Homework 6

Policy

We will grade this assignment as Credit/No-Credit: if you complete the homework to an acceptable level, you will get credit. If not, you will get no credit. Getting credit is required to obtain a grade for the group project that follows.

Problem 1

You have purchased a ticket for the 7th game in a 7-game series between two teams. Team A has a probability p of winning each game. Find the probability that the series will be decided before the 7th game (that is one of the two teams wins 4 of the first six games). Plot the probability for various values of p in the range 0 to 1.

Problem 2

Joe drives a bus with forty seats. On average, 10% of the people who buy tickets in advance do not show up. The ticket price is $10. Joe is smart so he overbooks for any number greater than capacity but no more than 50 seats. However, if one cannot get on the bus with a purchased ticket because the bus is full, $25 is paid as compensation. How many seats shall Joe sell to maximize his expected revenue?

Problem 3

The Re-Engineered Certificate of Deposit (RECD) is a portfolio of stocks with a given maturity. It also has both annual gain and loss cap. I will give a simple example below. For more information, please read the "Reading Material.pdf".

Assume that the annual gain cap is 5% and the loss cap is -30%. When the annual return of the portfolio is -50% (< -30%), the return of RECD is only -30%; when the annual return of the portfolio is -10% (> -30% and < 5%), the return of RECD remains -10%; when the annual return of the portfolio is 10% (> 5%), the return of RECD is 5%.

Suppose the annual return of the portfolio follows a normal distribution with mean = 3% and standard deviation = 5%. Assume the maturity of the RECD is ten years, the annual gain cap is 5%, and the annual loss cap is -30%.

    a) Please use simulation to calculate the average annual return of the RECD over ten years.
    b) If you also can buy the traditional 10-year CD with fixed annual return 1%, which one will you choose?

Problem 4 (Extended Monty Hall Paradox):

Suppose you're on a game show, and you're given the choice of 33 doors: Behind one door is a car; behind the others, goats.

- You pick a door, say No. 1.
- The host, who knows what's behind the other doors, opens 5 doors say No. 2,3,4,5,6. Each has a goat.
- He then says to you, 'Do you want to Switch?' - that is, do you want to pick another door in this case?

Use simulation to calculate the probability of winning when you decide to stick and the probability of winning when you decide to switch.

Problem 5:

It is a tradition to give Lucky Money in Chinese Lunar New Year. Right now, $100 lucky money is shared within 10 people in the following way. The first person will get $U1 \times 100$, where U1 is a [0,1] uniform distribution. The second person will get U2 of the remaining money, where U2 is also a [0,1] uniform distribution. So on and so forth. The last person will get all the remaining. Use simulation to calculate the probabilities that the ith person gets the largest amount where $i = 1, \ldots, 10$

Deliverables

Name your homework as homework6.pdf and submit it online.