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Kramers-Wannier duality applied to the boolean satifiability problem[1] JOE MITCHELL, Univ of Maryland-College Park, BENJAMIN HSU, Princeton University, VICTOR GALITSKI, Univ of Maryland-College Park — Kramers-Wannier duality, first considered in 1941, is an exact technique used in statistical mechanics to relate two models together through an order-disorder transformation, and thereby study their structure and critical phenomena. The boolean satisfiability problem is one of the most important problems in computer science, specifically complexity theory; it is the first proven NP-complete problem. Using a mapping to a multi-spin Ising model in the limit of zero temperature, we present an application of Kramers-Wannier duality to this problem. This results in a novel relationship between solving the boolean satisfiability counting problem and a different computational problem: listing the non-negative solutions to a particular system of linear integer equations. This mapping relates the complexity of the two problems. We discuss the generality of Kramers-Wannier duality and its possible application to other computational problems.

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