Arboricity and spanning-tree packing in random graphs with an application to load balancing

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Abstract

We study the arboricity A and the maximum number T of edge-disjoint spanning trees of the Erdős-Rényi random graph $\mathscr{G}(n,p)$. For all $p(n) \in [0,1]$, we show that, with high probability, T is precisely the minimum between δ and $\lfloor m/(n-1) \rfloor$, where δ is the smallest degree of the graph and m denotes the number of edges. Moreover, we explicitly determine a sharp threshold value for p such that: above this threshold, T equals $\lfloor m/(n-1) \rfloor$ and A equals $\lceil m/(n-1) \rceil$; and below this threshold, T equals δ, and we give a two-value concentration result for the arboricity A in that range. Finally, we include a stronger version of these results in the context of the random graph process where the edges are sequentially added one by one. A direct application of our result gives a sharp threshold for the maximum load being at most k in the two-choice load balancing problem, where $k \to \infty$. This research is joint work with **Pu Gao** and **Cristiane M. Sato**.