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A Computational Complexity-Theoretic Elaboration of Weak Truth-Table Reducibility

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The notion of weak truth-table reducibility plays an important role in recursion theory. In this paper, we introduce an elaboration of this notion, where a computable bound on the use function is explicitly specified. This elaboration enables us to deal with the notion of asymptotic behavior in a manner like in computational complexity theory, while staying in computability theory. We apply the elaboration to sets which appear in the statistical mechanical interpretation of algorithmic information theory. We demonstrate the power of the elaboration by revealing a critical phenomenon, i.e., a phase transition, in the statistical mechanical interpretation, which cannot be captured by the original notion of weak truth-table reducibility.

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