

Optimal congestion signaling under customer heterogeneity with private types

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In an unobservable queue, where customers lack the complete wait time information, a throughput-maximizing server aims to exploit the information asymmetry by strategically signaling coarse congestion information to incentivize customers' arrival into the system. The customers make a calculated decision about joining the queue by creating a belief of their utility given the congestion signal provided by the server. Using the Bayesian persuasion framework to model the customers' response, we map the problem of designing an optimal signaling mechanism to finding an optimal policy in a Constrained MDP problem. Afterward, we exploit the Constrained MDP formulation to derive the structure of the optimal policy. When customers are heterogeneous, we discover a counter-intuitive phenomenon where the optimal signaling mechanism attains a laminar structure, as opposed to a monotone structure commonly seen in MDP settings. We also show that the laminar structure of the optimal policy is also prevalent in a large class of admission control problems.

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