Homework III (Group)

Due date: 23:59 on November 27 (Friday), 2020

Please store the answers in a pdf file and upload the **pdf together with the *R* file** onto WM5. Each group submits only ONE copy. Make sure your names and IDs can be found on the pdf. Please show the simulation model on the document too. NO late submission will be accepted.

Q1 (50%) Let's revisit the case of Conley Fisheries. Define D_{Glou}~triangular(min=4000, max=8000, $mode$=7000) and D_{Rock}~triangular (min=4800, max=7200, $mode$=6300) as stochastic demand for cold fish. The prices are random $Price_{Glou}$~Normal(μ=3.5/lb, σ=0.35/lb) and $Price_{Rock}$~Normal(μ=3.65/lb, σ=0.25/lb). Also, corr($Price_{Glou}$, $Price_{Rock}$) is not zero.

In addition, the Conley Fisheries has two boats (each with a full load of 3800 lbs) driven by captain Rick and captain Morty. The daily fraction captured by Risk is a uniform(0.6, 0.9) random variable whereas the daily fraction captured by Morty is a triangular(min=0.5, max=1, mode=0.75) random variable. The day-to-day operating costs for each boat is about $7,200. Being the business analyst of Conley Fisheries, you lay out four possible selling strategies:

a) Rick goes to Glou and Morty goes to Rock;

b) Rick goes to Rock and Morty goes to Glou;

c) Rick and Morty go to Glou;

d) Rick and Morty go to Rock.

To assess which strategy is more profitable/less risky, write a simulation program that allows one to compute expected profit and CVAR(5%) for the four selling strategies above. After that, please finish the following tasks.

(1) (20%) Show a figure where the y-axis is expected profit and x-axis is corr($Price_{Glou}$, $Price_{Rock}$). For each of the following values in the x-axis: -0.8, -0.6, -0.4, -0.2, 0, 0.2, 0.4, 0.6, and 0.8, simulate 10,000 runs respectively. Compute and plot the expected profits of the four strategies and. The figure should show four lines (in different colors and types).

(2) (20%) Show a figure where the y-axis is CVAR(5%) and x-axis is corr($Price_{Glou}$, $Price_{Rock}$). For each of the following values in the x-axis: -0.8, -0.6, -0.4, -0.2, 0, 0.2, 0.4, 0.6, and 0.8, simulate 10,000 runs respectively. Compute and plot CVAR(5%) values of the four strategies. The figure should exhibit four lines (in different colors and types).

(3) (10%) Provide a succinct and logical discussion about findings in the two figures above. Also, explain what kind of selling strategies you would recommend the CEO to adopt.

Q2 (50%) NCCU Griffins (雄鷹) will play an important Bowl game next month, and we have an official license to sell official shirts. The shirts cost $10 each to produce, and we will sell them before the Bowl game at a price of $25. At this price, the anticipated demand before the game should be a Normal(9000, 2000) random variable (RV).

After the Bowl game, this depend on whether NCCU Griffins win or not. If they win, we will continue to sell the shirt for $25, and demand in the month afterwards will be a Normal(6000, 2000) RV. If they lose, we will cut the price to $12.5 and the demand should be a gamma RV with mean 2000 and standard deviation of 1000. The probability of our local heroes winning is 0.4. Unsold shirts will be given away for free.

(1) (20%) What is the production quantity that would maximize our expected profit? Please define a reasonable range of possible quantities for search.

(2) (20%) How would the optimal production quantity change if we instead want to maximize CVAR(q=10%)?

(3) (10%) Assuming we want to maximize expected profit in (a), what would be the expected value of perfect information about whether our local heroes will win the Bowl or not?