Homework #1

207.251 Management Science
Due: March 29, 2022

1. Go-Qual Coffee (GQC) sells high quality coffee and coffee beans imported from various places over the world. To increase the brand awareness, GQC plans to hold a marketing/promotion event by inviting target customers. The cost of renting a venue is KRW2,000,000, and an additional cost of KRW400 is required for printing each unit of advertisement broacher for all invited guests. In addition, GQC plans to provide a sample coffee gift to its guests which will cost KRW2,000 each. The company expects that roughly 35% of the invited guests will make a purchase, and the average size of an order is expected to be KRW35,000. Currently, GQC's margin rate is 40%; that is, a revenue of KRW10,000 yields a KRW4,000 profit. GQC is trying to determine the number of guests to invite. Assume all invited guests will show up to the event. Develop an excel spreadsheet model to answer the following questions.

a. What is the number of invitees needed to breakeven for this event? Obtain the breakeven point via: (i) enumeration, (ii) goalseek, and (iii) algebra.

b. In reality, it is uncertain what fraction of guests will actually make the purchase. Also, the average order size for each order is uncertain. Hence, GQC wishes to conduct a sensitivity analysis to see how the breakeven point changes under various scenarios. Use "data table" to obtain breakeven points where the purchase rate and the average order size vary between {25%, 30%, 35%, 40%, 45%} and {26000, 29000, 32000, 35000, 38000, 41000}, respectively.

2. The dataset in the "Q2 Detergent" worksheet contains a transaction history describing detergent purchases at a number of stores in a grocery chain over a period of several weeks. Answer the following questions. If possible, try to use various "excel functions" to obtain the answers. Show your work.

a. How many records are in this dataset?
b. How many fields are in this dataset?
c. Is the field "SALE" nominal or numerical?
d. Which field contains blank cells, and how many does it contain?
e. What is the highest price in the dataset?
f. How many records pertain to the description "SUNLIGHT GEL 2.49"?
g. Create a histogram of the "PRICE" variable and interpret it.
h. What is the average price?
i. What is the 88^{th} percentile value of the variable PRICE?
j. Are higher priced products generally more profitable? Examine the correlation between the two.
k. Does profit vary systematically across stores? Examine by showing a boxplot.
l. In week 387, which stores had average profit over $18?

3. Your neighbor is wondering whether the average price of the products from CASCADE is different from the average price of the products from DAWN. Use the data in the "Q3" worksheet and conduct a hypothesis test to give her your advice.

a. What are the null hypothesis and alternative hypothesis?
b. What is the difference in average price?
c. Compute the z-statistic and p-value.
d. What is your conclusion if you use 0.01 as the level of significance? Explain your answer.