# Online Algorithms for Optimal Discount Search in Supply Chain Finance

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Optimal Discount Search in Supply Chain Finance is an online optimization problem in which an online player searches for the optimal discount rate in a discount sequence to maximize his profit. The problem intrinsically represents the process of dynamic invoice discounting that is increasingly becoming a common financing option in the area of supply chain finance. A rough description of the problem is as follows: A seller who is in urgent need of money eliminates the requirement to use a third party's financing solution, such as a loan from a bank, that would incur a lot more costs. He rather makes offers to a buyer in order to pay his invoice earlier than the due date in exchange for a discount. The discount rates are chosen by the seller, and are presented to the buyer sequentially in a time horizon. The buyer (online player) must decide whether or not to accept a discount offer. We build the mathematical model of this problem, and present optimal online algorithms that ensure the maximal profit for the buyer in the absence of the information about the future discount rates. The analysis of the online algorithms is made utilizing the competitive analysis approach that falls within the framework of worst-case analysis. The competitive analysis differs from other traditional approaches that are highly dependent on the underlying distributional assumptions, that thus fall within the framework of average-case analysis. Furthermore, we give the lower bound for all deterministic online algorithms, as well as the lower bound for all randomized online algorithms. Our results are interesting not only from a supply chain finance perspective, but also from a competitive analysis perspective, since the upper bound of the discount rates is time-dependent, whereas other optimal search problem settings generally assume constant upper and lower bounds for the assets in their problem. Moreover, we give the online player freedom to invest his wealth so that we provide more realistic results in our setting unlike other optimal search problem settings.