consider the following modification to the simple Barabasi-Albert model ($N_0 = 2, q = 1$): a new node connects to any node in the graph with equal probability.

   (a) For this model,
   $$(3 + t)p_1(t + 1) = (2 + t)p_1(t) - p_1(t) + 1.$$

   Assume that p_1 becomes stationary, when $t \to \infty$. What will p_1 be in this limit?

   (b) For this model when $k > 1$,

   $$\langle N_k(t + 1) \rangle = \langle N_k(t) \rangle + \left(\langle N_{k-1}(t) - N_k(t) \rangle \right) / (2 + t).$$

   Compare $p_{k,\infty}$ for the simple B-A model and this modified model when $k = 50$