

THE BENEFIT OF INTRODUCING VARIABILITY IN QUALITY BASED SERVICE DOMAINS

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We consider a single-server queueing system in which the value customers obtain from service increases with their service time, but decreases with their waiting time. For such a system we show, surprisingly, that given a homogeneous customer population, system utility can be improved by increasing the variability in the system by varying the service rate. This is true even if the service rule is static, i.e., even if the service rate must be decided independent of the state of the system. Specifically, we show it is optimal to segment customers into service grades which are differentiated by their service rate (or equivalently mean service time). For such a system we derive the closed-form optimal strategies of service rate differentiation, showing that optimal service rates and grade utilizations both form geometric sequences. We also compute the asymptotic system performance (as number of grades increases to infinity) and illustrate the sensitivity of the benefits of differentiation with respect to customers' characteristics: marginal service value, marginal waiting cost and variation of processing time. We find that providing differentiated service can improve system performance by 5% without any additional capacity investment.