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# Joint distributions of runs in a sequence of higher-order two-state Markov trials

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**Abstract** Consider a time homogeneous  $\{0, 1\}$ -valued  $m$ -dependent Markov chain  $\{X_{-m+1+n}, n \geq 0\}$ . In this paper, we study the joint probability distribution of number of 0-runs of length  $k_0$  ( $k_0 \geq m$ ) and number of 1-runs of length  $k_1$  ( $k_1 \geq m$ ) in  $n$  trials. We study the joint distributions based on five popular counting schemes of runs. The main tool used to obtain the probability generating function of the joint distribution is the conditional probability generating function method. Further a compact method for the evaluation of exact joint distribution is developed. For higher-order two-state Markov chain, these joint distributions are new in the literature of distributions of run statistics. We use these distributions to derive some waiting time distributions.

**Keywords** Runs · Joint distribution ·  $m$ -dependent Markov Bernoulli trials · Conditional probability generating function