Optimal parking of idle elevators under myopic and state-dependent policies

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Abstract

In this paper we discuss the problem of optimally parking single and multiple idle elevators under light-traffic conditions. The problem is analyzed from the point of view of the elevator owner whose objective is to minimize the expected total cost of parking and dispatching the elevator (which includes the cost incurred for waiting passengers). We first consider the case of a single elevator and analyze a (commonly used but suboptimal) state-independent myopic policy that always positions the idle elevator at the same floor. Building on the results obtained for the myopic policy, we then show that the optimal non-myopic (state-dependent) policy calls for dispatching the idle elevator to the state-dependent median of a weight distribution. Next, we consider the more difficult case of two elevators and develop an expression for the expected dispatching distance function. We show that the objective function for the myopic policy is non-convex. The non-myopic policy is found to be dependent on the state of the two idle elevators. We compute the optimal state-dependent policy for two elevators using the results developed for the myopic policy. Next, we examine the case of multiple elevators and provide a general recursive formula to find the expected dispatching distance functions. Finally, we generalize the previous models by incorporating a fixed cost for parking the idle elevators that results in a two-sided optimal policy with different regions. Every policy that we introduce and analyze is illustrated by an example. The paper concludes with a short summary and suggestions for future research.

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