

A Queueing Model for Tiered Inspection Lines in Airports

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Abstract

This paper proposes a tiered inspection system for airport security, wherein passengers are divided into three classes based on historical security records. A two-dimensional Markov process and a Markov modulated Poisson process (MMPP) queue were used in the formulation of the security inspection system. Simulated annealing was then used to obtain near-optimum solution for the model. The efficacy of the proposed model was evaluated using the arrival data of passengers at Taoyuan International Airport and other two international airports. A comparison with two conventional queueing models with regard to the average waiting time demonstrated the effectiveness of the proposed security inspection system in enhancing service efficiency and boosting the level of security.

Keywords: Security inspection, two dimensional Markov process, Markov modulated Poisson process, queueing theory.

1. Introduction

Since its launch in Salt Lake City by the Transportation Security Administration (TSA) in February 2008, the “Black Diamond” self-select program has been expanded to 51 airports.[12] The self-selection process is meant to enable travelers familiar with TSA procedures to pass through checkpoints more quickly and efficiently, while giving families and others with special needs more time and assistance. Self-select lanes use familiar icons based on those used at ski resorts to guide people along trails or lanes in accordance with their skill level. Green designates a queue for families or beginners, blue is for casual travelers at an intermediate level, and the black diamond is reserved for expert travelers who are familiar with TSA rules and arrive at the checkpoint fully prepared. Self-selection also helps to reduce stress and anxiety levels among passengers, and infuse a sense of calm into the checkpoint environment. Reduced stress is a win-win situation for the traveling public as well as officers involved in maintaining transportation security. From the perspective of controlling waiting lines, this program can be seen as the conversion of a security screening system into a tiered service system.