HEAVY-TAILED DEPENDENT QUEUES IN HEAVY TRAFFIC

Władysław Szczotka
Wojbor A. Woyczyński

Abstract: The paper studies G/G/1 queues with heavy-tailed probability distributions of the service times and/or the interarrival times. It relies on the fact that the heavy traffic limiting distribution of the normalized stationary waiting times for such queues is equal to the distribution of the supremum $M = \sup_{0 \leq t < \infty}(X(t) - \beta t)$, where X is a Lévy process. This distribution turns out to be exponential if the tail of the distribution of interarrival times is heavier than that of the service times, and it has a more complicated non-exponential shape in the opposite case; if the service times have heavy-tailed distribution in the domain of attraction of a one-sided α-stable distribution, then the limit distribution is Mittag-Leffler's. In the case of a symmetric α-stable process X, the Laplace transform of the distribution of the supremum M is also given. Taking into account the known relationship between the heavy-traffic-regime distribution of queue length and its waiting time, asymptotic results for the former are also provided. Statistical dependence between the sequence of service times and the sequence of interarrival times, as well as between random variables within each of these two sequences, is allowed. Several examples are provided.

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