Power laws in random substitutions

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Abstract

We start by reviewing a probabilistic model introduced by Wentian Li 30 years ago, a model inspired by the process of duplication and mutation which is assumed to be one of the mechanisms driving the evolution of genomic sequences. The dynamics of the model is a random substitution of symbols by blocks of symbols, dynamics which impose a recursive relation on the terms of the two-sites correlation function. This recursive relation imposes in turn a power-law decay in the correlation function. Once we rigorously establish the connection between the structure of the random substitution and the power-law decay of correlations, we study the generalization of Li's model given by random substitution of symbols by blocks of symbols of equal length, and we prove that all these models can be treated as statistical mechanics models with an n-body long-range interaction giving place to power-law decay of correlations.

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