The Erdős-Rényi phase transition

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Abstract

In their great 1960 paper On the Evolution of Random Graphs Paul Erdős and Alfred Rényi expresses a special interest in the behavior of the random graph $G(n,p)$ when $p$ was near $n^{-1}$. Today we view it through the prism of Percolation Theory. If $p = cn^{-1}$ and $c < 1$ the process is subcritical and all components are small and simple. But for $c > 1$ the process is supercritical and a complex giant component has emerged. We now understand the fine structure: the critical window is parametrized $p = n^{-1} + \lambda n^{-4/3}$, with $\lambda \to -\infty$ and $\lambda \to +\infty$ representing the barely subcritical and barely supercritical phases. We discuss the behaviors, the arguments and the many analogies to bond percolation in Mathematical Physics.

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