Robust Network Revenue Management

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Abstract

In this paper, we investigate the application of robust optimization methods in a network Revenue Management (RM) setting. In particular, we analyze the airline yield management problem of managing capacity (available seats) and booking limits across a network of multiple interconnected flights and multiple customer classes.

We propose a robust optimization formulation, investigate the conditions of when it is a tractable problem, and present computational experiments that shed light on its applicability for networked systems, including airline operations.

1 Introduction

In this paper, we investigate the application of robust optimization methods in a network Revenue Management (RM) setting. In particular, we analyze the airline yield management problem of managing capacity (available seats) and booking limits across a network of multiple interconnected flights and multiple customer classes.

Succinctly, Revenue Management is concerned with identifying optimal strategies to control prices and capacities in order to maximize short term revenues. The complexity of this problem is due to the stochastic nature of the demand process and the presence of multiple customer classes with different willingness to pay for the same seat. The challenge in this environment is to be able to separate these different customer classes and charge them according to their willingness to pay. This segmentation requires using the available capacity to offer a menu of different products and managing this menu dynamically over time as market uncertainty gets resolved.

The prototypical example of this type of segmentation corresponds to the distinction between business and leisure passengers. In general, business passengers have a higher willingness to pay (or they are less sensitive to price) and tend to book their flights at the last minute compared to leisure travelers. Based on these differences, airlines can offer a discount fare to those passengers.