"Cruise Ship is not a Floating Hotel"
Cruise Ship Revenue Management
(Biehn, INFORMS 2005)

A travel company sells P ticket types (products) for a cruise ship. Customers buying these tickets are accommodated in n cabins. Each cabin has C_j rooms. One ticket is sold for one room. A room accommodates at least two passengers. Revenue from selling ticket type i for two passengers is r_i^d per passenger. Some rooms have additional berths available for large families. Revenue from these berths is r_i^a per each additional passenger. The number of tickets type i sold in cabin j is a_{ij}. The total number of passengers on the ship cannot exceed the lifeboat capacity, B. Ticket type i requires a_{iB} seats on the lifeboat. Future demand for ticket type i is estimated to be D_i.

How should the cruise ship be revenue managed?

Solution

Let x_i be the number of tickets sold of type i. With the objective of maximizing revenue, the travel company problem is given by the following LP

$$\max \quad \sum_{i=1}^{P} 2r_i^d x_i + r_i^a (a_{iB} - 2)x_i$$

subject to

$$\sum_{i=1}^{P} a_{ij} x_i \le C_j , \quad j = 1, 2, \ldots, n \quad \leftarrow \pi_j$$

$$\sum_{i=1}^{P} a_{iB} x_i \le B \quad \leftarrow \pi_B$$

$$x_i \le D_i$$

$$x_i \ge 0$$

Let π_j , j = 1, …, n, and π_B be the dual variables shadow prices corresponding to the capacity constraints on cabin and lifeboat. Then, the travel company can use "bid prices" control based on π_j and π_B. For example, a family requesting a ticket type i with four passengers in a room in cabin j should be given reservation if the price of ticket i exceeds $\pi_j + 4\ \pi_B$.