Scheduling Policies in the $M/G/1$ Make-to-Stock Queue

Hossein Abuee Mehrizi, Nima Sanajian
University of Toronto,
Joseph L. Rotman School of Management
105 St. George Street, Toronto, M5S 3E6, CANADA,
H.AboueeMehrizi07@Rotman.Utoronto.Ca, Nima.Sanajian06@Rotman.Utoronto.Ca

Barış Balcıoğlu
University of Toronto,
Department of Mechanical and Industrial Engineering
5 King's College Rd., Toronto, ON M5S 3G8, CANADA,
baris@mie.utoronto.ca

Abstract

In this paper, we analyze a production/inventory system modeled as an $M/G/1$ make-to-stock queue producing different products requiring different and general production times. We study different scheduling policies including the static first-come-first-served, preemptive and non-preemptive priority disciplines. For each static policy, we exploit the distributional Little's law to obtain the steady-state distribution of the number of customers in the system and then find the optimal inventory control policy and the cost. We additionally provide the conditions under which it is optimal to produce a product according to a make-to-order policy. We further extend the application area of a well-known dynamic scheduling heuristic, Myopic($\mathbf{T}$), for systems with non-exponential service times by permitting preemption. We compare the performance of the preemptive-Myopic($\mathbf{T}$) heuristic alongside that of the static preemptive-$b\mu$ rule against the optimal solution. The numerical study we have conducted demonstrates that the preemptive-Myopic($\mathbf{T}$) policy is superior between the two and yields costs very close to the optimal.

Keywords and Phrases: Make-to-Stock, $M/G/1$ queue, Little's distributional law, Static and dynamic production scheduling, Inventory control