

Bias Correction for Estimation of Performance Measures of a Markovian Queue *

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Abstract

There are several situations in our daily lives in which queues are present, such as cafeterias, supermarkets, banks, gas stations, and so forth. The performance of such queues can be described by several measures. In this article, the focus is on estimates of traffic intensity (ρ), also called the utilization factor of the service station, the expected number of customers in the system (L), and the average queue size (L_q) for infinite single-serve queues with Poisson arrivals and exponential (Markovian) service times. The computational experiments show that the maximum likelihood estimators (MLEs) of the performance measures are biased for small and moderate samples ($n < 50$). Thus, a version corrected by the nonparametric bootstrap method is analyzed, demonstrating that researchers could achieve with an extra computational effort bias-corrected estimates for samples of size $n = 10$ with average errors equivalent to the estimates from the MLE for samples of size $n = 200$. This reduction can be very important in practical applications because of the cost and time reduction that it may bring to the process of estimating the performance measures of a queueing system.

Keywords: Bias correction, Markovian queues, performance measures, bootstrap.

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