Walter Dean, Algorithms, feasibility, and models of computation

The purpose of this paper is to examine whether it is possible to provide a general characterization of the class of mathematical models which can be used as a basis for the development of computational complexity theory and algorithmic analysis. In the context of computability theory, such a characterization is arguably provided by Gandy's [1980] Principles for Mechanism which can be understood as specifying conditions which jointly entail that the functions computable relative to a given model must be partial recursive. A natural question in the context of complexity theory is whether a parallel condition on models can be found such that the class of models which satisfy it will be such that a language is decidable in polynomial time relative to a model in the class just in case it is decidable in polynomial time relative to one of the standard "reference models" (e.g. the multi-tape Turing machine or the RAM model). After highlighting the technical significance of this question, I will discuss some ways in which it seems to be bound up with some largely overlooked conceptual issues about how we should characterize the pre-theoretic notion "feasibly computable function" as it figures in our mathematical practices.

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