QUASI-STATIONARITY OF DISCRETE-TIME MARKOV CHAINS WITH DRIFT TO INFINITY

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Abstract

We consider a discrete-time Markov chain on the non-negative integers with drift to infinity and study the limiting behaviour of the state probabilities conditioned on not having left state 0 for the last time. Using a transformation, we obtain a dual Markov chain with an absorbing state such that absorption occurs with probability 1. We prove that the state probabilities of the original chain conditioned on not having left state 0 for the last time are equal to the state probabilities of its dual conditioned on non-absorption. This allows us to establish the simultaneous existence, and then equivalence, of their limiting conditional distributions. Although a limiting conditional distribution for the dual chain is always a quasi-stationary distribution in the usual sense, a similar statement is not possible for the original chain.

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