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ON OPTIMALITY ASPECTS OF A GENERALIZED $M^x/E_k/1/\infty$ QUEUEING MODEL-TRANSIENT APPROACH

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Abstract

In recent years, it has been seen in the literature of queueing theory that there is a common tendency to analyze some mixed queueing models keeping in view their vital role in our practical life. For example and more details, we refer to some noteworthy researchers [2,5,8,10,11….14,15,17 & 18] and references therein. Among various eminent researchers on the subject, Ghosal et al [8] have confined their attention to analyze some bulk arrival queueing systems and succeeded to demonstrate certain significant characteristics of their system size distribution. Of late, Maurya [11] considered a non-homogeneous $M(t)/G(t)/\infty$ and $M^x(t)/G(t)/\infty$ queueing systems and he has extended the same characteristics of the system size distribution for the model along with other important results. Moreover, a more generalized non-homogeneous $M^x(t)/G(t)/\infty$:$(\infty;FCFS)$ queueing model incorporating bulk arrival of random size of input customers and general service time distribution has been discussed recently by Maurya [12] for determining the covariance between number of present customers in the system in time t and the number of served customers during time t. It is further of our interest to note that Thiagarajan and Srinivasan [18] have considered recently an $M^x/M/1/\infty$ interdependent queueing model on taking into account of bulk arrivals of controllable rates and hence they succeeded to present the steady state solutions along with performance measures of the model. Thereafter, very recently Maurya [14] has focused his attention to analyze a more generalized $M^x/E_k/1/\infty$ queueing model taking into consideration of bulk arrivals of variable size and Erlangian service time distribution and he developed enormously both the idle as well as busy period equations together with joint probability mass function of the system. In the present paper, we intend to further study the generalized $M^x/E_k/1/\infty$ queueing model with bulk arrivals and Erlangian service time distribution under transient state conditions previously studied by Maurya [14] and we focus our keen attention to deal with problems of finding probability generating function of $f_{m,n}(t)$; the joint

probability mass function of the present customers and served customers of the system in time *t* by making use of Laplace transform technique. Moreover, the expected idle time of server of the system has also been developed in a little bit of our present attempt, which is very significant and useful from practical point of view particularly to focus the optimality aspect of the queueing model taken into our consideration. Furthermore, the present paper ends with development of the expected idle time of server in special case when system is empty. It is further remarkable here that the derived expected idle time of server during empty system and its graph plotted in figure-*5.1* facilitate us significant information for the empty system.

Keywords: Bulk arrivals, Erlangian service time distribution, probability distribution function, probability generating function, joint probability mass function, Laplace transform, convolution theorem etc.

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