Chapter 6: Simulation Using Spread-Sheets (Excel)

Refer to Reading Assignments

Simulation Using Spread-Sheets (Excel)

- **Application#1: Newspaper Vendor Inventory**

ABC Bakery store sells daily ***fresh bread for 5 SR***. They ***cost 3 SR to make*** a piece. The fresh bred that are not sold on a given day are purchased by a local ***farmer for 0.5 SR*** each. Assuming that ABC Bakery decides to make 30 fresh bread daily, what is the expected revenue for the bread, provided that the demand distribution is as show in as follows

d_i	5	10	40	45	50	55	60
$f(d_i)$	0.1	0.2	0.3	0.2	0.1	0.05	0.05
$F(d_i)$	0.1	0.3	0.6	0.8	0.9	0.95	1.0

Simulation Using Spread-Sheets (Excel)

- **Application#1: Newspaper Vendor Inventory**

Model Concept and Logic:

- Let **D** be a random variable representing the demand for the a given day

- Let **q** be the decision variable of number of bread that ABC Bakery will produce.

- Let **G(q,D)** as the profit at the end of the period for **q** units are ordered at the start of the period with **D** units of demand

Simulation Using Spread-Sheets (Excel)

- **Application#1: Newspaper Vendor Inventory**

Model Concept and Logic:

- Number of sold bread each day depends on the demand of that day **D** and the order quantity of the same day **q**

- The order quantity **q** is fixed and known, the demand **D** is random and unknown:

  - $D \geq q$ → no bread left → Sold units = **q**

  - $D < q$ → bread left **q – D** → Sold units = **D**

Simulation Using Spread-Sheets (Excel)

- **Application#1: Newspaper Vendor Inventory**

Model Concept and Logic:

- The total profits of each day **G(q,D)** :

$$G(q,D) = 5^{SR}\,[\text{Sold unit}] + 0.5^{SR}\,[\text{Salvage units}] - 3^{SR}\,[\text{quantity}]$$

$$G(q,D) = 5^{SR}\,(D) + 0.5^{SR}\,(0) - 3^{SR}\,(q) \qquad \text{if } D \geq q$$

or

$$G(q,D) = 5^{SR}\,(q) + 0.5^{SR}\,(q - D) - 3^{SR}\,(q) \qquad \text{if } D \geq q$$

The total profits :

$$G(q,D) = 5^{SR} \min\{D,q\} + 0.5^{SR} \max\{0,(q - D)\} - 3^{SR}\,(q)$$

Simulation Using Spread-Sheets (Excel)

- **Application#1: Newspaper Vendor Inventory**

Model Building in Excel :

- Start with deside how you want to layout the spreadsheet.
- You have to ***label the input cells*** very well at the top of the spreadsheet.
- Make the inputs clear at the top of the spreadsheet
  - decision variables
  - parameters of the model
  - Parameter of the distribution are clearly labeled and the demand distribution is. The simulation

Simulation Using Spread-Sheets (Excel)

- **Application#1: Newspaper Vendor Inventory**

Model Building in Excel :

- Label the simulation output in the middle of the spreadsheet.
- Create the data table used to perform the simulation analysis at the bottom to help adding more runs easily to simulation output

Simulation Using Spread-Sheets (Excel)

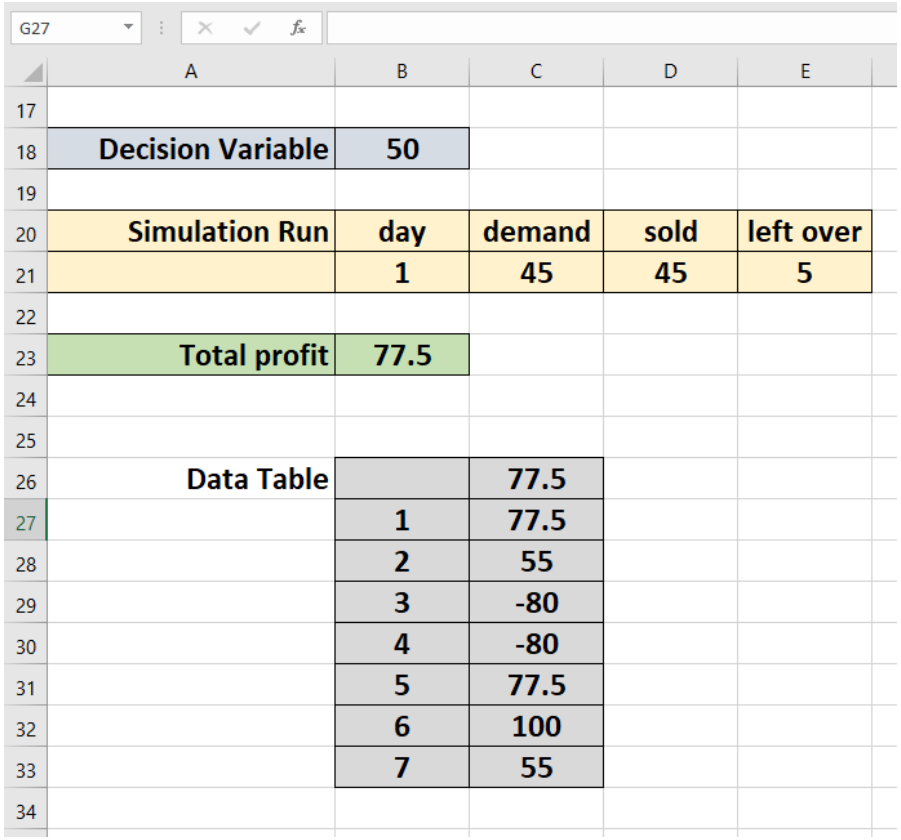
- **Application#1: Newspaper Vendor Inventory**

C32 | {=TABLE(,B26)}

	A	B	C	D	E	F
2						
3	Demand Dist.					
4			PMF	LR	CDF	D
5			0.1	0	0.1	5
6			0.2	0.1	0.3	10
7			0.3	0.3	0.6	40
8			0.2	0.6	0.8	45
9			0.1	0.8	0.9	50
10			0.05	0.9	0.95	55
11			0.05	0.95	1	60
12						
13	Input parameters					
14	per unit cost	3				
15	selling price per unit	5				
16	salvage price per unit	0.5				
17						
18	Decision Variable	50				
19						
20	Simulation Run	day	demand	sold	left over	
21		1	45	45	5	
22						
23	Total profit	77.5				
24						
25						

Simulation Using Spread-Sheets (Excel)

- **Application#1: Newspaper Vendor Inventory**



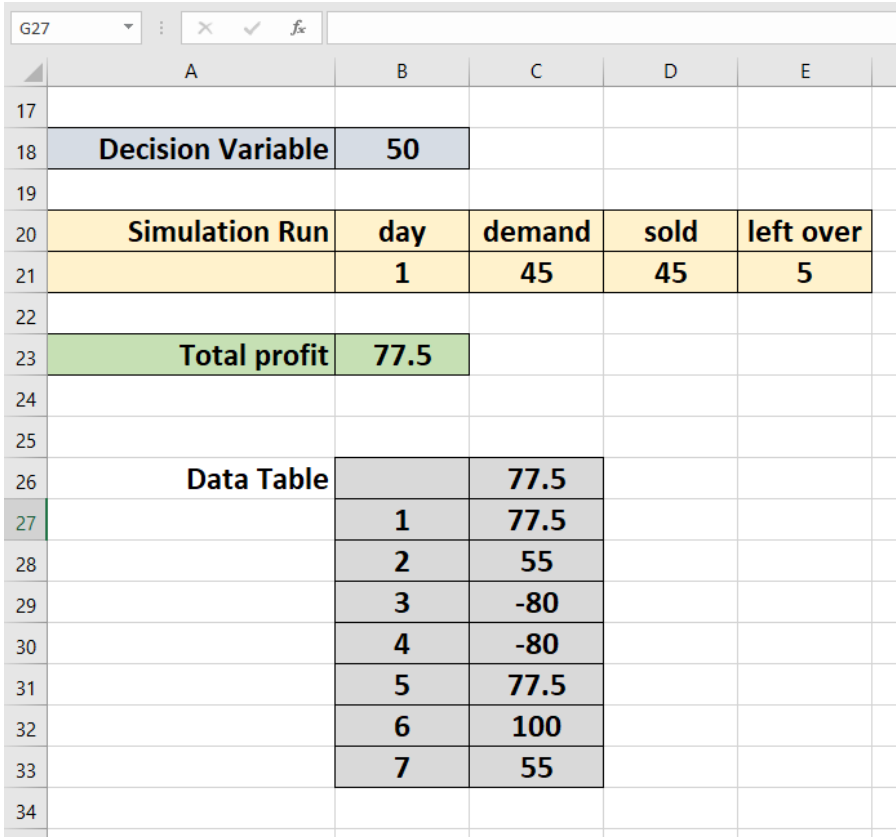
	A	B	C	D	E
17					
18	Decision Variable	50			
19					
20	Simulation Run	day	demand	sold	left over
21		1	45	45	5
22					
23	Total profit	77.5			
24					
25					
26	Data Table		77.5		
27		1	77.5		
28		2	55		
29		3	-80		
30		4	-80		
31		5	77.5		
32		6	100		
33		7	55		
34					

Simulation Using Spread-Sheets (Excel)

- **Application#1: Newspaper Vendor Inventory**

- Create 360 day Simulation Replications and

- Construct 95% Confidence interval for the total profit for q =30



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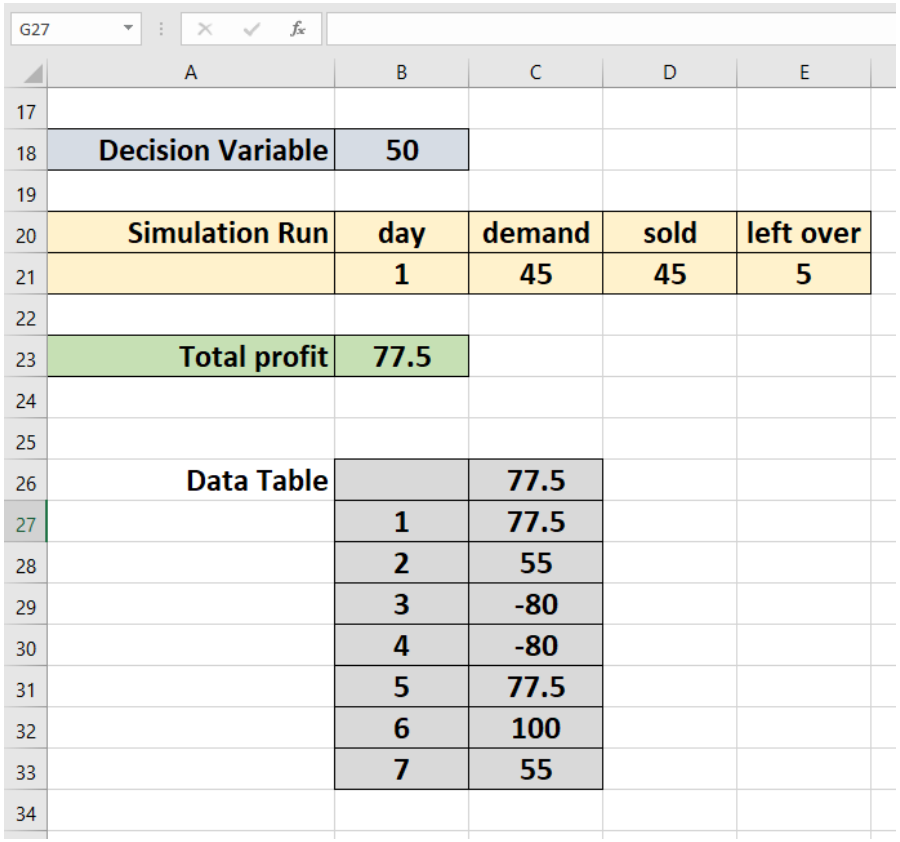
32		6	100		
33		7	55		
34					

Simulation Using Spread-Sheets (Excel)

- **Application#1: Newspaper Vendor Inventory**

- Use simulation to find the optimal production quantity q*
- Draw the profit function with 95% C.I. limits



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