A Study of Some Single Server Queueing Systems with Random
Breakdowns and Server's Vacation

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Abstract


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We study a single server queuing system with server's vacations and random breakdowns. Customers arrive at the system one by one in a Poisson process. The server provides one by one exponential service based on first in first out (FIFO) rule. We consider different variants of this M/M/1 queuing system by considering the following four different cases. In case 1, we assume exponential repair times as well as exponential vacations. In case 2, we consider exponential repair times and deterministic vacations. In case 3, it is assumed that the repair time consists of two exponential phases with different mean repair times and that the vacation times are exponential. Finally in case 4, it is assumed that both the repair times as well as the vacation times are deterministic.
We obtain the time-dependent as well as the steady state queue size probability generating functions for cases 1 and 2. For cases 3 and 4, we obtain only the steady state queue size probability generating functions. In addition, for all the four cases, we obtain some important performance measures of the system at a random epoch, such as the mean queue size, the mean system size and the mean waiting time of a customer in queue as well as in the system.

Keywords: single server, queuing system, Poisson arrivals, repair times, vacation times, steady state, and probability generating function.