World Academy of Science, Engineering and Technology
International Journal of Industrial and Systems Engineering
Vol:17, No:07, 2023

The Strategic Entering Time of a Commerce Platform

Authors : Chia-li Wang

Abstract : The surge of service and commerce platforms, such as e-commerce and internet-of-things, have rapidly changed our lives. How to avoid the congestion and get the job done in the platform is now a common problem that many people encounter every day. This requires platform users to make decisions about when to enter the platform. To that end, we investigate the strategic entering time of a simple platform containing random numbers of buyers and sellers of some item. Upon a trade, the buyer and the seller gain respective profits, yet they pay the cost of waiting in the platform. To maximize their expected payoffs from trading, both buyers and sellers can choose their entering times. This creates an interesting and practical framework of a game that is played among buyers, among sellers, and between them. That is, a strategy employed by a player is not only against players of its type but also a response to those of the other type, and, thus, a strategy profile is composed of strategies of buyers and sellers. The players' best response, the Nash equilibrium (NE) strategy profile, is derived by a pair of differential equations, which, in turn, are used to establish its existence and uniqueness. More importantly, its structure sheds valuable insights of how the entering strategy of one side (buyers or sellers) is affected by the entering behavior of the other side. These results provide a base for the study of dynamic pricing for stochastic demand-supply imbalances. Finally, comparisons between the social welfares (the sum of the payoffs incurred by individual participants) obtained by the optimal strategy and by the NE strategy are conducted for showing the efficiency loss relative to the socially optimal solution. That should help to manage the platform better.

Keywords : double-sided queue, non-cooperative game, nash equilibrium, price of anarchy
Conference Title : ICODS 2023 : International Conference on Operations and Decision Sciences
Conference Location : Rome, Italy
Conference Dates : July 17-18, 2023

Open Science Index, Industrial and Systems Engineering Vol:17, No:07, 2023 publications.waset.org/abstracts/167407.pdf