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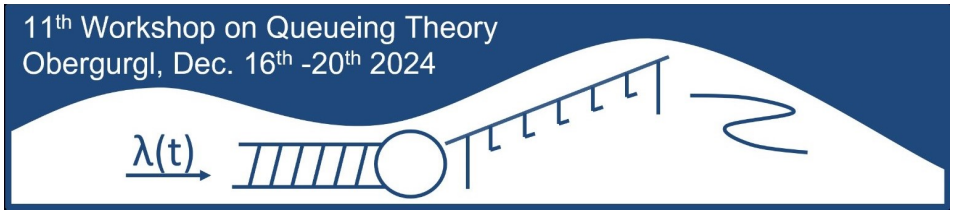

Staffing policies for queueing systems with stochastic and finite customer populations

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Abstract

Efficiently staffing check-in counters of dedicated check-ins at airports, presents a challenge for service providers. Insufficient staffing leads to long wait times, passenger dissatisfaction, and missed check-in deadlines, while overstaffing increases operational costs. In practice, demand for check-in services is highly variable, influenced by fluctuating arrival rates and traffic conditions. Furthermore, when service providers and airlines agree on staffing, the exact number of passengers remains uncertain due to ongoing ticket sales, necessitating a stochastic representation of the finite passenger population. This makes workforce flexibility beneficial to maintain service quality and operational efficiency.

To balance flexibility and the cost of enabling flexible responsiveness in the check-in process, we propose a new staffing policy, that combines two types of personnel. The proposed staffing policy includes personnel for counters scheduled according to a time-dependent policy, predetermined for the entire planning horizon. Additionally, a second type of personnel is scheduled according to a time- and state-dependent policy. This second type of personnel provides flexibility to handle unexpected incidents. We formalize the optimization problem for queuing systems with a stochastic finite population of passengers as a single-stage optimization problem. Solutions for the proposed staffing policy are generated by combining complete enumeration of the time-dependent policy with stochastic dynamic programming for the state-dependent policy. Preliminary numerical results of the proposed policy and benchmark policies from the literature are presented.