INDR371 - HW4

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December 13, 2022

Question 1

To find success probability, I calculated $P(2.97 \leq X \leq 3.03)$ where X $\sim$ N(3, 0.02) with the following line:

$$p_{success} = norm.cdf(3.03, loc = 3, scale = 0.02) - norm.cdf(2.97, loc = 3, scale = 0.02)$$

which resulted in 0.8664.

Part A

Q	Probability
100	0.000001
110	0.116330
120	0.882458

Table 1: Success probability table for Q=100,110,120

In Table 1, for Q = 100, 110 and 120, you can see the estimate success probabilities calculated by the normal approximation to the binomial yield.

Part B

Q	Probability
1000	0.000000
1100	0.000008
1200	0.999532

Table 2: Success probability table for Q=1000,1100,1200

In Table 2, for Q = 1000, 1100 and 1200, you can see the estimate success probabilities calculated by the normal approximation to the binomial yield.

Question 2

For this question, I have built my code upon SASimulation.py file shared with us. In each loop, I have initially checked whether the current machine is in maintenance. If so, I have checked whether the maintenance should be over or not. If yes, then I have continued with ordinary operations such as unloading and loading with a new product etc. If not, the operator travels to the next machine and loop runs again. You can see the implementation in more detail in my code.

I should note that I have averaged the results of **1000** replications in the simulation.

Part A

m	Produced
2	108.365
3	142.938
4	149.161
5	150.317

Table 3: Expected production quantity for differing machine counts

Note that, the values in 3 are dependent on the order of the calls to the random functions in the simulation and also on the random seed as well.

Part B

p_{stuck}	Produced	Damaged
0.02	142.867	1.166
0.01	148.378	0.619

Table 4: Produced and damaged product quantities for 2 stuck probabilities

From 4, we can observe that the production quantity increases by approximately 5.5 by decreasing stuck probability from 0.02 to 0.01 for m = 3.

Part C

$p_{success}$	Produced	Scrap
0.985	142.999	2.155
0.995	144.016	0.690

Table 5: Produced and scrap product quantities for 2 success probabilities

From 4, we can observe that the production quantity increases by approximately 1 by increasing success probability from 0.985 to 0.995 for m = 3.

Even though damaged products decreased by around 0.5 in part B whereas scrap products decreased by around 1.5 in part C, the improvement in part B was significantly better than part C, due to the fact that even though damaged/scrap products decreased less in part B, the change in maintenance time was the key to the increase in part B.