

Stabilization time of random strings with three types

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Abstract

This thesis investigates the stabilization process and the limiting distribution of random sequences containing three different elements. Extending existing research on sequences with only two types, this study initially explores sequences with just two types to establish a foundational understanding. The sequences evolve by swapping adjacent elements until no further swaps are needed, leading to a fully sorted sequence. The time required for this stabilization is the primary focus of this thesis.

When introducing a third type, the dynamics of the stabilization process become more complex. This study aims to analyze how the additional type affects the overall time required for the sequence to stabilize in the special case of three-type sequences, when there is only one occurrence of the third type. We approached the expression of stabilization time differently, making it more generalizable and better understood in the context of three-type sequences. This new approach helps us handle the complexities introduced by the additional type.

We introduced the evolution for the aforementioned special three-type sequences and examined the additional time required compared to the stabilization time for their projection into two types. We characterized this additional time and studied its limiting distribution for different probabilities.

Overall, the research aims to deepen our understanding of how complexity affects dynamic systems. The thesis provides a detailed examination of how sequences with three types stabilize and offers insights into the mathematical properties that govern this process, focusing on the excess time introduced by the additional type.