



Numerical Approach for the Analysis and Optimization of GI/M/1/N Queue with Vacations

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Abstract

The main purpose of the current paper is to use Taylor series expansion approach for analyzing and optimization of the GI/M/1/N queue with multiple working vacations, with an emphasis on perturbation analysis. We then considered a non-parametric sensitivity analysis to investigate the numerical evaluation of stationary characteristics of the same queue in the case where we suppose that the working vacation rate is not assessed in perfect manner, i.e. it is subject to propagate uncertainty. Furthermore, an approximative values of the expectation and variance of some stationary characteristics have been also obtained. This approach has the advantage of being transform-free as it avoids the use of Laplace transforms and/or numerical inversion techniques, which are predominantly used in the literature. Several numerical examples are also presented for illustrative purposes.

Keywords: Multiple working vacations, Taylor series expansion, numerical approximation, optimization, parametric uncertainty.

References:

- [1] K. Abbas, B. Heidergott and D. Aissani, A functional approximation for the M/G/1/N queue. *Discrete Event Dyn. Syst.* 23 (2013), no. 1, 93–104.
- [2] Y. Baba, Analysis of a GI/M/1 queue with multiple working vacations. *Oper. Res. Lett.* 33 (2005), no. 2, 201–209
- [3] A. D. Banik, U. C. Gupta and S. S. Pathak, On the GI/M/1/N queue with multiple working vacations- analytic analysis and computation. *Appl. Math. Modell.* 31 (2007), no. 9, 1701–1710.
- [4] X.-R. Cao, The Maclaurin series for performance functions of Markov chains. *Adv. in Appl. Probab.* 30 (1998), no. 3, 676–692.
- [5] B. Heidergott and A. Hordijk, Taylor expansions for stationary Markov chains. *Adv. in Appl. Probab.* 35 (2003), no. 4, 1046–1070.