Multi-objective Performance Improvements of General Finite Single-Server Queueing Networks *

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Abstract

Optimizing the performance of general finite single-server acyclic queueing networks is a challenging problem and has been the subject of many studies. The version of the optimization problem treated here considers the minimization of the buffer areas and the service rates simultaneously with the maximization of the throughput. These are conflicting objectives, and the most appropriate methodology appears to be a multiobjective methodology. In fact, algorithms have previously been proposed, and the aim here is to show that the use of a mixed methodology can occasionally improve solutions without a significant increase in the computational costs. This paper shows that improvements in throughput can be achieved through a solution of a type of stochastic knapsack problem, which consists of redistributing the buffer spaces between the lines while preserving the overall capacity using a simulated annealing algorithm; that is, one objective is improved (the throughput) without worsening the other (the overall allocated capacity). A set of computational experiments are presented to demonstrate the effectiveness of the proposed approach. Additionally, some of the insights presented here may help scientists and practitioners in finite single-server queueing network planning.

Keywords: Multiobjective optimization, genetic algorithm, simulated annealing, buffer allocation.

*Journal of Heuristics. Oct. 2018, Volume 24, Issue 5, p. 757-781. DOI: 10.1007/s10732-018-9379-8. The final publication will be available at https://link.springer.com.