Bayesian Sample Size Determination in a Single-Server Deterministic Queueing System *

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Abstract

Although queueing models in the mathematical field of queueing theory are mainly studied in the steady-state regime and practical applications are interested mostly in queues in transient situations subject to burst arrivals and congestion, their use is still justified as a first step towards a more complex and thorough analysis. In these practical applications, parameters such as the traffic intensity, which is the ratio between the arrival rate and service rate, are unknown and need to be estimated statistically. In this study, a Markovian arrival and deterministic single-server queueing system, known in Kendall notation as an $M/D/1$ queueing model, is considered. This is one of the simplest queueing models with deterministic service time and may be seen as an approximation of a variety of applications in the performance evaluation of production management, telecommunications networks, and other areas. The main goal of this manuscript is to propose a methodology to determine the sample size for an $M/D/1$ queueing system under the Bayesian setup by observing the number of customer arrivals during the service time of a customer. To verify the efficiency and efficacy of the proposed approach, an extensive set of numerical results is presented and discussed.

Keywords: $M/D/1$ queue, Bayesian inference, sample size, credible region.

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