On approximations in a two state Markov chain

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Abstract

For a Markov chain $X = \{X_i, i = 1, 2, \ldots, n\}$ with the state space $\{0, 1\}$, the random variable $S := \sum_{i=1}^{n} X_i$ is said to follow a Markov binomial distribution. The exact distribution of S, denoted as $\mathcal{L}S$, is very computationally intensive for large n. This talk concerns suitable approximate distributions for $\mathcal{L}S$ when X is stationary. We conclude that the negative binomial and binomial distributions are appropriate approximations for $\mathcal{L}S$ depending on $varS$ greater than and less than ES respectively. Also, due to the unique structure of the distribution, we are able to derive explicit error estimates for these approximations. Approximation for the count of r-head runs in X is also considered. The proofs are based on Stein's method and coupling.