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Kolmogorov complexity.
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Summary: This dissertation discusses new results on Kolmogorov complexity. Its first part focuses on the study of Kolmogorov complexity without time bounds. Here we deal with the concept of non-monotonic randomness, that is, randomness characterized by martingales that bet non-monotonically. We will state the definitions of several different randomness classes and then separate them from each other. We also present a a systematic survey of a wide array of traceability notions and characterize them through (auto)complexity notions. Traceabilities are a group of notions that express that a set is not far away from being computable. The second part of the document deals with the topic of time bounded Kolmogorov complexity. First we investigate the difference between two ways of describing a word: the complexity of describing it well enough so that it can be distinguished from other words, and the complexity of describing it well enough so that the word can actually be produced from the description. While this difference is unimportant in the case of Kolmogorov complexity without time bounds, it plays an essential role when time bounds are present. Next, we introduce the notion of computational depth and prove a dichotomy result about it that is reminiscent of Kummer's well-known gap theorem. Lastly, we look at the important notion of Solovay functions. Solovay functions are computable upper bounds of Kolmogorov complexity that are actually sharp infinitely often. We will use them, first, to characterize Martin-Loef randomness in a certain way and, second, to give a characterization of being jump-traceable.

Keywords: Kolmogorov complexity without time bounds; non-monotonic randomness; randomness classes; traceability; time bounded Kolmogorov complexity; computational depth; Kummer's gap theorem; Solovay functions; Martin-Loef randomness; jump-traceable
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