



Bookmarks



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Lecture

Lecture questions due Oct 04,
2016 at 19:30 IST

**Recitation****Problem Set 4**

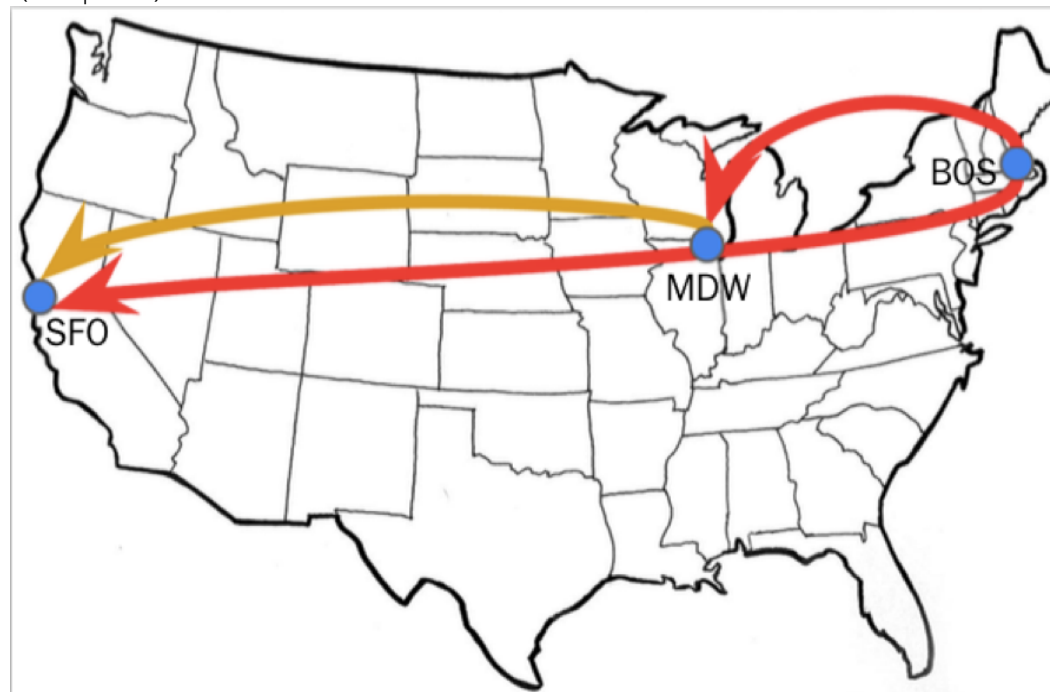
Homework 4 due Oct 04, 2016 at
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Week 4 > Problem Set 4 > Problem 5

PART A

(1/1 point)



Airlines optimize their ticket sales in order to maximize their revenue. This is called the airline network revenue management problem. In this problem, we are trying to decide how many tickets for each origin-destination (O-D) pair to sell at each price level. The goal is to maximize revenue, and we cannot sell more tickets than there is demand for, or space on the planes for.

There are three origin-destination pairs, with two price classes for each pair. The three origin-destination pairs are BOS-MDW, MDW-SFO, or BOS-SFO via MDW. BOS stands for Boston, MDW is Chicago-Midway, and SFO is San Francisco. Each O-D pair has a “regular” and “discount” fare class. And there are two planes to serve the three origin-destination pairs. One plane flies from BOS to MDW, another plane flies from MDW to SFO. Each plane’s capacity is 166 people. The data we will use is summarized as follows:

| | Price | Demand |
|------------------|-------|--------|
| BOS-MDW Regular | 428 | 80 |
| BOS-MDW Discount | 190 | 120 |
| BOS-SFO Regular | 642 | 75 |
| BOS-SFO Discount | 224 | 100 |
| MDW-SFO Regular | 512 | 60 |
| MDW-SFO Discount | 190 | 110 |

Table 1: Fares for Origin-Destination (O-D) pairs

For this problem, we will make the (admittedly unrealistic) assumption that the demand for discount fairs and regular fairs is disjoint. For example, if we focus entirely on demand and not on airplane capacity, it is possible to sell 100 discount tickets from BOS to SFO and also sell 75 regular tickets from BOS to SFO.

Formulate an integer program that maximizes the total revenue. We can define decision vector \mathbf{x} to refer to the number of tickets to sell for each O-D pair and fare class (i.e., $x_{BOS-MDW-R}$ is the number of tickets to sell for O-D pair BOS-MDW with regular fare class, $x_{BOS-MDW-D}$ is the number of tickets to sell for O-D pair BOS-MDW with discount fare class). Which of the following is the correct objective function for this maximization problem?

☐ $618x_{BOS-MDW-R} + 866x_{BOS-SFO-R} + 702x_{MDW-SFO-R}$

☐ $428x_{BOS-MDW-R} + 642x_{BOS-SFO-R} + 512x_{MDW-SFO-R}$

☐ $80x_{BOS-MDW-R} + 120x_{BOS-MDW-D} + 75x_{BOS-SFO-R} + 100x_{BOS-SFO-D}$
 $+ 60x_{MDW-SFO-R} + 110x_{MDW-SFO-D}$

☒ $428x_{BOS-MDW-R} + 190x_{BOS-MDW-D} + 642x_{BOS-SFO-R} + 224x_{BOS-SFO-D}$ ✓
 $+ 512x_{MDW-SFO-R} + 190x_{MDW-SFO-D}$

☐ $428x_{BOS-MDW-R} + 80x_{BOS-MDW-R} + 190x_{BOS-MDW-D}$
 $+ 120x_{BOS-MDW-D} + 512x_{BOS-SFO-R} + 75x_{BOS-SFO-R}$
 $+ 190x_{BOS-SFO-D} + 100x_{BOS-SFO-D} + 224x_{MDW-SFO-R}$
 $+ 60x_{MDW-SFO-R} + 190x_{MDW-SFO-D} + 110x_{MDW-SFO-D}$

You have used 1 of 3 submissions

PART B

(3/3 points)

Choose the necessary constraint(s) (we cannot sell more tickets than there is demand for, or space on the planes for) from below. Select 5 sets of constraints.

☐ $x_{BOS-MDW-R} \leq 428, x_{BOS-MDW-D} \leq 190$

☐ $x_{BOS-SFO-R} \leq 642, x_{BOS-SFO-D} \leq 224$

☐ $x_{MDW-SFO-R} \leq 512, x_{MDW-SFO-D} \leq 190$

☒ $x_{BOS-MDW-R} \leq 80, x_{BOS-MDW-D} \leq 120$

☒ $x_{BOS-SFO-R} \leq 75, x_{BOS-SFO-D} \leq 100$

☒ $x_{MDW-SFO-R} \leq 60, x_{MDW-SFO-D} \leq 110$

☐ $x_{BOS-MDW-R} + x_{BOS-MDW-D} \leq 166$

☐ $x_{MDW-SFO-R} + x_{MDW-SFO-D} \leq 166$

☐ $x_{BOS-SFO-R} + x_{BOS-SFO-D} \leq 166$

☒ $x_{BOS-MDW-R} + x_{BOS-MDW-D} + x_{BOS-SFO-R} + x_{BOS-SFO-D} \leq 166$

☒ $x_{MDW-SFO-R} + x_{MDW-SFO-D} + x_{BOS-SFO-R} + x_{BOS-SFO-D} \leq 166$



You have used 3 of 3 submissions

PART C

(3/3 points)

Solve this airline revenue management problem using Julia and JuMP or Excel. What is the optimal total profit? Error checking hint. The optimal value is between 121000 and 121100.



121090

You have used 1 of 3 submissions

PART D

(1/1 point)

How many discount MDW to SFO seats should be sold?



You have used 1 of 3 submissions

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