**OM 386: Pricing & Revenue Management**

**Assignment #5**

**Write the names of your team members here**: Yi-Ting Huang(yh23933), Yen Wen Ting(yt6344), Lucas Fernandez(lf23234), Shawn Kalish(smk3874)

*\*For all of the problems below, please turn in either spreadsheets or code you use to solve them.*

**Problem 1:** The Hilton Austin has a capacity of 350 standard rooms. Demand varies across days. Suppose Hilton is considering the prices for the following days, for which the demands follow the following linear function

1. Suppose Hilton can only charge a single price across the days. Solve the optimal price.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **D\_i** | **m\_i** | **demand** | **price** | **sales** | **capacity** |
| 1100 | 10 | 497.06 | $60.29 | 350.00 | 350 |
| 700 | 8 | 217.65 |  | 217.65 | 350 |
| 650 | 7 | 227.94 |  | 227.94 | 350 |
| 700 | 8 | 217.65 |  | 217.65 | 350 |
| 1000 | 11 | 336.76 |  | 336.76 | 350 |
| 1300 | 12 | 576.47 |  | 350.00 | 350 |
| 1600 | 16.5 | 605.15 |  | 350.00 | 350 |
|  |  |  |  |  |  |
|  |  |  | **total rev =** | **$123,602.94** |  |

1. Suppose Hilton can use variable pricing. Solve the optimal prices across the days.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **D\_i** | **m\_i** | **p\_i** | **sales** | **capacity** |
| 1100 | 10 | $75.00 | 350.00 | 350 |
| 700 | 8 | $43.75 | 350.00 | 350 |
| 650 | 7 | $46.43 | 325.00 | 350 |
| 700 | 8 | $43.75 | 350.00 | 350 |
| 1000 | 11 | $59.09 | 350.00 | 350 |
| 1300 | 12 | $79.17 | 350.00 | 350 |
| 1600 | 16.5 | $75.76 | 350.00 | 350 |
|  |  |  |  |  |
|  | **total rev =** | | **$146,869.59** |  |

**Problem 2**: Based on the demand table above, assume that every arriving customer during this period always stays for 2 nights and pays the list price of the arrival day for each night. For example, a customer arrives on Apr 1 and the list price on Apr 1 is $50; then this customer pays 2\*$50 for the two nights of her/his stay. Also assume there is no demand on the days before Apr 1 and the days after Apr 7 (i.e., no need to worry about the past or the future of this period).

Suppose Hilton publishes all the prices online, so every customer can see the prices of the 7 days before they arrive. After seeing the prices, the customers may change their arrival time to the next day of their original arrival (only one day ahead) if the next day has a lower price unless all the rooms of the next day are expected to be full. Every $1 difference of the two prices can cause 1 customer to shift (these are assumed to be the base units; you don’t need to round in case the price difference has decimals). For instance, if the price on Apr 1 is $50 while the price on Apr 2 is $48.5, then 1.5 customers who originally would arrive on Apr 1 would like to shift their arrival to Apr 2 subject to the capacity constraint on Apr 2 and Apr 3. Also, assume that there is no customer before Apr 1 and the customers on Apr 7 won’t shift to the future.

Solve the optimal prices across the days. (20 points)

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **2** |  |  |  |  |  |  |  |
| **D\_i** | **m\_i** | **p\_i** | **demand** | **shifted** | **demand shifted** | **2-day booking** | **capacity** |
| 1100 | 10 | $83.80 | 261.95 | 0 | 252.89 | 0 | 350 |
| 700 | 8 | $74.75 | 102.04 | 9.06 | 97.11 | 350.00 | 350 |
| 650 | 7 | $60.76 | 224.70 | 13.99 | 238.68 | 335.79 | 350 |
| 700 | 8 | $73.14 | 114.91 | 0 | 111.32 | 350.00 | 350 |
| 1000 | 11 | $69.54 | 235.09 | 3.60 | 238.68 | 350.00 | 350 |
| 1300 | 12 | $97.85 | 125.79 | 0 | 111.32 | 350.00 | 350 |
| 1600 | 16.5 | $83.38 | 224.21 | 14.47 | 238.68 | 350.00 | 350 |
|  |  |  |  |  |  |  |  |
|  |  |  |  |  | **total rev =** | **$196,973.30** |  |

**Problem 3:** Jena gets the idea to start a business selling a new line of clothing—puffy shirts. Due to the long lead time, Jena needs to get the shirts from a supplier well before the selling season and there is no replenishment opportunity afterwards. Jena estimated that the selling season will last 3 months, in which the linear demand functions will be as follows:

|  |  |  |
| --- | --- | --- |
| Month | D\_i | m\_i |
| 1 | 280 | 3.5 |
| 2 | 230 | 3.5 |
| 3 | 150 | 4 |

Jena thinks that she can salvage the shirts at $12 per unit if there is any leftover by the end of month 3.

1. Suppose Jena is given 300 shirts for free. Find the optimal markdown price scheme for her in these three months (p1>p2>p3). (20 points)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **D\_i** | **m\_i** | **p\_i** | **sales** | **Total Inv** | **Leftover** | **Salvage** |
| 280 | 3.5 | $46.00 | 119.00 | 300 | 36 | $12.00 |
| 230 | 3.5 | $38.86 | 94.00 |  |  |  |
| 150 | 4 | $24.75 | 51.00 |  |  |  |
|  |  |  |  |  |  |  |
|  |  | **Total** | 264 |  |  |  |
|  |  |  |  |  |  |  |
|  |  | **Total Rev** | **$ 10,820.82** |  |  |  |

1. After conducting this business for one time, Jena realized that the selling season actually can last 5 months, and this time she estimated the demand functions as follows:

|  |  |  |
| --- | --- | --- |
| Month | D\_i | m\_i |
| 1 | 280 | 3.5 |
| 2 | 230 | 3.5 |
| 3 | 150 | 4 |
| 4 | 120 | 4 |
| 5 | 120 | 6 |

Again, suppose she is given for free 300 shirts, and she thinks that any leftover shirt can be salvaged $12 per unit by the end of month 5. Find the optimal markdown price scheme in the five months (p1>p2>p3>p4>p5). (10 points)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **D\_i** | **m\_i** | **p\_i** | **sales** | **Total Inv** | **Leftover** | **Salvage** |
| 280 | 3.5 | $47.14 | 115.00 | 300 | 0 | $12.00 |
| 230 | 3.5 | $40.00 | 90.00 |  |  |  |
| 150 | 4 | $25.89 | 46.43 |  |  |  |
| 120 | 4 | $22.14 | 31.43 |  |  |  |
| 120 | 6 | $17.14 | 17.14 |  |  |  |
|  |  |  |  |  |  |  |
|  |  | **Total** | 300 |  |  |  |
|  |  |  |  |  |  |  |
|  |  | **Total Rev** | **$ 11,213.39** |  |  |  |

1. Compare the optimal pricing schemes in the above two scenarios (e.g., whether any shirts are salvaged) and discuss possible reasons if there is difference. (10 points)

* In part (a), there are 36 shirts leftover after the 3-month selling season which are salvaged for $12 each, increasing total revenue by $432. In part (b), there are no shirts leftover after the 5-month selling season, but total revenue is higher than part (a). An obvious reason for the higher revenue in (b) is a longer season and therefore more selling opportunities. A less obvious reason could be that the 2 additional markdowns assisted in better optimization of the total revenue.

1. Now consider scenario (b) again. Instead of being given the shirts, Jena needs to decide how many shirts to produce before Month 1, anticipating the demands and the prices she will charge in the following 5 months. She only has the chance to produce the shirts before Month 1 (i.e., she cannot replenish inventory afterwards). Suppose the production cost is $20 per shirt. All other information remains the same as in (b). What is the best number of shirts to produce before Month 1 and what are the corresponding optimal prices to charge in the 5 months? (10 points)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **D\_i** | **m\_i** | **p\_i** | **sales** | **Total Inv** | **Leftover** | **Salvage** |
| 280 | 3.5 | $50.00 | 105.00 | 240 | 0 | $12.00 |
| 230 | 3.5 | $42.86 | 80.00 |  |  |  |
| 150 | 4 | $28.75 | 35.00 |  |  |  |
| 120 | 4 | $25.00 | 20.00 |  |  |  |
| 120 | 6 | $20.00 | 0.00 |  |  |  |
|  |  |  |  |  |  |  |
|  |  | **Total** | 240 |  |  |  |
|  |  |  |  |  |  |  |
| **TotalRev – ShirtCost =** | | | **$5,384.82** |  |  |  |