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|  | **BOSTON**  **UNIVERSITY** | **METROPOLITAN COLLEGE**  **DEPARTMENT OF ADMINISTRATIVE SCIENCES** |

**AD 616: Enterprise Risk Analytics**

**Assignment 3**

**What to submit?**

Please submit (i) a word file explaining in detail your answers to each question (you can use screenshots of the R to explain your answers) AND (ii) an R file with a separate tab for each question. For each question, make sure you develop the model and present the simulation results – the R file should be self-explanatory. **The assessment of your work will include both the accuracy and the clarity of your word file and the R file. But even if you are struggling with R, we will grade favorably if you demonstrate your understanding of the concepts and how you are planning to solve the problem.**

1. A call center is examining its data regarding the complaints of its callers. Two complaint areas are identified: customers who complain due to the wait time to talk to an agent, and customers who complain due to inexperienced agents. Each data set consists of number of complaints per week. The Excel file Assignment3\_Problem1\_Data includes the complaint data for the last year for these two categories.
2. What is the distribution of weekly complaints in each category? Identify the name of the distribution and its mean and standard deviation. Fit a continuous distribution to the data and use the K-S test as goodness-of-fit criteria.
3. Are the two categories of weekly complaints correlated to each other? If yes, describe their correlation.

Set up a simulation that calculates the total complaints by week. In your simulation, there will be two input variables – one for weekly complaints due to the wait time to talk to an agent and one for the weekly complaints due to inexperienced agents. Use the fitted distributions that you identified in (a). If there is a correlation between the complaint types, include it in your model. Using your simulation model, answer the following questions.

1. What is the mean and standard deviation of the total complaints by week?
2. What is the 95% confidence interval for the mean complaints by week? Interpret this interval.
3. What is the probability that the total complaints in a week will be less than 600?
4. What is the probability that the total complaints in a week will be bigger than 2600?

Now, re-run the simulation by ignoring the correlation among the complaint types and re-answer

questions (c)- (f) above. How would your answers to those questions change? What is the impact of

ignoring correlation in this setting?

1. The data set Assignment3\_Problem2\_Data contains two different currency exchange rates in terms of the US dollar: Mexican peso (MXN) and Japanese Yen (JPY). Both data are daily closing rates and are transformed to daily logarithmic returns.
   1. What is the distribution of the MXN? Fit a continuous distribution to the data and use the K-S test as goodness-of-fit criteria.
   2. What is the distribution of the JPY? Fit a continuous distribution to the data and use the K-S test as goodness-of-fit criteria.

In finance, it is common to model the exchange rate data with a Normal distribution. Do your findings support this practice? What characteristics do you observe in the two data sets?

1. Consider a motor vehicle department that operates as follows. Each customer sees a clerk (receptionist) to check their documents for accuracy. The service time per customer (in minutes) can take any value between 2 to 5 minutes. Then, each customer require service on (a) getting or renewing a driver’s license or registering an automobile, or leave. 30% of customers get or renew a driver’s license, 50% of the customers register an automobile and the remaining 20% of customers leave the service. The service time for getting or renewing a driver’s license is gamma distributed with shape parameter 3 and scale parameter 10. Registering a car is a new service offered to customers in this department so the management lacks data to find the best distribution to represent the characteristics of this service. However, the experts believe that the service time is usually between 10 to 35 minutes with 20% chance of being less than 15 minutes, 60% chance of being less than 25 minutes and 95% chance of being less than 30 minutes. Labor costs are $20 per hour for the receptionist, $30 for the clerk who serve people getting or renewing their driver’s license, $40 for the clerk who helps customer to register an automobile. Develop a simulation model for this system and answer the following questions:
   1. What is the mean and standard deviation of the service time per customer (do not include waiting time)?
   2. What is the probability that the service time per customer will be less than 8 minutes? What is the probability that the service time per customer will exceed 20 minutes?
   3. What is the mean and standard deviation of the labor cost per customer to deliver this service?