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Queue $MAP/G/1$ with Inverse Discipline and Probabilistic Priority

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A queue $MAP/G/1/r$ $(r \leq \infty)$ with Markovian input is considered. The input is defined by l-matrices Λ and N, where matrix Λ corresponds to a phase of generation (of customers) without customers and matrix N corresponds to the same case with customers. Service times are i.i.d. (with a distribution function B.)

Inverse discipline with probabilistic priority means the following. It is assumed that all service times of customers being in the system are known. If the queue is empty then the arrival customer begins service immediately. Otherwise, it interrupts (with resuming) the current service of a customer and pushes out the interrupted customer in the top of queue with a probability $d_n(x, y)$ depending only on its service time x, unfinished service time y of interrupted customer, and number n of customers in the system. With probability $1 - d_n(x, y)$ an arriving customer occupies the top of the queue. The order of (shifted) queue stays valid. In addition, under $r < \infty$, $d_{r+1}(x, y)$ is loss probability (of the arriving customer) and with probability $1 - d_{r+1}(x, y)$ the arriving customer replaces the one being served (and the latter is lost).

If $r = \infty$ it is assumed the standard (necessary and sufficient) stationary condition $\rho < 1$ to be held, where ρ is traffic intensity. In addition (under $r = \infty$) it is assumed that probability $d_n(x, y) = d(xy)$ that is independent of the number of customers in the system.

The main stationary characteristics of the system under investigation are studied.

Some numerical results are given which are based on the developed algorithms.