Homework I (Group)
Due date: 23:59 on October 16 (Friday), 2020

Q1(20%). Exercise 1.4 in Bertsimas and Freund (2004) Chapter 1

Q2(20%). Exercise 1.5 in Bertsimas and Freund (2004) Chapter 1

Q3(15%) Three dices are to be rolled. Suppose two of the three are fair dies, but one die is unfair with probability of 0.25 to be 2 and equal probabilities for (1, 3, 4, 5, 6). Please write a simulation program (use sample( )) that calculates the expected value of the smallest number of rolling the three dies (三顆骰子中最小的值).

Q4(30%). You are a manager of SAP, and you just hire a salesperson from Oracle. Suppose the salesperson has to visit 20 potential clients this month. Before he/she makes these visits, you think high skill or low skill is equally likely. If there is high skill, then the probability of making a sale is 2/3 in each of the 20 visits. If there is low skill, then the probability of making a sale is 1/3 in each of the 20 visits. Use the *sample*( ) and whatever functions needed in *R* to write a simulation program for the case described above. Simulate the scenario for 1,000 runs and answer the following questions based on simulation results.

(a) Suppose you have a policy of promoting the salesperson if there are at least 9 sales in these 20 visits. What is the probability this salesperson will be promoted this month?
(b) What is the conditional probability that this person will be promoted if there is high skill?
(c) What is the conditional probability that there is high skill given that the salesperson is promoted under this policy?
(d) Make a table showing how the three probabilities in (a), (b), and (c) would change, if the policy instead promotes the salesperson when there are at least *n* sales in the 20 visits for *n* in 1, 2, 3,…, 19, 20.

Q5(15%) Suppose you go to the college of commerce library (商圖) on Monday evening and would like to borrow a book. You are told that the book has been checked out the previous Thursday. Assume no one else is waiting for the book. The library staff tells you that borrowers return books after 4, 5, 6, or 7 days, with probabilities of 0.1, 0.2, 0.3, 0.4. Note that the library is open 7 days a week.
As before, 50% of students return their books to a "foreign" library (社圖/總圖), resulting in an extra 2-day delay before the book arrives back to the home library. You decide to check the status of the book every evening. What is the probability you will need to wait until Wednesday evening to get the book?
Write a Monte-Carlo simulation program to compute the probability (Hint: the probability should be close to 4/19).

Please store the answers in a pdf file and upload the file onto WM5. Each group submits only ONE copy. Make sure names and IDs of students within each group can be found on the file. For Q3, Q4 & Q5, please show the written simulation program on the document too. NO late submission will be accepted.

P.S.: While this is a group assignment, everyone in the group must have a solid grasp of what is going on. Free riders would be in trouble in the midterm exam.