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Maximum bounded-density subgraphs of random graphs

For the Erdős-Rényi random graph, we give a precise asymptotic formula for the order of a largest vertex subset whose induced subgraph has average degree at most t, given that $p = p(n) \geq n^{-2/9}n^{\varepsilon}$ for some fixed $\varepsilon > 0$, p is bounded away from 1, and $t = t(n) = o(\log(np)/\log\log(np))$. For $t^2 = o(\log(np)/\log\log(np))$, we obtain two-point concentration. This generalises a theorem on the independence number of random graphs. For both the lower and upper bounds, our proofs rely on large deviations inequalities for the binomial distribution. We provide a comparison with a formula for the order of a largest vertex subset whose induced subgraph has maximum degree at most t, which was obtained instead by methods from analytic combinatorics. This is joint work with Nikolaos Fountoulakis and Colin McDiarmid.