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Steady state analysis of a non–Markovian bulk queueing system with $2b$–policy and multiple vacation with exceptional last vacation.*

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Abstract

This paper deals with the analysis of $M^x/G(a,b)/1$ queueing system with $2b$–policy and multiple vacations with exceptional last vacation. After completing a service, if the queue length ξ is less than a, then the server leaves for multiple vacation till the queue length reaches b. After a vacation, if the queue length ξ is at least b, then the server avails an exceptional last vacation R. After this last vacation R, if the queue length ξ is greater than or equal to $2b$, then the server starts the service with a batch of b customers, where $b \geq a$. Otherwise, the server remains in the system till the queue length reaches $2b$ (by this assumption, the server has to complete at least two batches of service before availing a vacation). The period in which the server is available in the system without serving the customer is called as the dormant period. The subsequent services are done with b customers. After a service, if the queue length ξ is such that $a \leq \xi \leq b$, then the server serves a batch of $\min(\xi, b)$ customers, where $b \geq a$. Using supplementary variable technique, the probability generating function of the steady state queue size at an arbitrary epoch is obtained.

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Expressions for expected queue length, expected length of busy and idle periods are derived. Expected waiting time in the queue is also obtained. A cost model of the queueing system is developed. Numerical illustration is presented.