American University
The Department of Computer Science
Spring 2021

Introduction to Simulation and Modeling, CSC 432/632

Project 2

Description of the project:

This is a unified project and all groups require to work together and answer the questions at the end of each question. Some of the questions require exploring in different sources and conversation among team members. After collecting all the answers and explanations, you need to collect a unified summary and provide a report about your observations about the companies and organizations using operations management techniques and strategies. Only one copy by the group representative is required due to submission. Submit one WORD copy for answering the questions and one .py file containing all Python codes. No page limit or format is imposed. Try your best to submit a professional and comprehensive report.

Problem 1:

In August 2020, a car dealer is trying to determine how many 2021 cars should be ordered. Each car ordered in August 2020 costs $10,000. The demand for the dealer's 2021 cars has the probability distribution shown below.

Number of Cars Demanded	Probability
20	0.30
25	0.15
30	0.15
35	0.20
40	0.20

The dealer can order any integer number of cars. Each car sells for $15,000. If the demand for 2021 cars exceeds the number of cars ordered in August, the dealer must re-order at a cost of $12,000 per car. Excess cars may be sold to other dealers for $9000 per car. (Do the following steps by hand or using MS Excel, and run the simulation using Python and include the .py file in the submission folder.)

a) Develop a simulation model for this problem. You can use MS Excel to depict the model.
b) Using the trial-and-error method, determine how many cars should be ordered in August.
c) For your optimal order quantity in part b, provide a 95% confidence interval for the expected profit.
d) The dealer would like to know if the expected profit exceeds $120,000. Conduct a statistical analysis to answer the question with 97% confidence coefficient. Clearly determine the null and alternative hypothesis.
e) Repeat this analysis if the demand for cars is assumed to be normally distributed with a mean of 30 and a standard deviation of 7. (Round the demand to an integer.)

Problem 2:

Six months before its annual convention, The Computer Science Conference (CSC) must determine how many rooms to reserve. CSC believes the number of people attending the convention will be normally distributed with a mean of 5000 and a standard deviation of 1000. (Clearly, this demand must be rounded to an integer since only whole people attend the conference.) At this time, CSC can reserve rooms at a cost of $50 per room. CSC can reserve up to 8000 rooms, but it must reserve rooms in blocks of 100. CSC must pay the $50 room cost even if the room is not occupied. If the number of people attending the convention exceeds the number of rooms reserved, extra rooms must be reserved at a cost of $80 per room. (Do the following steps by hand or using MS Excel, and run the simulation using Python and include the .py file in the submission folder.)

a) Develop a simulation model for this problem. You can use MS Excel to depict the model.
b) Using the trial-and-error method, determine the number of rooms that should be reserved to minimize the expected cost.
c) For your optimal order quantity in part b, provide a 95% confidence interval for the expected cost.
d) CSC would like to know if the expected cost exceeds $300,000. Conduct a statistical analysis to answer the question with 93% confidence coefficient. Clearly determine the null and alternative hypothesis.

Problem 3:

A ticket from Indianapolis to Orlando on Deleast Airlines sells for $150. The plane can hold 100 people. It costs $8000 to fly an empty plane. The airline incurs variable costs of $30 (food and fuel) for each person on the plane. If the flight is overbooked, anyone who cannot get a seat receives $300 in compensation. Not everyone who has a reservation shows up for the flight. The number of people with reservations who actually show up for the flight is binomial with p = 0.95. (Do the following steps by hand or using MS Excel, and run the simulation using Python and include the .py file in the submission folder.)

a) To maximize expected profit, how many reservations for the flight should be taken by Deleast?
b) What is the associated expected profit for this number of reservations?
c) Provide a Hypothesis test with alpha=0.95 for the associated expected profit (from part a).
e) Deleast Airlines would like to know if the expected profit is bellow $5000. Conduct a statistical analysis to answer the question with 97% confidence coefficient. Clearly determine the null and alternative hypothesis.