Case 1: The Great Indian Summer Sale Earphones - XV744

Some of the products on your website weren't selling well. To tackle this, you're looking to launch 'The Great Indian Summer Sale' where you'll be offering certain discounts to the customers on these products so as to free your warehouses quickly.

One such product that isn't selling well is a wireless earphone model XV-744. You have a total of 510 such earphones for sale in stock. The demand forecasting for this product with respect to different discounts has been provided in the Excel sheet below. Use this data in the Excel sheet and answer the questions below.

Objective here is to maximize the revenue.

Which of the following would be a possible constraint in solving the above - mentioned problem?

–Earphones at 20% discount ≤ 105

	Scenario	Price	Demand
XV-744 Wireless Earphones	Regular	1050	80
	20% Discount	840	105
	30% Discount	735	150
	40% Discount	630	200
	50% Discount	525	260

–Total earphones to sell ≤ 510

–Earphones at regular price ≤ 80

	Scenario	Price	Demand
XV-744 Wireless Earphones	Regular	1050	80
	20% Discount	840	105
	30% Discount	735	150
	40% Discount	630	200
	50% Discount	525	260

Can you tell how many earphones you should sell at the regular price?

Ans: 80

Constraints	LHS	Sign	RHS
Total Available	0	<=	510
Regular	0	<=	80
20% Discount	0	<=	105
30% Discount	0	<=	150
40% Discount	0	<=	200
50% Discount	0	<=	260
Regular NN	0	>=	0
20% Discount NN	0	>=	0
30% Discount NN	0	>=	0
40% Discount NN	0	>=	0
50% Discount NN	0	>=	0

How many earphones should be sold at a discount of 40% according to the optimal solution?

Ans: 175

According to the optimal solution, what is the maximum revenue you can generate by selling these earphones?
Ans: ₹3,92,700

Suppose that you want to cater to your premium members. For this, you have kept aside 40 earphones to be sold only to premium members at a discount of 50%. Based on this additional condition, what is the optimal revenue you can make?
Ans: ₹3,88,500

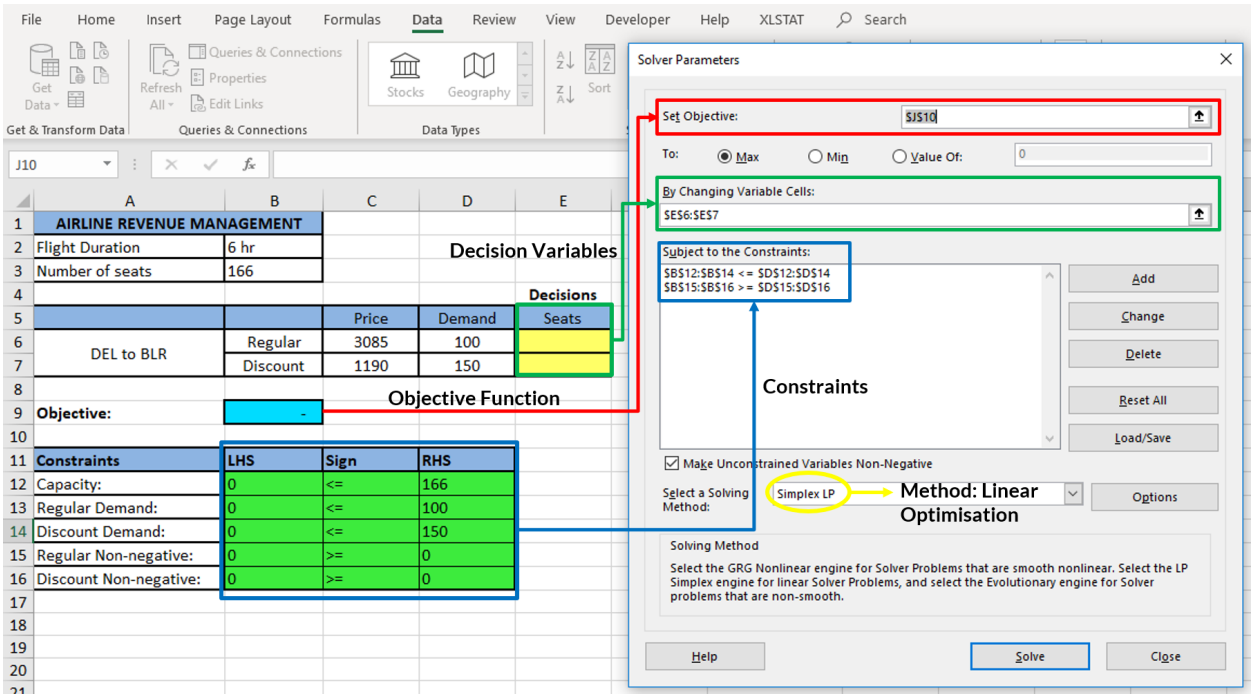
The problem at hand in this session was that the airline company XYZ wanted to maximise its revenue for a particular Delhi to Bangalore flight by allocating the regular and discounted seats judiciously. The prices of the tickets are as follows:

Discounted: Rs. 1190
Regular (Non-Discounted): Rs. 3085
Your objective function for this problem thus became 3085x + 1190y.

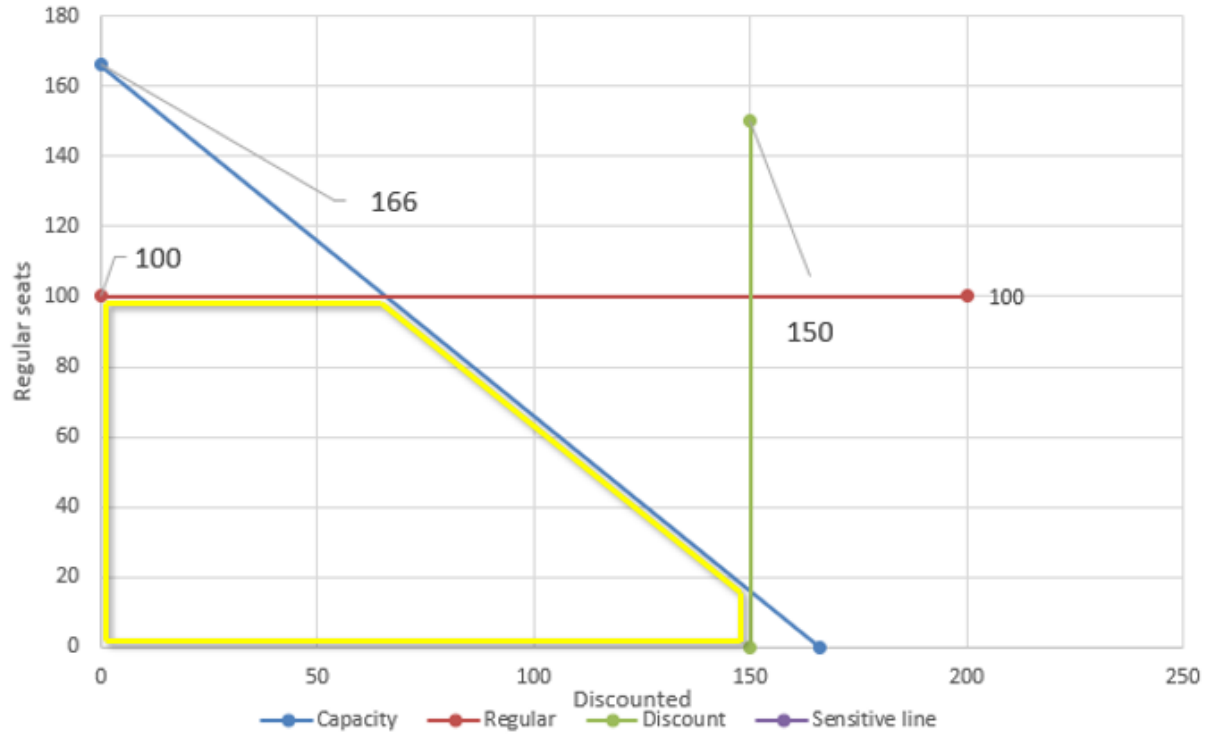
	A	B	C	D	E
1	**AIRLINE REVENUE MANAGEMENT**				
2	Flight Duration	6 hr			
3	Number of seats	166			
4					**Decisions**
5			Price	Demand	Seats
6	DEL to BLR	Regular	3085	100	
7		Discount	1190	150	
8					
9	**Objective:**	=SUMPRODUCT(C6:C7,E6:E7)			
10					

The cells C6 and C7 contain the price of the regular and discounted tickets respectively. The cells E6 and E7 are the ones where we will fill in the seats that we decide to allocate in order to get the optimal revenue. Basically, these cells are the decision variables, i.e., the variables that need to be changed to arrive at the optimal solution.

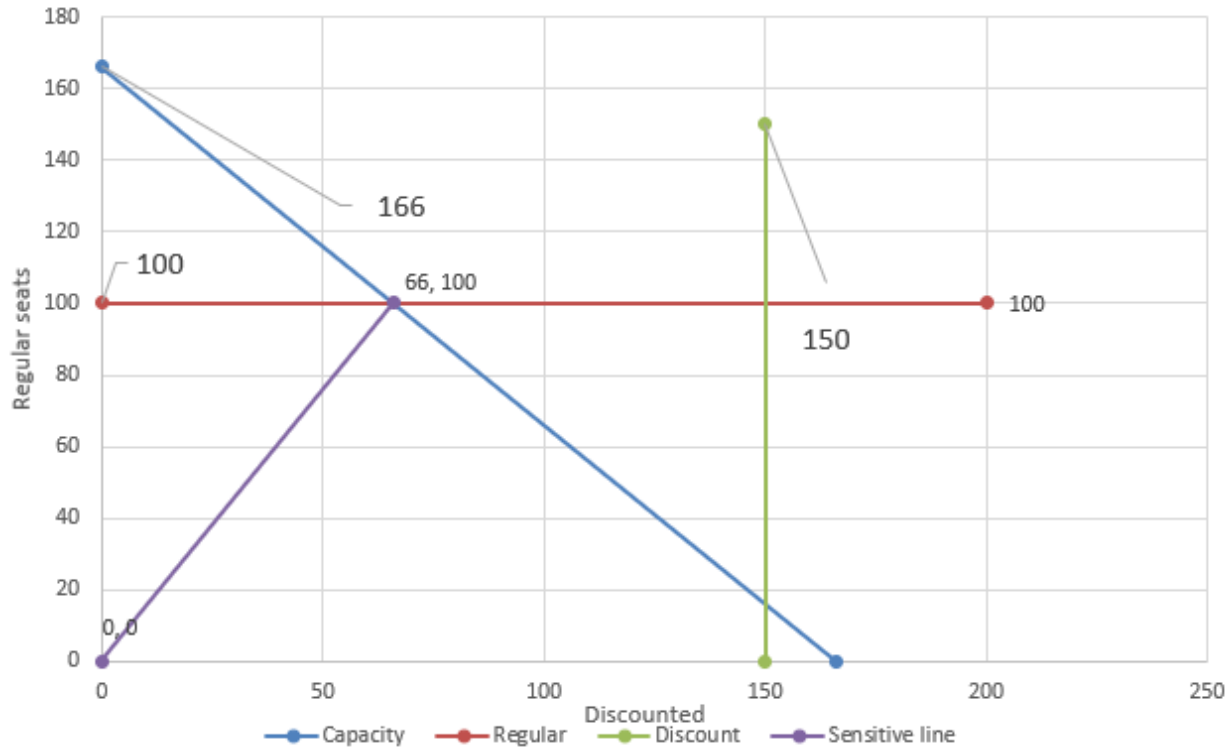
Constraints	LHS	Sign	RHS
Capacity:	0	<=	166
Regular Demand:	0	<=	100
Discount Demand:	0	<=	150
Regular Non-negative:	0	>=	0
Discount Non-negative:	0	>=	0



Finally, you saw how you can visualize the constraints and results of the graph.



The yellow polygon highlights the feasible solution region in the graph. And in the graph below, the purple line showcases the optimal solution.



Case 2: Optimal Distribution Model

Suppose you own a car company, which produces two models of a car, Model 1 and Model 2. Their selling prices are Rs 30 lakh and Rs 45 lakh, respectively. You purchase the components of both the cars from another manufacturer at Rs 15 lakh and Rs 22.5 lakh, respectively and then assemble them. One of the primary reasons for your success is that you test the cars thoroughly after assembling them and before rolling them out in the market.

Assembling costs you Rs 1,100 per labor hour; Model 1 requires 500 assembling hours, and Model 2, 600 assembling hours.

Testing is a slightly more expensive process, at Rs 1,500 per labor hour; you need 100 hours for testing Model 1 and 200 hours for testing Model 2.

With the number of workers in your factory, the maximum number of assembly hours and testing hours that you can get is also limited, that is, 10,00,000 assembly hours and 3,00,000 testing hours.

You also recently manufactured a new premium model, Model3, which you have decided to sell at Rs 60 lakh. Its components cost Rs 27.5 lakh, and it requires 800 assembly hours and 300 testing hours.

You ask your marketing team to provide you with the sales prediction along with the respective costs of all three models. They tell you they can sell a maximum of 600 cars of Model 1, 1200 cars of Model 2, and only 50 cars of Model 3, as it is new and expensive. At this point, you realize that you don't have enough working labor hours to maximize the production to 600 + 1200 + 50 cars, i.e., 1850 cars. You decide to hire more workers, but until then, you have to manage with the current restraints. Now, with these restraints in place, you have to determine how many of each car model you should produce to maximize your profits.

What is the number of Model 1 cars produced for maximum profit?
Ans: 524

What is the number of Model 3 cars produced for maximum profit?
Ans: 48

What is the amount of maximum value of the profit you can earn?
Ans: ₹ 20155 lakhs

What would be the maximum profit if the selling price of Model 3 changes to 50 Lakh?
Ans: ₹ 19960 lakhs

How does the maximum profit change when the selling price of Model 3 is slowly increased from 50 lakhs to 60 lakhs?
Ans: Profit remains constant for a bit and then increases with an increase in the SP of Model 3.

I started off by performing a sensitivity analysis on the airline optimisation problem when marketing came into the picture. I understood that even though you would get the optimal revenue by selling all the tickets at a regular price, I wouldn't do it to lose out on a customer segment.

Next, I performed another sensitivity analysis - this time for different capacities. There you saw that the 166-seater gave you the maximum marginal revenue and the 218 seater gave you the maximum market share (since its capacity is the highest) along with a decent marginal revenue. I then understood that based on the business situation - increasing profitability or increasing the market share, you would make the appropriate decision.

Finally, you saw another example of connecting flight where the flight from Delhi to Bangalore had a stop at Mumbai and understood that the main skill to have while solving any optimization problem is the ability to define the objective function, identify the decision variables, and formulate the constraints.