PROBABILITY
AND
MATHEMATICAL STATISTICS
Vol. 21, Fasc. 1 (2001), pp. 123–134

RECURRENCE THEOREMS FOR MARKOV RANDOM WALKS

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Abstract: Let $(M_n, S_n)_{n\geq 0}$ be a Markov random walk whose driving chain $(M_n)_{n\geq 0}$ with general state space $(\mathcal{S}, \mathcal{C})$ is ergodic with unique stationary distribution ξ. Providing $n^{-1}S_n \to 0$ in probability under P_ξ, it is shown that the recurrence set of $(S_n - \gamma(M_0) + \gamma(M_n))_{n\geq 0}$ forms a closed subgroup of R depending on the lattice-type of $(M_n, S_n)_{n\geq 0}$. The so-called shift function γ is bounded and appears in that lattice-type condition. The recurrence set of $(S_n)_{n\geq 0}$ itself is also given but may look more complicated depending on γ. The results extend the classical recurrence theorem for random walks with i.i.d. increments and further sharpen results by Berbee, Dekking and others on the recurrence behavior of random walks with stationary increments.

1991 AMS Mathematics Subject Classification: 60J05, 60J15, 60K05, 60K15.

Key words and phrases: Markov random walk, random walk with stationary increments, recurrence point.

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