Assignment 4 - Prescriptive Analysis

Part 3: Optimization Approach to Hotel Selection Problem

3.a

- **Objective:** Maximize total predicted profitability

  $Max\_P = \sum(Predicted\ Profitability\ of\ Hotel\ \ i)*x_i\ \ (for,\ 1 \le i \le 16)$

- **Decision Variables:** To represent wether a hotel is selected or not.

  $X_i = 0\ (if\ hotel\ i\ is\ not\ purchased)\ OR\ 1\ (if\ hotel\ i\ is\ purchased)$

- **Constraints:** Things to keep in mind while achieving the objective.

$$Constraint\ 1:\ \sum x_i \le 16\ (for,\ 1 \le i \le 16)$$

$$Constraint\ 2:\ x_i = 0\ OR\ 1\ (for\ each\ hotel\ i)$$

$$Constraint\ 3:\ \sum(Price\ of\ Hotel\ i)*x_i \le \$10{,}000{,}000\ (for,\ 1 \le i \le 16)$$

3.b

Hotel_i	Hotel_1	Hotel_2	Hotel_3	Hotel_4	Hotel_5	Hotel_6	Hotel_7	Hotel_8	Hotel_9	Hotel_10	Hotel_11	Hotel_12	Hotel_13	Hotel_14	Hotel_15	Hotel_16
Decision Variables	0	0	0	0	1	0	1	1	0	0	1	1	0	0	1	1
Price of Hotel ($)	2925000	10000000	3750000	3500000	325000	8950000	1950000	1750000	4900000	1650000	1125000	2500000	1975000	3750000	1475000	750000
Predicted Profitability	37.5706259	52.1452738	41.5397993	41.1155804	35.7279993	47.1775124	56.6700963	56.3307211	61.6758802	37.5013472	36.6104874	38.9436918	38.0528319	41.0647866	37.2043939	35.97415891

Constraint_Values	Operator	Max_Value
7	<=	16
9875000	<=	10000000

Max_P =	297.461549

3.c

Based on the model's results, the hotels which we should purchase are Hotel 5, Hotel 7, Hotel 8, Hotel 11, Hotel 12, Hotel 15 and Hotel 16.
With a total predicted profitability = 297.46

3.d

Our optimization model achieves a total predicted profitability of 297.46, in comparison to the 211.29 achieved by the greedy approach. This means, we are able to increase our profitability by about 86.17 units using the optimization model. The model performs better than the greedy approach as it also considers the price of the hotel along with it's profitability and makes the decision accordingly, whereas the greedy approach only considers the profitability resulting in distribution of the budget in a way that is not optimal.