On the structure of Kronecker graphs

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Abstract

In the thesis we study the asymptotic structure of Kronecker graphs. Kronecker graphs were introduced in computer science as possible models of small-world networks and have been studied by a number of combinatorialists and probabilists as an interesting model of random graph in which the neighbourhoods of different vertices are correlated.

Kronecker graph is a graph on vertex set $\mathbb{Z}_2^n$, where the probability that two vertices are connected depends on the number of positions in their labels on which they have common zeros, common ones, and different values. In the thesis we study the behaviour of these graphs as n tends to infinity.

In the first part of the work we examine several properties of Kronecker graphs such as k-connectivity and the existence of a perfect matching. In particular, we show that the thresholds for connectivity and for the existence of perfect matching basically coincide. These results are partially based on my paper published in *Electronic Journal of Combinatorics*.

In the last chapter of the thesis we study the diameter of Kronecker graphs and prove that just above the connectivity threshold, the diameter of Kronecker graphs, with probability tending to 1 as n tends to infinity, is bounded from above by a constant. The article containing this result, by Tomasz Łuczak and myself, was published in *Discrete Mathematics*.

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