

## Distribution and double generating function of number of patterns in a sequence of Markov dependent multistate trials

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**Abstract** In this manuscript, the dual relationship between the probability of number of runs and patterns and the probability of waiting time of runs and patterns in a sequence of multistate trials has been studied via double generating functions and recursive equations. The results, which are established under different assumptions on patterns, underlying sequences and counting schemes, are extensions of Koutras's results (1997, *Advances in Combinatorial Methods and Applications to Probability and Statistics*, Boston: Birkhäuser). As byproducts, the exact distributions of the longest-run statistics are also derived. Numerical examples are provided for illustrating the theoretical results.

**Keywords** Simple and compound patterns · Waiting time · Finite Markov chain imbedding · Probability generating function · Double generating function