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Phase Transitions in a random NK landscape Model and a random 3-SAT problem

We analyze the satisfiability problem of a certain random 3-SAT problem in which the appearances of 3-clauses are not independent. The random model is reduced directly from the solubility problem of a random NK landscape model with $K = 3$. Proposed by Kauffman, the NK model is one of the most notable mathematical models to study the evolution on a fitness landscape, where a fitness landscape is a function that maps each genetic composition (genotype) to the fitness of the expression (phenotype) of the genetic composition in an environment.

Gao and Culberson introduced a random NK model and pointed out that the solubility problem of the random NK model is equivalent to the satisfiability problem of a certain random 3-SAT problem in which the appearances of 3-clauses are not independent. In this paper, a phase transition phenomenon is found for the random 3-SAT problem. In the course of the analysis, we also introduce a generalized random 2-SAT formula and show its phase transition phenomenon.

Joint work with Sung-Soon Choi and Kyomin Jung.