Chapter 11, Estimation of Absolute Performance
By, Mohammad Abubakar Atiq, F2022031002, BSIE, To: Sir Rehan Ashraf
Department of Mechanical Engineering
Exercise Question No. 10:
A store selling Mother's Day cards must decide 6 months in advance on the number of cards to stock. Reordering is not allowed. Cards cost $0.45 and sell for $1.25. Any cards not sold by Mother's Day go on sale for $0.50 for 2 weeks. However, sales of the remaining cards is probabilistic in nature according to the following distribution:
32% of the time, all cards remaining get sold.
40% of the time, 80% of all cards remaining are sold.
28% of the time, 60% of all cards remaining are sold.
Any cards left after 2 weeks are sold for $0.25. The card-shop owner is not sure how many cards can be sold, but thinks it is somewhere (i.e., uniformly distributed) between 200 and 400. Suppose that the card-shop owner decides to order 300 cards. Estimate the expected total profit with an error of at most $5.00. [Hint: Make ten initial replications. Use these data to estimate the total sample size needed. Each replication consists of one Mother's Day.]
Solution:
Calculate the Average Profit = [Sum of all profit]/[Total number of replications]
$E = \ Check\ for\ Error\ of\ \pm\ \$5.00.$
s =Standard deviation of profit.
Determine required sample size (n):

$$n = \left(z.\frac{s}{E}\right)^2$$

z: $confidence\ level\ (e.g., 1.96\ for\ 95\%\ confidence).$
s: $standard\ deviation\ of\ the\ profits.$
E: $desired\ margin\ of\ error\ (\$5.00).$

Calculate the Average Profit	=	133	
Check for Error of +- $5.00, standard deviation of Profit	=	59	Check for Error of $\pm\$5.00$, standard deviation s
Required Sample Size (n)	=	543	$<-\ -Number\ of\ simulations\ required\ to\ achieve\ the\ desired\ accuracy.$

Week 2

Replication	Random #	Demand range (200 to 400) fixed	Demand (D)	Sold at $1.25	Unsold Cards	Sold at $0.50	Leftover Cards	Revenue ($)	Cost($)	Profit($)
1	0.094	400	37	37	263	263	0	178	135	43
2	0.270	400	108	108	192	192	0	231	135	96
3	0.366	400	146	146	154	123	31	252	135	117
4	0.312	400	125	125	175	175	0	244	135	109
5	0.580	400	232	232	68	55	14	320	135	185
6	0.782	400	313	300	0	0	0	375	135	240
7	0.307	400	123	123	177	177	0	242	135	107
8	0.779	400	311	300	0	0	0	375	135	240
9	0.014	400	6	6	294	294	0	154	135	19
10	0.383	400	153	153	147	117	29	258	135	123
11	0.323	400	129	129	171	137	34	238	135	103
12	0.540	400	216	216	84	67	17	308	135	173
13	0.669	400	267	267	33	26	7	349	135	214
14	0.407	400	163	163	137	110	27	265	135	130
15	0.212	400	85	85	215	215	0	214	135	79
16	0.499	400	200	200	100	80	20	295	135	160
17	0.320	400	128	128	172	137	34	238	135	103
18	0.768	400	307	300	0	0	0	375	135	240
19	0.266	400	106	106	194	194	0	230	135	95
20	0.418	400	167	167	133	106	27	269	135	134
21	0.267	400	107	107	193	193	0	230	135	95
22	0.393	400	157	157	143	114	29	261	135	126