Solution to Canadian Tire Problem

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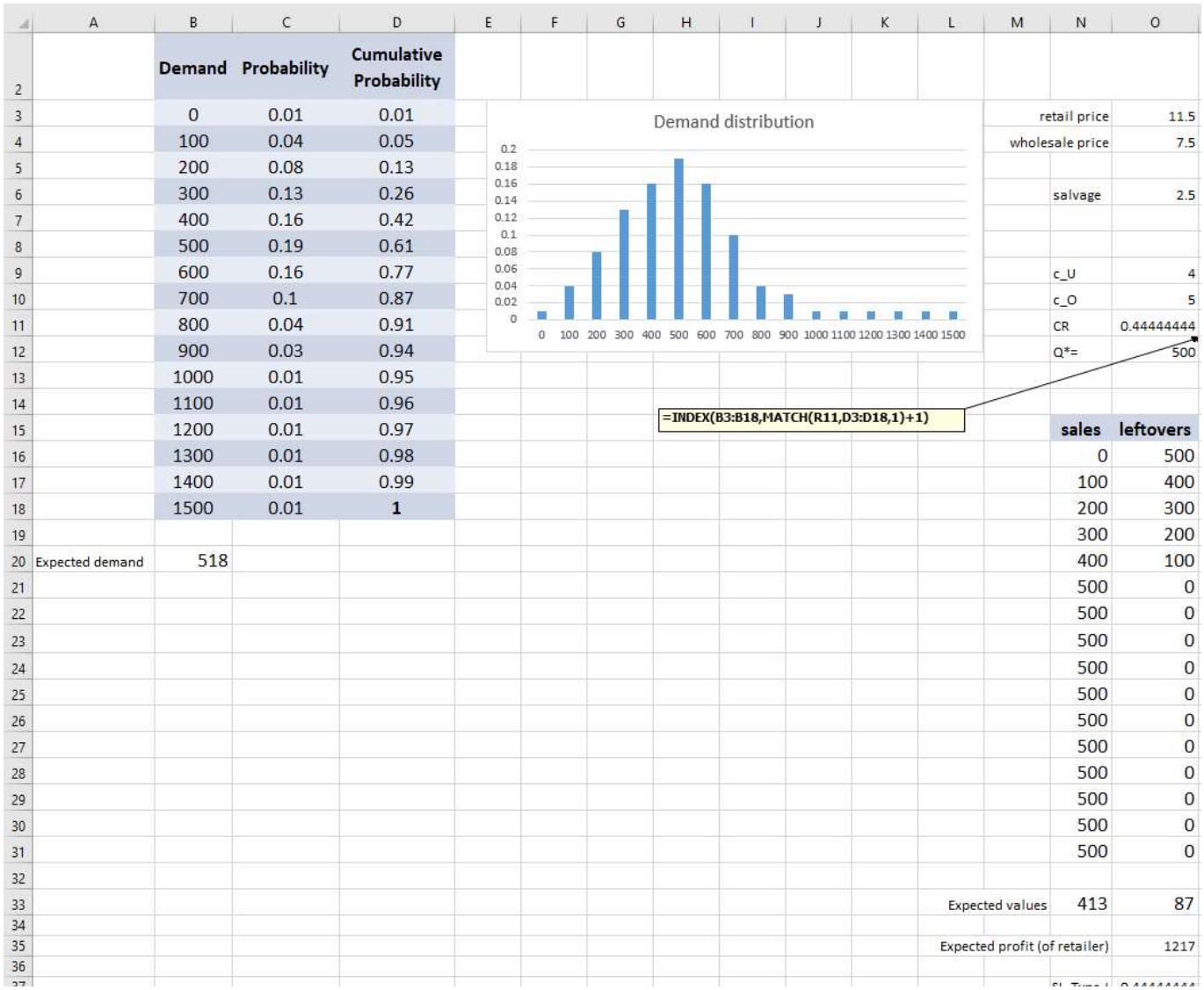
Figure 4.5 presents a screenshot of the solution, which is provided in the file titled "**04 EXCEL model -- toy truck example.xlsx (docs/05%20EXCEL%20model%20--%20toy%20truck%20example.xlsx?ou=312779)**"



	Demand	Probability	Cumulative Probability
	0	0.01	0.01
	100	0.04	0.05
	200	0.08	0.13
	300	0.13	0.26
	400	0.16	0.42
	500	0.19	0.61
	600	0.16	0.77
	700	0.1	0.87
	800	0.04	0.91
	900	0.03	0.94
	1000	0.01	0.95
	1100	0.01	0.96
	1200	0.01	0.97
	1300	0.01	0.98
	1400	0.01	0.99
	1500	0.01	1
Expected demand	518		

retail price	11.5
wholesale price	7.5
salvage	2.5
c_U	4
c_O	5
CR	0.44444444
Q*=	500

=INDEX(B3:B18,MATCH(R11,D3:D18,1)+1)

sales	leftovers
0	500
100	400
200	300
300	200
400	100
500	0
500	0
500	0
500	0
500	0
500	0
500	0
500	0
500	0
500	0
500	0
500	0
500	0
Expected values	413	87
Expected profit (of retailer)	1217

Fig 4.5

As demonstrated in figure 4.5, we calculate the following:

- the underage cost as 11.5 - 7.5 = 4
- the overage cost as 7.5 - 2.5 = 5
- the critical ratio of 4/(4+5) = 0.444

Examining the demand distribution, the optimal quantity is the first quantity at which the cdf exceeds 0.444, which is 500. The INDEX formula in cell O12 performs this search.

Calculate Expected Profit

To calculate the expected profit at Q=500, we calculate the expected sales, which is the min[Q,D] and the expected leftover, which is Q-min[Q,D]. This is done in range N16:O31, and in cells N33 and O33, which take the SUMPRODUCT of the corresponding sales or leftovers and their probabilities from column C. The results are 413 and 87.

The expected profit is 413*4 – 87*5 = 1217.

Service level of Type-I is the probability to satisfy all demand, or the critical ratio of 0.444. Service level of Type-II is the fraction of satisfied demand, or the 413 divided by the expected demand of 518 (cell B20).

Evaluate Certainty of Answer

Finally, for certainty, evaluate the expected profit from ordering any number other than 500 and observe that it is less than 1217.

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