كلية الحاسبات والذكاء الإصطناعي

SC311
Modeling and Simulation

Lecture 06

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Chapter 4: Inventory Simulation

- Introduction.
- Simulating of Inventory System.
- The Newspaper Seller's Problem.

Sim. of Inventory System(12/13)

Simulation Table (5 Cycles)

Cycle	Day	Beginning Inventory	Random Digits for Demand	Demand	Ending Inventory	Shortage Quantity	Order Quantity	Random Digits for Lead Time	Days until Order Arrives
1	1	3	24	1	2	0	–	–	1
	2	2	35	1	1	0	–	–	0
	3	9	65	2	7	0	–	–	–
	4	7	81	3	4	0	–	–	–
	5	4	54	2	2	0	9	5	1
2	1	2	03	0	2	0	–	–	0
	2	11	87	3	8	0	–	–	–
	3	8	27	1	7	0	–	–	–
	4	7	73	3	4	0	–	–	–
	5	4	70	2	2	0	9	0	3
3	1	2	47	2	0	0	–	–	2
	2	0	45	2	0	2	–	–	1
	3	0	48	2	0	4	–	–	0
	4	9	17	1	4	0	–	–	–
	5	4	09	0	4	0	7	3	1
4	1	4	42	2	2	0	–	–	0
	2	9	87	3	6	0	–	–	–
	3	6	26	1	5	0	–	–	–
	4	5	36	2	3	0	–	–	–
	5	3	40	2	1	0	10	4	1
5	1	1	07	0	1	0	–	–	0
	2	11	63	2	9	0	–	–	–
	3	9	19	1	8	0	–	–	–
	4	8	88	3	5	0	–	–	–
	5	5	94	4	1	0	10	8	2
					88				

Sim. of Inventory System(13/13)

Performance analysis:

- Based on five cycles of simulation, the average ending inventory is approximately 3.5 (88 ÷ 25) units.
- On 2 of 25 days a shortage condition existed.
- For large number of cycles, the computer is used.

YOUR TURN

Bonus Question:

Programmatic +2

In the previous example:

- Perform the simulation for 10 cycles.
- Plot a graph for this simulation.
  - (Time, Amount in inventory)
- Submit your answer (Due Date: 6-April-2023)
  - https://docs.google.com/forms/d/e/1FAIpQLSfxnJfAKMgo8cgC8RosczNjYYqwOPR3auqeznR4PiKqc5iNA/link

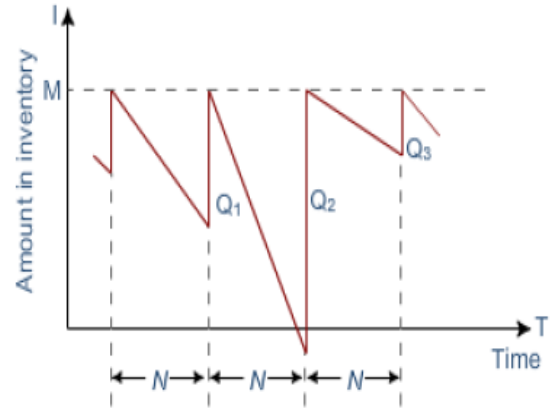
Note: Graph

Cycle	Day	Beginning Inventory	Random Digits for Demand	Demand	Ending Inventory	Shortage Quantity	Order Quantity	Random Digits for Lead Time	Days until Order Arrives
1	1	3	24	1	2	0	–	–	1
	2	2	35	1	1	0	–	–	0
	3	9	65	2	7	0			–
	4	7	81	3	4	0			–
	5	4	54	2	2	0			1
2	1	2	03	0	2	0	–	–	0
	2	11	87	3	8	0	–	–	–
	3	8	27	1	7	0	–	–	–
	4	7	73	3	4	0	–	–	–
	5	4	70	2	2	0	9	0	3
3	1	2	47	2	0	0			
	2	0	45	2	0	2			
	3	0	48	2	0	4			
	4	9	17	1	4	0			
	5	4	09	0	4	0			
4	1			2	2	0			
	2			3	6	0			
	3	6	26	1	5	0			
	4	5	36	2	3	0			
	5	3	40	2	1	0			
5	1	1	07	0	1	0			
	2	11	63	2	9	0			
	3	9	19	1	8	0			
	4	8	88	3	5	0			
	5	5	94	4	1	0			

88

Amount: *y*-Axis

Time: *x*-Axis



The Newspaper Seller (1/8)

The Newspaper Seller's Problem (1/2):

- A classical inventory problem concerns the purchase and sale of newspapers.
- The paper seller buys the papers for 33 cents each and sells them for 50 cents each. Newspapers not sold at the end of the day are sold as scrap for 5 cents each.
- Newspapers can be purchased in bundles of 10. Thus, the paper seller can buy 10, 20, … ,60 , … and so on.

The Newspaper Seller (1/8)

The Newspaper Seller's Problem (2/2):

- There are three types of newsdays, "good," "fair," and "poor," with probabilities of 0.35, 0.45, and 0.20, respectively.
- The problem is to determine the optimal number of papers the newspaper seller should purchase.

The Newspaper Seller (2/8)

Random-Digit Assignment for Type of Newsday

Type of Newsday	*Probability*
Good	0.35
Fair	0.45
Poor	0.20

The Newspaper Seller (2/8)

Random-Digit Assignment for Type of Newsday

Type of Newsday	*Probability*	*Cumulative Probability*	*Random-Digit Assignment*
Good	0.35	0.35	01–35
Fair	0.45	0.80	36–80
Poor	0.20	1.00	81–00

The Newspaper Seller (3/8)

Random-Digit Assignment for Type of Newsday

Type of Newsday	*Probability*	*Cumulative Probability*	*Random-Digit Assignment*
Good	0.35	0.35	01–35
Fair	0.45	0.80	36–80
Poor	0.20	1.00	81–00

Distribution of Newspapers Demanded

	Demand Probability Distribution		
Demand	*Good*	*Fair*	*Poor*
40	0.03	0.10	0.44
50	0.05	0.18	0.22
60	0.15	0.40	0.16
70	0.20	0.20	0.12
80	0.35	0.08	0.06
90	0.15	0.04	0.00
100	0.07	0.00	0.00

The Newspaper Seller (4/8)

Random-Digit Assignments for Newspapers Demanded

	Cumulative Distribution			*Random-Digit Assignment*		
Demand	*Good*	*Fair*	*Poor*	*Good*	*Fair*	*Poor*
40						
50						
60						
70						
80						
90						
100						

The Newspaper Seller (4/8)

Random-Digit Assignments for Newspapers Demanded

	Cumulative Distribution			*Random-Digit Assignment*		
Demand	*Good*	*Fair*	*Poor*	*Good*	*Fair*	*Poor*
40	0.03					
50	0.08					
60	0.23					
70	0.43					
80	0.78					
90	0.93					
100	1.00					

Demand Probability Distribution

Demand	*Good*	*Fair*	*Poor*
40	0.03	0.10	0.44
50	0.05	0.18	0.22
60	0.15	0.40	0.16
70	0.20	0.20	0.12
80	0.35	0.08	0.06
90	0.15	0.04	0.00
100	0.07	0.00	0.00

The Newspaper Seller (4/8)

Random-Digit Assignments for Newspapers Demanded

	Cumulative Distribution			*Random-Digit Assignment*		
Demand	*Good*	*Fair*	*Poor*	*Good*	*Fair*	*Poor*
40	0.03			01–03		
50	0.08			04–08		
60	0.23			09–23		
70	0.43			24–43		
80	0.78			44–78		
90	0.93			79–93		
100	1.00			94–00		

The Newspaper Seller (4/8)

Random-Digit Assignments for Newspapers Demanded

	Cumulative Distribution			*Random-Digit Assignment*		
Demand	*Good*	*Fair*	*Poor*	*Good*	*Fair*	*Poor*
40	0.03	0.10				
50	0.08	0.28				
60	0.23	0.68				
70	0.43	0.88				
80	0.78	0.96				
90	0.93	1.00				
100	1.00	1.00				

	Demand Probability Distribution		
Demand	*Good*	*Fair*	*Poor*
40	0.03	0.10	0.44
50	0.05	0.18	0.22
60	0.15	0.40	0.16
70	0.20	0.20	0.12
80	0.35	0.08	0.06
90	0.15	0.04	0.00
100	0.07	0.00	0.00

The Newspaper Seller (4/8)

Random-Digit Assignments for Newspapers Demanded

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Demand	*Good*	*Fair*	*Poor*	*Good*	*Fair*	*Poor*
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90	0.15	0.04	0.00
100	0.07	0.00	0.00

The Newspaper Seller (4/8)

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90	0.15	0.04	0.00
100	0.07	0.00	0.00

The Newspaper Seller (4/8)

Random-Digit Assignments for Newspapers Demanded

	Cumulative Distribution			*Random-Digit Assignment*		
Demand	*Good*	*Fair*	*Poor*	*Good*	*Fair*	*Poor*
40	0.03	0.10		01–03	01–10	
50	0.08	0.28		04–08	11–28	
60	0.23	0.68		09–23	29–68	
70	0.43	0.88		24–43	69–88	
80	0.78	0.96		44–78	89–96	
90	0.93	1.00		79–93	97–00	
100	1.00			94–00		

The Newspaper Seller (4/8)

Random-Digit Assignments for Newspapers Demanded

	Cumulative Distribution			*Random-Digit Assignment*		
Demand	*Good*	*Fair*	*Poor*	*Good*	*Fair*	*Poor*
40	0.03	0.10	0.44			
50	0.08	0.28	0.66			
60	0.23	0.68	0.82			
70	0.43	0.88	0.94			
80	0.78	0.96	1.00			
90	0.93	1.00	1.00			
100	1.00		1.00			

	Demand Probability Distribution		
Demand	*Good*	*Fair*	*Poor*
40	0.03	0.10	0.44
50	0.05	0.18	0.22
60	0.15	0.40	0.16
70	0.20	0.20	0.12
80	0.35	0.08	0.06
90	0.15	0.04	0.00
100	0.07	0.00	0.00

The Newspaper Seller (4/8)

Random-Digit Assignments for Newspapers Demanded

	Cumulative Distribution			*Random-Digit Assignment*		
Demand	*Good*	*Fair*	*Poor*	*Good*	*Fair*	*Poor*
40	0.03	0.10	0.44			
50	0.08	0.28	0.66			
60	0.23	0.68	0.82			
70	0.43	0.88	0.94			
80	0.78	0.96	1.00			
90	0.93	1.00	1.00			
100	1.00		1.00			

	Demand Probability Distribution		
Demand	*Good*	*Fair*	*Poor*
40	0.03	0.10	0.44
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60	0.15	0.40	0.16
70	0.20	0.20	0.12
80	0.35	0.08	0.06
90	0.15	0.04	0.00
100	0.07	0.00	0.00

The Newspaper Seller (4/8)

Random-Digit Assignments for Newspapers Demanded

	Cumulative Distribution			*Random-Digit Assignment*		
Demand	*Good*	*Fair*	*Poor*	*Good*	*Fair*	*Poor*
40	0.03	0.10	0.44			
50	0.08	0.28	0.66			
60	0.23	0.68	0.82			
70	0.43	0.88	0.94			
80	0.78	0.96	1.00			
90	0.93	1.00				
100	1.00					

	Demand Probability Distribution		
Demand	*Good*	*Fair*	*Poor*
40	0.03	0.10	0.44
50	0.05	0.18	0.22
60	0.15	0.40	0.16
70	0.20	0.20	0.12
80	0.35	0.08	0.06
90	0.15	0.04	0.00
100	0.07	0.00	0.00

The Newspaper Seller (4/8)

Random-Digit Assignments for Newspapers Demanded

	Cumulative Distribution			*Random-Digit Assignment*		
Demand	*Good*	*Fair*	*Poor*	*Good*	*Fair*	*Poor*
40	0.03	0.10	0.44	01–03	01–10	01–44
50	0.08	0.28	0.66	04–08	11–28	45–66
60	0.23	0.68	0.82	09–23	29–68	67–82
70	0.43	0.88	0.94	24–43	69–88	83–94
80	0.78	0.96	1.00	44–78	89–96	95–00
90	0.93	1.00		79–93	97–00	
100	1.00			94–00		

The Newspaper Seller (4/8)

- The profits are given by the following relationship:

$$\text{Profit} = \begin{pmatrix}\text{revenue}\\ \text{from sales}\end{pmatrix} - \begin{pmatrix}\text{cost of}\\ \text{newspapers}\end{pmatrix} - \begin{pmatrix}\text{lost profit from}\\ \text{excess demand}\end{pmatrix} + \begin{pmatrix}\text{salvage from sale}\\ \text{of scrap papers}\end{pmatrix}$$

- This will be accomplished by simulating demands for **20** days and recording profits from sales each day. The policy (number of newspapers purchased) is changed to other values and the simulation repeated until the best value is found.

The Newspaper Seller (5/8)

Simulation Table (70 newspapers, 20 days)

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94	Poor	80	60	$30.00	–	$0.50	$7.40
2	77	Fair	20	50	25.00	–	1.00	2.90
3	49	Fair	15	50	25.00	–	1.00	2.90
4	45	Fair	88	70	35.00	–	–	11.90
5	43	Fair	98	90	35.00	$3.40	–	8.50
6	32	Good	65	80	35.00	1.70	–	10.20
7	49	Fair	86	70	35.00	–	–	11.90
8	00	Poor	73	60	30.00	–	0.50	7.40
9	16	Good	24	70	35.00	–	–	11.90
10	24	Good	60	80	35.00	1.70	–	10.20
11	31	Good	60	80	35.00	1.70	–	10.20
12	14	Good	29	70	35.00	–	–	11.90
13	41	Fair	18	50	25.00	–	1.00	2.90
14	61	Fair	90	80	35.00	1.70	–	10.20
15	85	Poor	93	70	35.00	–	–	11.90
16	08	Good	73	80	35.00	1.70	–	10.20
17	15	Good	21	60	30.00	–	0.50	7.40
18	97	Poor	45	50	25.00	–	1.00	2.90
19	52	Fair	76	70	35.00	–	–	11.90
20	78	Fair	96	80	35.00	1.70	–	10.20
					$645.00	$13.60	$5.50	$174.90

The Newspaper Seller (6/8)

Simulation Table (in the question)

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94		80					
2	77		20					
3	49		15					
4	45		88					
5	43		98					
6	32		65					
7	49		86					
8	00		73					

The Newspaper Seller (6/8)

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4	45		88					
5	43		98					
6	32		65					
7	49		86					
8	00		73					

The Newspaper Seller (6/8)

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5	43		98					
6	32		65					
7	49		86					
8	00		73					

The Newspaper Seller (6/8)

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4	45		88					
5	43		98					
6	32		65					
7	49		86					
8	00		73					

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2	77		20					
3	49		15					
4	45		88					
5	43		09					
6	32							
7	49							
8	00		73					

Have	Demand	Lost Profit
70	90	20*(17 cents)

The paper seller buys the papers for 33 cents each and sells them for 50 cents each.

The Newspaper Seller (6/8)

Simulation Table (in the question)

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
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The Newspaper Seller (6/8)

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2	77		20					
3								
4								
5								
6								
7	49		86					
8	00		73					

$$\text{Profit} = \begin{pmatrix}\text{revenue}\\ \text{from sales}\end{pmatrix} - \begin{pmatrix}\text{cost of}\\ \text{newspapers}\end{pmatrix} - \begin{pmatrix}\text{lost profit from}\\ \text{excess demand}\end{pmatrix} + \begin{pmatrix}\text{salvage from sale}\\ \text{of scrap papers}\end{pmatrix}$$

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94		80					
2	77		20					
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The Newspaper Seller (7/8)

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1	94		80
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4	45		88
5	43		98

Type of Newsday	Probability	Cumulative Probability	Random-Digit Assignment
Good	0.35	0.35	01–35
Fair	0.45	0.80	36–80
Poor	0.20	1.00	81–00

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

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The Newspaper Seller (7/8)

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2	77	Fair	20	
3	49	Fair	15	
4	45	Fair	88	
5	43	Fair	98	

	Cumulative Distribution			Random-Digit Assignment		
Demand	Good	Fair	Poor	Good	Fair	Poor
40	0.03	0.10	0.44	01–03	01–10	01–44
50	0.08	0.28	0.66	04–08	11–28	45–66
60	0.23	0.68	0.82	09–23	29–68	67–82
70	0.43	0.88	0.94	24–43	69–88	83–94
80	0.78	0.96	1.00	44–78	89–96	95–00
90	0.93	1.00	1.00	79–93	97–00	
100	1.00	1.00	1.00	94–00		

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3	49	Fair	15	
4	45	Fair	88	
5	43	Fair	98	

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Demand	Good	Fair	Poor	Good	Fair	Poor
40	0.03	0.10	0.44	01–03	01–10	01–44
50	0.08	0.28	0.66	04–08	11–28	45–66
60	0.23	0.68	0.82	09–23	29–68	67–82
70	0.43	0.88	0.94	24–43	69–88	83–94
80	0.78	0.96	1.00	44–78	89–96	95–00
90	0.93	1.00	1.00	79–93	97–00	
100	1.00	1.00	1.00	94–00		

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4	45	Fair	88	
5	43	Fair	98	

	Cumulative Distribution			Random-Digit Assignment		
Demand	Good	Fair	Poor	Good	Fair	Poor
40	0.03	0.10	0.44	01–03	01–10	01–44
50	0.08	0.28	0.66	04–08	11–28	45–66
60	0.23	0.68	0.82	09–23	29–68	67–82
70	0.43	0.88	0.94	24–43	69–88	83–94
80	0.78	0.96	1.00	44–78	89–96	95–00
90	0.93	1.00	1.00	79–93	97–00	
100	1.00	1.00	1.00	94–00		

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94	Poor	80	60				
2	77	Fair	20					
3	49	Fair	15					
4	45	Fair	88					
5	43	Fair	98					

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand
1	94	Poor	80	60
2	77	Fair	20	
3	49	Fair	15	
4	45	Fair	88	
5	43	Fair	98	

	Cumulative Distribution			Random-Digit Assignment		
Demand	Good	Fair	Poor	Good	Fair	Poor
40	0.03	0.10	0.44	01–03	01–10	01–44
50	0.08	0.28	0.66	04–08	11–28	45–66
60	0.23	0.68	0.82	09–23	29–68	67–82
70	0.43	0.88	0.94	24–43	69–88	83–94
80	0.78	0.96	1.00	44–78	89–96	95–00
90	0.93	1.00	1.00	79–93	97–00	
100	1.00	1.00	1.00	94–00		

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94	Poor	80	60				
2	77	Fair	20	50				
3	49	Fair	15					
4	45	Fair	88					
5	43	Fair	98					

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94	Poor	80	60				
2	77	Fair	20	50				
3	49	Fair	15	50				
4	45	Fair	88	70				
5	43	Fair	98	90				

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94	Poor	80	60	$30.00	-	$0.50	$7.40
2	77	Fair	20	50				
3	49	Fair	15	50				
4	45	Fair	88	70				
5	43	Fair	98	90				

60*(50 cents) = $30.00

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94	Poor	80	60	$30.00	-	$0.50	$7.40
2	77	Fair	20	50				
3	49	Fair	15	50				
4	45	Fair	88	70				
5	43	Fair	98	90				

10*(5 cents) = $0.50

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers
= 70*0.33 = $23.10

$$\text{Profit} = \begin{pmatrix}\text{revenue}\\ \text{from sales}\end{pmatrix} - \begin{pmatrix}\text{cost of}\\ \text{newspapers}\end{pmatrix} - \begin{pmatrix}\text{lost profit from}\\ \text{excess demand}\end{pmatrix} + \begin{pmatrix}\text{salvage from sale}\\ \text{of scrap papers}\end{pmatrix}$$

	Random Digits for	Random		Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
				$30.00	-	$0.50	$7.40
3	49	Fair	15				
4	45	Fair	88				
5	43	Fair	98				

Profit (Day#1)
$= 30.00 - 23.10 - 0 + 0.50$
$= \$7.40$

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94	Poor	80	60	$30.00	–	$0.50	$7.40
2	77	Fair	20	50	25.00	–	1.00	2.90
3	49	Fair	15	50				
4	45	Fair	88	70				
5	43	Fair	98	90				

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94	Poor	80	60	$30.00	-	$0.50	$7.40
2	77	Fair	20	50	25.00	-	1.00	2.90
3	49	Fair	15	50				
4	45	Fair	88	70				
5	43	Fair	98	90				

50*(50 cents) = $25.00

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94	Poor	80	60	$30.00	-	$0.50	$7.40
2	77	Fair	20	50	25.00	-	1.00	2.90
3	49	Fair	15	50				
4	45	Fair	88	70				
5	43	Fair	98	90				

20*(5 cents) = $1.00

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers
= 70*0.33 = $23.10

$$\text{Profit} = \begin{pmatrix}\text{revenue}\\ \text{from sales}\end{pmatrix} - \begin{pmatrix}\text{cost of}\\ \text{newspapers}\end{pmatrix} - \begin{pmatrix}\text{lost profit from}\\ \text{excess demand}\end{pmatrix} + \begin{pmatrix}\text{salvage from sale}\\ \text{of scrap papers}\end{pmatrix}$$

					Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
		Random Digits for		Random				
					$30.00	-	$0.50	$7.40
					25.00	-	1.00	2.90
3	49	Fair	15	50				
4	45	Fair	88					
5	43	Fair	98					

Profit (Day#2)
$= 25.00 - 23.10 - 0 + 1.00$
$= \$2.90$

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94	Poor	80	60	$30.00	–	$0.50	$7.40
2	77	Fair	20	50	25.00	–	1.00	2.90
3	49	Fair	15	50	25.00	–	1.00	2.90
4	45	Fair	88	70	35.00	–	–	11.90
5	43	Fair	98	90				

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94	Poor	80	60	[illegible]		[illegible]	[illegible]7.40
2	77	Fair	20	50	[illegible]	–	[illegible]	2.90
3	49	Fair	15	50	25.00	–	1.00	2.90
4	45	Fair	88	70	35.00	–	–	11.90
5	43	Fair	98	90				

70*(50 cents) = $35.00

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers
= 70*0.33 = $23.10

$$\text{Profit} = \begin{pmatrix}\text{revenue}\\ \text{from sales}\end{pmatrix} - \begin{pmatrix}\text{cost of}\\ \text{newspapers}\end{pmatrix} - \begin{pmatrix}\text{lost profit from}\\ \text{excess demand}\end{pmatrix} + \begin{pmatrix}\text{salvage from sale}\\ \text{of scrap papers}\end{pmatrix}$$

					evenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94	P					$0.50	$7.40
2	77	F					1.00	2.90
3	49	F					1.00	2.90
4	45	Fair	88	70	35.00	-	-	11.90
5	43	Fair	98	90				

Profit (Day#4)
$= 35.00 - 23.10 - 0 + 0$
$= \$11.90$

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94	Poor	80	60	$30.00	–	$0.50	$7.40
2	77	Fair	20	50	25.00	–	1.00	2.90
3	49	Fair	15	50	25.00	–	1.00	2.90
4	45	Fair	88	70	35.00	–	–	11.90
5	43	Fair	98	90	35.00	$3.40	–	8.50

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94	Poor	80	60	$30.00	-	$0.50	$7.40
2	77	Fair	20	50	25.00	-	1.00	2.90
3	49	Fair	15	50	[illegible]	[illegible]	[illegible]	2.90
4	45	Fair	88	70	35.00	-	-	11.90
5	43	Fair	98	90	35.00	$3.40	-	8.50

70*(50 cents) = $35.00

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94	Poor	80	60	$30.00	-	$0.50	$7.40
2	77	Fair	20	50	25.00	-	1.00	2.90
3	49	Fair	15	50				2.90
4	45	Fair	88	70	35.00	-	-	11.90
5	43	Fair	98	90	35.00	$3.40	-	8.50

20*(17 cents) = $3.40

The Newspaper Seller (7/8)

Simulation Table (70 newspapers, 5 days)

Cost of daily newspapers
= 70*0.33 = $23.10

$$\text{Profit} = \begin{pmatrix}\text{revenue}\\ \text{from sales}\end{pmatrix} - \begin{pmatrix}\text{cost of}\\ \text{newspapers}\end{pmatrix} - \begin{pmatrix}\text{lost profit from}\\ \text{excess demand}\end{pmatrix} + \begin{pmatrix}\text{salvage from sale}\\ \text{of scrap papers}\end{pmatrix}$$

		Random			evenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
					$30.00	-	$0.50	$7.40
2	77	F					1.00	2.90
3	49	F					1.00	2.90
4	45	F					-	11.90
5	43	Fair	98	90	35.00	$3.40	-	8.50

Profit (Day#5)
$= 35.00 - 23.10 - 3.40 + 0$
$= \$8.50$

The Newspaper Seller (8/8)

Profit (1/5):

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
1	94	Poor	80	60	$30.00	-	$0.50	$7.40

On day 1 the demand is for 60 newspapers. The revenue from the sale of 60 newspapers is $30.00. Ten newspapers are left over at the end of the day. The salvage value at 5 cents each is 50 cents.

The Newspaper Seller (8/8)

Profit (2/5):

Cost of daily newspapers = 70*0.33 = $23.10

$$\text{Profit} = \begin{pmatrix}\text{revenue}\\ \text{from sales}\end{pmatrix} - \begin{pmatrix}\text{cost of}\\ \text{newspapers}\end{pmatrix} - \begin{pmatrix}\text{lost profit from}\\ \text{excess demand}\end{pmatrix} + \begin{pmatrix}\text{salvage from sale}\\ \text{of scrap papers}\end{pmatrix}$$

On day 1 the demand is for 60 newspapers. The revenue from the sale of 60 newspapers is $30.00. Ten newspapers are left over at the end of the day. The salvage value at 5 cents each is 50 cents. The profit for the first day is determined as follows:

$$\textbf{Profit (Day\#1)} = 30.00 - 23.10 - 0 + 0.50 = \$7.40$$

The Newspaper Seller (8/8)

Profit (3/5):

Cost of daily newspapers = 70*0.33 = $23.10

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
5	43	Fair	98	90	35.00	$3.40	-	8.50

On the fifth day the demand is greater than the supply. The revenue from sales is $35.00, since only 70 papers are available under this policy. An additional 20 papers could have been sold. Thus, a lost profit of $3.40 (20 × 17 cents) is assessed.

The Newspaper Seller (8/8)

Profit (4/5):

Cost of daily newspapers = 70*0.33 = $23.10

$$\text{Profit} = \begin{pmatrix}\text{revenue}\\ \text{from sales}\end{pmatrix} - \begin{pmatrix}\text{cost of}\\ \text{newspapers}\end{pmatrix} - \begin{pmatrix}\text{lost profit from}\\ \text{excess demand}\end{pmatrix} + \begin{pmatrix}\text{salvage from sale}\\ \text{of scrap papers}\end{pmatrix}$$

On the fifth day the demand is greater than the supply. The revenue from sales is $35.00, since only 70 papers are available under this policy. An additional 20 papers could have been sold. Thus, a lost profit of $3.40 (20 × 17 cents) is assessed.

$$\text{Profit (Day\#5)} = 35.00 - 23.10 - 3.40 + 0 = \$8.50$$

The Newspaper Seller (8/8)

Profit (5/5):

Cost of 20 days newspapers
= 70*0.33*20 = $462

Day	Random Digits for Type of Newsday	Type of Newsday	Random Digits for Demand	Demand	Revenue from Sales	Lost Profit from Excess Demand	Salvage from Sale of Scrap	Daily Profit
20	78	Fair	96	80	35.00	1.70	–	10.20
					$645.00	$13.60	$5.50	$174.90

The profit for the 20-day period is the sum of the daily profits, $174.90. It can also be computed from the totals for the 20 days of the simulation as follows:

$$\text{Total profit} = \$645.00 - \$462.00 - \$13.60 + \$5.50$$
$$= \$174.90$$

YOUR TURN

You can do the following, and not only:

1. Repeat the simulations many times and take the average of the total profits.
2. Change the number of purchased Newspapers, then repeat the simulation.
3. Draw a graph to show the relation between the number of purchased Newspapers and the total profits.
4. …

Video Lectures

All Lectures: https://www.youtube.com/playlist?list=PLxIvc-MGOs6geFJmdvDOIN5zE89-Hq8Ij

Lecture #6: https://www.youtube.com/watch?v=6UYLkzvBnCQ&list=PLxIvc-MGOs6geFJmdvDOIN5zE89-Hq8Ij&index=18

Thank You

Dr. Ahmed Hagag

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