Coursework Assignment – Revenue Management
Dr Joern Meissner

This *individual* assignment is due January 28th, 2011, at noon. Please submit a paper copy of your answers that explains clearly how you derived at the solution. You may want to copy parts of your spreadsheet into the answer and use the annotation feature to comment on the content in a cell. In addition, please submit two pieces of your course work in electronic form on LUVLE. First, please submit your printed answer as Word-File. Please name your file RM-LastName-LibraryCardNumber.docx, e.g. in my case the file would be named RM-Meissner-00113674.docx. Second, please also submit an Excel-Workbook with your numerical answers. This will be used only if your paper answer is not self-explaining and we need to check how you derived at the solution. Please put the answer for each question on a separate sheet within that Excel-Workbook (e.g. your submission will have six sheets named 1a, 1b, 1c, 1d, 2a, and 2b, respectively. Please name your file RM-LastName-LibraryCardNumber.xlsx, e.g. in my case the file would be named RM-Meissner-00113674.xlsx.

Problem 1 (70 points)

We will consider a revenue optimization problem that is similar to the one studied in the Fashion-Retailer Session. A product manager is responsible for selling 2000 units of a fashion retail item over a period of 15 weeks. We will assume that the salvage value at the end of the horizon is $40 per unit. The demand characteristics can be segmented into two distinct groups:

1. Early session demand (weeks 1 to 4): The price response curve for this segment representing the total demand for all 4 weeks is $d_1(p) = \alpha*(3500 - 10*p)$, where α is an unknown parameter that ranges uniformly in the interval [.6, 1.4].
2. Late session demand (weeks 5 to 15): The price response curve for this segment representing the total demand for all 11 weeks is $d_2(p) = \alpha*(3000 - 25*p)$, where α is the unknown market size parameter described above.

In other words, the nominal demand for weeks 1 to 4 is for 3500 – 10*p units, and the scale factor α can be interpreted as an adjustment of up to +/- 40% that accounts for products that are selling well versus others that are not. That is, the proportional effect of a price change is well known, but the actual demand in numbers of units is unknown at the beginning of the selling horizon due to the uncertainty of the scale parameter α.

a) Assuming that the demand is deterministic (i.e., that the unknown scale parameter α is equal to 1), the demand for weeks 1 to 4 is d1(p) = 3500 – 10*p, and that for weeks 5 to 15 is d2(p) = 3000 – 25*p. What is the corresponding optimal pair of prices for these two periods? (15 points)

b) The success of such fashion products depends crucially on its sales in the first 4 weeks that attract consumers that are willing to purchase the item at full price, and to that end the manager feels that it is important to incorporate the market size uncertainty for period 1 demand in the pricing decision. That is, she wishes to study a problem where the period 1 demand is given by $d_1(p) = \alpha*(3500 - 10*p)$, for some unknown parameter α that ranges uniformly in the interval [.6, 1.4], and the demand for weeks 5 to 15 is given by $d_2(p) = 3000 - 25*p$. What is expected revenue under the pricing policy obtained in problem 1? How does it compare to the revenue computed in part a) that disregarded the uncertainty in the market size of period 1 demand? (20 points)

c) Compute the optimal pricing strategy for the case where you include the market size uncertainty for period 1 demand. What is the expected revenue under this policy? (20 points)

   [Hint: The structure of the pricing policy you should derive is different than that of problem (a). Specifically, for a fixed price in period 1, the beginning inventory in week 5 can take many values depending on what was the observed market size captured through the value of the parameter α. Apart from a single price for period 1, your policy should therefore define a menu for selecting the appropriate price for period 2 as a function of the remaining inventory in the beginning of week 5. In setting this up in solver you may want to treat the period 2 prices for each of these inventory scenarios as different variables.]

d) Suppose the per-unit cost of this item to the retailer is $80. What is the difference in profit margin between the policy derived in part a) and that of part c)? (15 points)

Problem 2 (30 points)

Sky Airlines is a carrier flying from London to Luxembourg. They use only one type of aircraft with capacity to transport 80 passengers in order to save maintenance costs. Discount tickets are available for $50 whereas the full fare is $90. However, discount tickets come with an advance purchase restriction which causes discount customers always to book before full fare travelers. Assume full fare demand to follow a normal distribution with mean 33 and standard deviation of 12, and discount fare demand also normal distributed with mean 58 and standard deviation of 21.

e) Calculate the optimal protection level and booking limit for which expected revenue is maximized. (20 points)

f) A marketing campaign successfully advertised the discount fare. As a result, discount demand has now a mean of 80 and a standard deviation of 18. The campaign only affected discount demand. What is the optimal booking limit and protection level that maximized expected revenue now? (10 points)