Proceedings of the 2014 International Conference on Industrial Engineering and Operations Management
Bali, Indonesia, January 7 – 9, 2014

On the Airport Check-In Counter Allocation Problem – A Stochastic Dynamic Programing Approach Supported by Empirical Data

Mahmut PARLAR
McMaster University
Canada

Brian Rodrigues and Moosa Sharafali
Singapore Management University
Singapore

Abstract

In this paper we consider the real life problem faced by airport operators in deciding the optimal number of check-in counters to allocate for a single flight. The problem pertains to airports using the exclusive-use check-in counter system. An important and significant aspect of our work is the use of empirical data collected at a renowned international airport. Evident from the literature is the fact that this problem is hard to analyse analytically. Hence, most of the works in the literature are only simulation models. In this paper, we show that this problem is amenable to analytical treatment. We show that although there is an underlying basic queue (single or parallel) in operation in the system, we do not have to use complicated queueing theory results per se. This is due to the behavioural aspects of the passengers which are tested statistically using the data collected. This is a first in the literature. This helps us to propose an easy-to-use event-based stochastic dynamic programming model which simplifies considerably the optimization analysis even for large scale problems with 700+ booked passengers. Specifically, we address the following research questions: (i) For a particular flight, what is the optimal number of counters the system should open with and what is the corresponding optimal total cost? (ii) At any event epoch, given the state of the system at that instant, is it optimal to open another counter and what is the optimal cost to go from this state? The real data we collected at the airport are used to test the assumptions, estimate some parameters and to run the computational experiments. We apply our model to flights for which data were collected at the airport and identify cases where, depending on the cost parameters, the model advocates the use of either a dynamic or a static policy. The paper also contributes to the literature by way of the statistical hypothesis tests on some features/characteristics/behaviours of the system. The paper demonstrates the intricacies associated with incorporating real data in modelling studies.

Keywords
Airport check-in counters, dynamic programming, multichannel queues, statistical inference.

Biography

Mahmut Parlar is a Professor of Management Science at McMaster University's DeGroote School of Business. He holds a B.Sc. in mathematics (1973) and a M.Sc. in operations research/statistics (1975) both from the Middle East Technical University, Ankara, Turkey, and a Ph.D. in management sciences (1979) from the University of Waterloo, Canada. Mahmut Parlar's research program is focused in the areas of stochastic modelling, dynamic optimization and game theory applications in supply chain management. His work in these and related areas has been supported by the Natural Sciences and Engineering Research Council of Canada (NSERC) research grants since 1980 and have appeared in the form of more than 100 articles published in journals such as Operations Research, Management Science, Production and Operations Management, Naval Research Logistics, IIE Transactions, Journal of Operations Management, Annals of Operations Research, Transportation Science, Applied Mathematical Finance and others. Professor Parlar is the author of a book entitled Interactive Operations Research with Maple published in 2000 by Birkhäuser, Boston.

Dr. Brian Rodrigues completed his Ph.D. in Mathematics in 1987 from the University of California and pursued a career in academia in the US. He later returned from the US and was appointed Deputy Head of the Operations Analysis Department and a Senior Research Scientist in the Ministry of Defense, Singapore. He subsequently returned to academia joining the National University of Singapore and later moved to the Singapore Management University where he is currently Professor and Deputy Dean in the Lee Kong Chian School of Business. His interests include convex optimization, metaheuristics, scheduling, supply chain management and logistics.

Moosa Sharafali is an Associate Professor of Operations Management (Edn.) with the Lee Kong Chian School of Business, Singapore Management University, Singapore. Prior to that, he has held academic positions in University of Melbourne, Australia; National University of Singapore, Singapore and University of Madras, Chennai, India. He was also associated with The Logistics Institute – Asia pacific, National University of Singapore. His broad area of research is Stochastic Modeling with particular interest in Queues, Logistics and Supply Chain Management. His research articles have appeared in journals like *Management Science, Operations Research, Production and Operations Management, Journal of Applied Probability IIE Transactions, European Journal of Operational Research, International Journal of Production Research, Journal of the Operational Research Society, Opsearch etc.*