END3032 – SYSTEMS SIMULATION

Laboratory Practice #2.2

The News Dealer’s Problem

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08.04.2020

Problem Definition*

- The newsstand 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 newsstand can buy 40, 50, etc.
- There are three types of newsdays: "good", "fair" and "poor''; they have the probabilities 0.35, 0.45 and 0.20, respectively as shown in Table 1.

Table 1. Distribution of Type of Newsdays

Type	Prob.	Cum. Prob.
Good	0.35	0.35
Fair	0.45	0.80
Poor	0.20	1.00

Please make sure that you use common random numbers for different amounts of purchase (i.e., 40,50, etc.)!

*Banks, J., Carson II, J.S., Nelson, B.L., Nicol, D.M. (2005). Discrete-event system simulation. Pearson Prentice Hall.

Problem Definition

- The distribution of newspapers demanded on each of these days is given, in Table 2.
- The problem is to compute the optimal number of papers the newsstand should purchase. This will be accomplished by simulating demands for 20 days and recording profits from sales each day.

Table 2. Distribution of Newspapers Demanded per Day

Demand	Good		Fair		Poor	
	Prob.	Cum. Prob.	Prob.	Cum. Prob.	Prob.	Cum. Prob.
40	0.03	0.03	0.10	0.10	0.44	0.44
50	0.05	0.08	0.18	0.28	0.22	0.66
60	0.15	0.23	0.40	0.68	0.16	0.82
70	0.20	0.43	0.20	0.88	0.12	0.94
80	0.35	0.78	0.08	0.96	0.06	1.00
90	0.15	0.93	0.04	1.00	0.00	1.00
100	0.07	1.00	0.00	1.00	0.00	1.00

MS Excel Application

- Form the table structure in order to simulate demands for 20 days

	A	B	C	D	E	F	G	H	I	J	K
1											
2		Purchase:									
3											
4		day	random numbers for type of newsday	type of newsday	random numbers for demand	demand	revenue from sales	lost profit from excess demand	salvage from sale of scrap	daily profit	
5		1									
6		2									
7		3									
8		4									
9		5									
10		6									
11		7									
12		8									
13		9									
14		10									
15		11									
16		12									
17		13									
18		14									
19		15									
20		16									
21		17									
22		18									
23		19									
24		20									
25								Average Daily Profit:			

MS Excel Application

- Start with purchase amounts of 40
- Generate random numbers for type of newsday

	A	B	C	D	E	F	G	H	I	J	K
1											
2		Purchase:	40								
3											
4		day	random numbers for type of newsday	type of newsday	random numbers for demand	demand	revenue from sales	lost profit from excess demand	salvage from sale of scrap	daily profit	
5		1	=S_SAYI_ÜRET()								
6		2									
7		3									
8		4									
9		5									
10		6									
11		7									
12		8									
13		9									
14		10									
15		11									
16		12									
17		13									
18		14									
19		15									
20		16									
21		17									
22		18									
23		19									
24		20									
25								Average Daily Profit:			

MS Excel Application

- Determine the type of newsday according to the random number generated in the previous step

	A	B	C	D	E	F	G	H	I	J	K
1											
2		Purchase:	40								
3											
4		day	random numbers for type of newsday	type of newsday	random numbers for demand	demand	revenue from sales	lost profit from excess demand	salvage from sale of scrap	daily profit	
5	=EĞER(C5<0,36;"Good";EĞER(C5<0,81;										
6	"Fair";"Poor"))										
7		3									
8		4									
9		5									
10		6									
11		7									
12		8									
13		9									
14		10									
15		11									
16		12									
17		13									
18		14									
19		15									
20		16									
21		17									
22		18									
23		19									
24		20									
25								Average Daily Profit:			

MS Excel Application

- Generate random numbers for demand

	A	B	C	D	E	F	G	H	I	J	K
1											
2		Purchase:	40								
3											
4		day	random numbers for type of newsday	type of newsday	random numbers for demand	demand	revenue from sales	lost profit from excess demand	salvage from sale of scrap	daily profit	
5		1	0,579104	Fair	=S_SAYI_ÜRET()						
6		2									
7		3									
8		4									
9		5									
10		6									
11		7									
12		8									
13		9									
14		10									
15		11									
16		12									
17		13									
18		14									
19		15									
20		16									
21		17									
22		18									
23		19									
24		20									
25								Average Daily Profit:			

MS Excel Application

- Determine the demand according to the random number generated in the previous step

	A	B	C	D	E	F	G	H	I	J	K
1											
2		Purchase:	40								
3											
4		day	random numbers for type of newsday	type of newsday	random numbers for demand	demand	revenue from sales	lost profit from excess demand	salvage from sale of scrap	daily profit	
5		1	0,579104	Fair	0,606619	=EĞER(D5="Good";EĞER(E5<0,04;40;EĞER(E5<0,09;50;EĞER(					
6		2				E5<0,24;60;EĞER(E5<0,44;70;EĞER(E5<0,79;80;EĞER(E5<0,94;90;					
7		3				100))))));EĞER(D5="Fair";EĞER(E5<0,11;40;EĞER(E5<0,29;50;					
8		4				EĞER(E5<0,69;60;EĞER(E5<0,89;70;EĞER(E5<0,97;80;90)))));					
9		5				EĞER(E5<0,45;40;EĞER(E5<0,67;50;EĞER(E5<0,83;60;EĞER(E5<					
10		6				0,95;70;80)))))					
11		7									
12		8									
13		9									
14		10									
15		11									
16		12									
17		13									
18		14									
19		15									
20		16									
21		17									
22		18									
23		19									
24		20									
25								Average Daily Profit:			

MS Excel Application

- Calculate revenue from sales

	A	B	C	D	E	F	G	H	I	J	K
1											
2		Purchase	40								
3											
4		day	random numbers for type of newsday	type of newsday	random numbers for demand	demand	revenue from sales	lost profit from excess demand	salvage from sale of scrap	daily profit	
5		1	0,579104	Fair	0,606619	60	=EĞER(F5<=C2;F5*0,5;C2*0,5)				
6		2									
7		3									
8		4									
9		5									
10		6									
11		7									
12		8									
13		9									
14		10									
15		11									
16		12									
17		13									
18		14									
19		15									
20		16									
21		17									
22		18									
23		19									
24		20									
25								Average Daily Profit:			

MS Excel Application

- Calculate lost profit from excess demand

	A	B	C	D	E	F	G	H	I	J	K
1											
2		Purchase:	40								
3											
4		day	random numbers for type of newsday	type of newsday	random numbers for demand	demand	revenue from sales	lost profit from excess demand	salvage from sale of scrap	daily profit	
5		1	0,579104	Fair	0,606619	60	20	=EĞER(F5>C2;(F5-C2)*0,17;0)			
6		2									
7		3									
8		4									
9		5									
10		6									
11		7									
12		8									
13		9									
14		10									
15		11									
16		12									
17		13									
18		14									
19		15									
20		16									
21		17									
22		18									
23		19									
24		20									
25								Average Daily Profit:			

MS Excel Application

- Calculate salvage from sale of scrap

	A	B	C	D	E	F	G	H	I	J	K
1											
2		Purchase	40								
3											
4		day	random numbers for type of newsday	type of newsday	random numbers for demand	demand	revenue from sales	lost profit from excess demand	salvage from sale of scrap	daily profit	
5		1	0,579104	Fair	0,606619	60	20	3,4	=EĞER(C2>F5;(C2-F5)*0,05;0)		
6		2									
7		3									
8		4									
9		5									
10		6									
11		7									
12		8									
13		9									
14		10									
15		11									
16		12									
17		13									
18		14									
19		15									
20		16									
21		17									
22		18									
23		19									
24		20									
25								Average Daily Profit:			

MS Excel Application

- Calculate daily profit

	A	B	C	D	E	F	G	H	I	J	K
1											
2		Purchase:	40								
3											
4		day	random numbers for type of newsday	type of newsday	random numbers for demand	demand	revenue from sales	lost profit from excess demand	salvage from sale of scrap	daily profit	
5		1	0,579104	Fair	0,606619	60	20	3,4	0	=G5-0,33*C2-H5+I5	
6		2									
7		3									
8		4									
9		5									
10		6									
11		7									
12		8									
13		9									
14		10									
15		11									
16		12									
17		13									
18		14									
19		15									
20		16									
21		17									
22		18									
23		19									
24		20									
25								Average Daily Profit:			

MS Excel Application

- Similarly, simulate it for 20 days
- Calculate average daily profit

- Simulate it different amounts of purchase (i.e., 50, 60 etc.)
- Then compute the optimal number of papers the newsstand should purchase

	A	B	C	D	E	F	G	H	I	J	K
1											
2		Purchase:	40								
3											
4		day	random numbers for type of newsday	type of newsday	random numbers for demand	demand	revenue from sales	lost profit from excess demand	salvage from sale of scrap	daily profit	
5		1	0,579104	Fair	0,606619	60	20	3,4	0	3,4	
6		2	0,395463	Fair	0,763667	70	20	5,1	0	1,7	
7		3	0,636179	Fair	0,883129	70	20	5,1	0	1,7	
8		4	0,512266	Fair	0,113083	50	20	1,7	0	5,1	
9		5	0,569102	Fair	0,410296	60	20	3,4	0	3,4	
10		6	0,982305	Poor	0,672462	60	20	3,4	0	3,4	
11		7	0,696351	Fair	0,719192	70	20	5,1	0	1,7	
12		8	0,174201	Good	0,725681	80	20	6,8	0	-1,8E-15	
13		9	0,878662	Poor	0,824502	60	20	3,4	0	3,4	
14		10	0,657549	Fair	0,59409	60	20	3,4	0	3,4	
15		11	0,42977	Fair	0,184851	50	20	1,7	0	5,1	
16		12	0,285182	Good	0,646695	80	20	6,8	0	-1,8E-15	
17		13	0,276949	Good	0,016037	40	20	0	0	6,8	
18		14	0,836925	Poor	0,861169	70	20	5,1	0	1,7	
19		15	0,462022	Fair	0,906255	80	20	6,8	0	-1,8E-15	
20		16	0,647399	Fair	0,665439	60	20	3,4	0	3,4	
21		17	0,180903	Good	0,076438	50	20	1,7	0	5,1	
22		18	0,548977	Fair	0,351819	60	20	3,4	0	3,4	
23		19	0,231146	Good	0,378601	70	20	5,1	0	1,7	
24		20	0,43391	Fair	0,937401	80	20	6,8	0	-1,8E-15	
25								Average Daily Profit		=ORTALAMA(J5:J24)	

MS Excel Application

Purchase: 100

Common Random Numbers!!!

day	random numbers for type of newsday	type of newsday	random numbers for demand	demand	revenue from sales	lost profit from excess demand	salvage from sale of scrap	daily profit
1	0,579104	Fair	0,606619	60	30	0	2	-1
2	0,395463	Fair	0,763667	70	35	0	1,5	3,5
3	0,636179	Fair	0,883129	70	35	0	1,5	3,5
4	0,512266	Fair	0,113083	50	25	0	2,5	-5,5
5	0,569102	Fair	0,410296	60	30	0	2	-1
6	0,982305	Poor	0,672462	60	30	0	2	-1
7	0,696351	Fair	0,719192	70	35	0	1,5	3,5
8	0,174201	Good	0,725681	80	40	0	1	8
9	0,878662	Poor	0,824502	60	30	0	2	-1
10	0,657549	Fair	0,59409	60	30	0	2	-1
11	0,42977	Fair	0,184851	50	25	0	2,5	-5,5
12	0,285182	Good	0,646695	80	40	0	1	8
13	0,276949	Good	0,016037	40	20	0	3	-10
14	0,836925	Poor	0,861169	70	35	0	1,5	3,5
15	0,462022	Fair	0,906255	80	40	0	1	8
16	0,647399	Fair	0,665439	60	30	0	2	-1
17	0,180903	Good	0,076438	50	25	0	2,5	-5,5
18	0,548977	Fair	0,351819	60	30	0	2	-1
19	0,231146	Good	0,378601	70	35	0	1,5	3,5
20	0,43391	Fair	0,937401	80	40	0	1	8
						Average Daily Profit		0,8

amounts of purchase	average daily profit
40	2,720
50	5,810
60	7,970
70	7,960
80	6,400
90	3,600
100	0,800

optimal amount

Thanks!...

Questions?

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