BAN 602   Quantitative Fundamentals   Fall 2019
Homework Assignment 2

1. Hamilton County judges try thousands of cases per year. In an overwhelming majority of the cases disposed, the verdict stands as rendered. However, some cases are appealed, and of those appealed, some of the cases are reversed. Kristen DelGuzzi of The Cincinnati Enquirer con-ducted a study of cases handled by Hamilton County judges over a three-year period. Shown in dataset Judge.csv are the results for 182,908 cases handled (disposed) by 38 judges in Common Pleas Court, Domestic Relations Court, and Municipal Court. Two of the judges (Dinkelacker and Hogan) did not serve in the same court for the entire three-year period. The purpose of the newspaper's study was to evaluate the performance of the judges. Appeals are often the result of mistakes made by judges, and the newspaper wanted to know which judges were doing a good job and which were making too many mistakes. You are called in to assist in the data analysis. Use your knowledge of probability and condi-tional probability to help with the ranking of the judges. You also may be able to analyze the likelihood of appeal and reversal for cases handled by different courts.
   Managerial Report: Prepare a report with your rankings of the judges. Also, include an analysis of the likelihood of appeal and case reversal in the three courts. At a minimum, your report should include the following: 1. The probability of cases being appealed and reversed in the three different courts. 2. The probability of a case being appealed for each judge. 3. The probability of a case being reversed for each judge. 4. The probability of reversal given an appeal for each judge. 5. Rank the judges within each court. State the criteria you used and provide a rationale for your choice.

2. A local bank reviewed its credit card policy with the intention of recalling some of its credit cards. In the past approximately 5% of cardholders defaulted, leaving the bank unable to collect the outstanding balance. Hence, management established a prior probability of .05 that any particular cardholder will default. The bank also found that the probability of missing a monthly payment is .20 for customers who do not default. Of course, the probability of missing a monthly payment for those who default is 1.
   a. Given that a customer missed one or more monthly payments, compute the posterior probability that the customer will default.
   b. The bank would like to recall its card if the probability that a customer will default is greater than .20. Should the bank recall its card if the customer misses a monthly payment? Why or why not?

3. Great Grasslands Grains, Inc. (GGG) manufactures and sells a wide variety of breakfast cereals. GGG's product development lab recently created a new cereal that consists of rice flakes and banana-flavored marshmallows. The company's marketing research department has tested the new cereal extensively and has found that consumers are enthusiastic about the cereal when 16-ounce boxes contain at least 1.6 ounces and no more than 2.4 ounces of the banana-flavored

marshmallows. As GGG prepares to begin producing and selling 16-ounce boxes of the new cereal, which it has named Go Bananas!, management is concerned about the amount of banana-flavored marshmallows. It wants to be careful not to include less than 1.6 ounces or more than 2.4 ounces of banana-flavored marshmallows in each 16-ounce box of Go Bananas! Tina Finkel, VP of Production for GGG, has suggested that the company measure the weight of banana-flavored marshmallows in a random sample of 25 boxes of Go Bananas! on a weekly basis. Each week, GGG can count the number of boxes out of the 25 boxes in the sample that contain less than 1.6 ounces or more than 2.4 ounces of banana-flavored marshmallows; if the number of boxes that fail to meet the standard weight of banana-flavored marshmallows is too high, production will be shut down and inspected.

Ms. Finkel and her staff have designed the production process so that only 8% of all 16-ounce boxes of Go Bananas! fail to meet the standard weight of banana-flavored marsh- mallows. After much debate, GGG management has decided to shut down production of Go Bananas! if at least five boxes in a weekly sample fail to meet the standard weight of banana-flavored marshmallows.

    a. Calculate the probability that a weekly sample will result in a shutdown of production if the production process is working properly. Comment on GGG management's policy for deciding when to shut down production of Go Bananas!.

    b. GGG management wants to shut down production of Go Bananas! no more than 1% of the time when the production process is working properly. Suggest the appropriate number of boxes in the weekly sample that must fail to meet the standard weight of banana-flavored marshmallows in order for production to be shut down if this goal is to be achieved.

    c. Ms. Finkel has suggested that if given sufficient resources, she could redesign the production process to reduce the percentage of 16-ounce boxes of Go Bananas! that fail to meet the standard weight of banana-flavored marshmallows when the process is working properly. To what level must Ms. Finkel reduce the percentage of 16-ounce boxes of Go Bananas! that fail to meet the standard weight of banana-flavored marshmallows when the process is working properly in order for her to reduce the probability at least five of the sampled boxes fail to meet the standard to .01 or less?

4. Television viewing reached a new high when the Nielsen Company reported a mean daily viewing time of 8.35 hours per household. Use a normal probability distribution with a standard deviation of 2.5 hours to answer the following questions about daily television viewing per household.

    a. What is the probability that a household views television more than 3 hours a day?

    b. What is the probability that a household spends 5 – 10 hours watching television more a day?

    c. How many hours of television viewing must a household have in order to be in the top 3% of all television viewing households?

Please also submit the R file (just one R file) in which you performed the analysis along with your answers in pdf. Good luck!