
Complex Network Models

You may hand in your solutions (handwritten or typeset in LaTeX) to konstantinos.lakis@inf.ethz.ch if you want to get feedback

Exercise 1

We study the variation of the Chung-Lu model where we generate a multigraph, and vertices u and v have a number of edges sampled according to a Poisson of mean $\frac{w_u w_v}{n}$. Let u be a vertex of weight w_u , and let v be a uniformly random neighbour of u . What is the distribution of w_v (conditioned on v being a neighbour of u)? Show that w_v follows a power-law distribution whose exponent you should give. What is special about the cutoff?

Exercise 2

Let $n \in \mathbb{N}$, and let $d_1, \dots, d_n \in \mathbb{N}_0$ be a valid degree sequence. We want to sample a graph G according to the configuration model of that degree sequence, using Algorithm 1 (from the lecture). Show that if there exist $C > 0$ such that $\sum_i d_i^2 < Cn$, then there exist a constant $C' = C'(C)$ independent of n such that Algorithm 1 will generate in expectation at most C' multiple edges.