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Title: ***Analyzing extreme values and loss parameters of queuing models in a finite time interval***

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ABSTRACT: Classical performance evaluation of sharing resources systems using queues is usually done assuming a stable model considered in equilibrium. The reason is that in many situations, time scales are such that we can assume that all transients disappear in practice, for most of the reasonable applications we typically have in mind. But there are situations where we are interested in the transient life of the model, say in what happens during a finite time interval [0,T]. This work addresses this type of situation.

A basic object of interest when we look at the behavior or a queuing system during a finite time period [0,T] is the maximal number of customers that are in the queue in that interval, which, as a function M(T) of T, is a stochastic process. This paper deals first with a method for the evaluation of the distribution of this random variable and its moments. The proposed algorithmic scheme is derived in a Markovian setting starting by the use of Jensen's method (or Uniformization) to move to discrete time. We will illustrate the method by means of the classical M/M/1 model, and then, if time allows, of some simple M/PH/1 one (e.g., the M/E/1 queue). Observe that there is a somehow related metric, the maximum number of customers in the queue during a busy period, but that obviously both metrics are very different.

Another interesting transient metric, when the queuing model is closed, that is, when it has a finite storage capacity, concerns losses. Instead of looking at the loss rate of the queue in equilibrium, the usual metric capturing this side of the system, we consider the case where only the behavior in [0,T] is relevant. In such a case, we can look at the number of lost units during the interval, or at the loss ratio on [0,T]. With the same kind of approach, we can also evaluate the distribution of this type of variable, and some results will be also given and illustrated with basic models such as the M/M/1/H one.