Available online at www.sciencedirect.com
SCIENCE DIRECT®
European Journal of Operational Research 170 (2006) 863–886
EUROPEAN JOURNAL OF OPERATIONAL RESEARCH
www.elsevier.com/locate/ejor

Stochastics and Statistics

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

Mahmut Parlar [a,*], Moosa Sharafali [b,1], Jihong Ou [c]

[a] DeGroote School of Business, McMaster University, 1280 Main Street W., Hamilton, Ont., Canada L8S 4M4
[b] Department of Management, Faculty of Economics and Commerce, University of Melbourne, Parkville, Vic 3010, Australia
[c] Department of Decision Sciences, National University of Singapore, 15 Law Link, Singapore 117591, Singapore

Received 13 January 2003; accepted 1 July 2004
Available online 16 September 2004

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.

Keywords: Applied probability; Location science; Nonlinear programming

* Corresponding author. Tel.: +1 905 525 9140; fax: +1 905 521 8995.
E-mail address: parlar@mcmaster.ca (M. Parlar).
[1] Research conducted while Moosa Sharafali was with The Department of Decisions Sciences and The Logistics Institute—Asia Pacific, National University of Singapore.

0377-2217/$ - see front matter © 2004 Elsevier B.V. All rights reserved.
doi:10.1016/j.ejor.2004.07.042