

**Two-threshold Policy for $M^{[x]}/G/1$ Queueing System
with Two Vacation Types, Startup Time and
an Un-reliable Server**

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Abstract

This paper studies the control policy of an $M^{[x]}/G/1$ queue with two types of generally distributed random vacation: type 1 (long) and type 2 (short) vacations, where arrivals in batch form a Poisson process and service times are generally distributed. The server is turned off and takes a type 1 vacation whenever the system is empty. If the number of customers waiting in the system at the instant of a vacation completion is less than M , the server will take a type 1 vacation again. If the number of customers in the system is greater than or equal to M and smaller than N , the server will take a type 2 vacation. If the server returns from a vacation and finds at least N customers in the system, he is immediately turned on and requires a startup time before providing the service until the system is again empty. Furthermore, it is assumed that the server breaks down according to a Poisson process and his repair time has a general distribution. The system characteristics of such a model is analyzed and the total expected cost function per unit time is developed to determine the optimal thresholds of M and N at a minimum cost.

Keywords: Breakdowns, Cost model, Queue, Startup, Vacation.