In-Class Exercises (Slide 16)

A jewellery store sells a necklace at the price of $1,100. The number of visits to the store per day follows a binomial distribution with a mean of 300 and maximum value of 1,000. Among the arriving customers, one out ten will show interests in this necklace. Customer willingness-to-pay for the product follows a normal distribution with a mean of $1,000 and a standard deviation of $300. What is the average daily sales quantity of this necklace?

This exercise requires your understanding of

(1) Binomial distribution and Normal distribution
(2) How to generate Binomial random numbers
(3) The concept of Monte Carlo simulation

To estimate the average daily sales quantity of this necklace, we need to simulate the daily sales many times and compute the average.

To simulate the daily sales, we need to

(1) Simulate the daily visits X = binom.inv(1000, 0.3, rand())
(2) Simulate the daily interested customers Y = binom.inv(X, 0.1, rand())
(3) Calculate the probability of purchase p = 1 – norm.dist(1100, 1000, 300, 1)
(4) Simulate the daily sales quantity S = binom.inv(Y, p, rand())

Note that norm.dist(1100, 1000, 300, 1) gives the cumulative probability; i.e., Pr(WTP<=1100). A customer would like to buy the necklace if the WTP >= 1100. The interested customers are not exactly 10% of the visits. You should understand it as each visiting customer has a chance of 1/10 showing an interest. Please check the Excel file Jewllery_Store.xlsx for the details of the simulation model.

After-Class Exercises (Slide 36)

Q1. Ken is good at shooting three-pointers. For each shot, the chance of success is 0.92. To simulate the total score after 10 shots, in total 10 random numbers should be generated.

False. Given that the 10 shots are independent and have the same probability of success, we should know that the number of successes follows a binomial distribution with n = 10 and p = 0.92. To simulate the number of successes S, we just need to generate one random number in the following way:

S = Binom.Inv(10, 0.92, rand()).

Q3. We want to simulate the operations of a restaurant. Assume customer dining time per table follows an exponential distribution with a mean of 1 hour. Currently, there are 20 tables of dining customers. Among them, the number of customers still eating after half an hour can be simulated by a binomial distribution.

True. Given that exponential distribution is memoryless, the distribution of residual dining time for each table is identical. Hence, each table has the same probability of finishing in 1 hour or staying after 1 hour. Hence, the number of staying tables follows Binomial distribution with n = 20 and p = exp(-1).

Pinevalley Bank

Please refer to “Pinevalley.xlsx”.