A Model for Rational Abandonments from Invisible Queues

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Abstract

We propose a model for abandonments from a queue, due to excessive wait, assuming that waiting customers act rationally but without being able to observe the queue length. Our goal is to characterize customers' patience via more basic primitives, specifically waiting costs and service benefits: these two are optimally balanced by waiting customers, based on their individual cost parameters and anticipated waiting time. The waiting time distribution and patience profile then emerge as an equilibrium point of the system. The problem formulation is motivated by Teleservices, prevalently telephone- and Internet-based. In such services, customers and servers are remote and queues are typically associated with the servers, hence queues are invisible to waiting customers. Our base model is the M/M/m queue, where it is shown that a unique equilibrium exists, in which rational abandonments can occur only upon arrival (zero or infinite patience for each customer). As such a behavior fails to capture the essence of abandonments, the base model is modified to account for unusual congestion or failure conditions. This indeed facilitates abandonments in finite time, leading to a non-trivial, customer dependent patience profile. Our analysis shows, quite surprisingly, that the equilibrium is unique in this case as well, and amenable to explicit calculation.