The $Geo^{[X]}/G/1$ Retrial Queue with General Retrial Times, Admission Control and Starting Failures

Jinting Wang and Yunle Yin

Beijing Jiaotong University

Abstract

This paper analyzes a discrete-time $Geo^{[X]}/G/1$ retrial queue with control of admission where the retrial time has a general distribution and the server is subject to starting failures. Batches of customers arrive at the system according to a geometrical process and each individual customer in a batch is subject to a control admission policy upon arrival. If the server is found idle, one of the customers admitted to the system may start his service and the rest joins the retrial group, whereas all the admitted customers go to the retrial group when the server is unavailable upon arrival. An arriving customer (primary or retrial) must turn-on the server, which takes negligible time. If the server is started successfully, the customer gets service immediately. Otherwise, the repair for the server commences immediately and the customer must leave for the orbit and make a retrial at a later time. It is assumed that the customers who find the server unavailable are queued in the orbit in accordance with an FCFS discipline and only the customer at the head of the queue is allowed for access to the server. Both external arrivals and first customer in orbit may arrive at the same epoch. Under the early arrival system (EAS) assumption, the Markov chain underlying the considered queueing system is studied and the generating functions of the orbit size and the system size distributions are obtained along with the marginal distributions of the orbit size when the server is idle, busy or down. Finally, two stochastic decomposition laws for the system size distribution are presented.

Keywords: Batch arrival retrial queue, Markov chain, general retrial time, admission control, starting failure.