Northeastern University
College *of* Professional Studies

Emergency Facilities Readiness Project

Overview and Rationale

This project is designed to provide you with hands-on experiences in performing simulation techniques – a method that students learn to use for decision-making purposes. You are asked to use simulation to evaluate the readiness and competency of a local emergency facilities.

Course Outcomes

This assignment is directly linked to the following key learning outcomes from the course syllabus:

CO1: Use descriptive, Heuristic and prescriptive analysis to drive business strategies and actions

CO3: Analyze the role of analytics in supporting decision making for various other stakeholder groups within and outside of your organization

Assignment Summary

University administers at a local University have recently launched several planning projects to determine how effectively local emergency facilities such as local hospitals can handle natural disasters (weather, fire,…). One of these projects focused on the transport of disaster victims from the campus to the five major hospitals in the area 1:

(i) Beth Israel Deaconess Medical Center

(ii) Tufts Medical Center

(iii) Massachusetts General Hospital

(iv) Boston Medical Center

(v) Brigham and Women's Hospital

The project team would like to determine how many victims each hospital might expect in a disaster, and how long it would take to transport victims to the hospitals. However, because of lack of historical data on disasters in the area, the project team have decided to

assume that the total number of victims is best approximated by a triangular probability distribution with a minimum and a maximum of respectively 20 and 300 victims, and with a peak of 80 victims.

The emergency facilities and capabilities at the five hospitals vary. The following table describes how victims will be distributed to the hospitals in the event of a disaster situation:

Hospital	Allocation of Disaster Victims
Beth Israel Medical	20%
Tufts Medical	15%
Massachusetts General	30%
Boston Medical	25%
Brigham and Women's	10%

The proximity of the hospitals to the university campus also varies. It is estimated that the transport times to each of the hospitals is exponentially distributed with a certain average that depends on that hospital. The following table indicates the average of the transport time for each hospital.

Hospital	Average in Minutes
Beth Israel Medical	15
Tufts Medical	10
Massachusetts General	7
Boston Medical	15
Brigham and Women's	20

For simplicity, we may assume that each hospital has two emergency vehicles, so that one leaves the university campus when the other one leaves the hospital. This means that one emergency vehicle arrives at the campus when the other arrives at the hospital. Therefore,

the total transport time for each hospital will be the sum of transporting each victim to that hospital.

Project Instructions:

1. Perform a simulation analysis consisting of 5,000 simulations to determine:

    a. Average number of victims that can be expected at each hospital.

    b. For each hospital, the average total time (in hours) needed to transport all victims.

    c. For part (a) above, create a chart the displays the Law of Large Numbers in action for the Beth Israel Medical. (Law of large numbers: As the number of trials becomes larger, the observed averages approach to the theoretical average.)

    d. For the Beth Israel Medical hospital, perform an exploratory data analysis of the total transport time by:

        i. Calculating a 95% confidence interval for the total transport time,

        ii. Determining a probability distribution that best fits the total transport time (in hours).

        iii. Supporting your assertion in part (ii) by creating a frequency distribution and performing a Chi-squared Goodness of fit test.

    e. Let t denote the average transport time (in minutes) per victim for the entire process of transporting all victims. Perform an exploratory data analysis of t.

2. Perform a simulation analysis consisting of 5,000 simulations in another worksheet of your workbook; however, assume that the total number of victims is normally distributed with a mean of 150 victims and a standard deviation of 50 victims. Furthermore, suppose that the transport time for each hospital is normally distributed with a mean and a standard deviation that differ for each hospital. The table below displays these quantities:

Hospital	Average in Minutes	SD in Minutes
Beth Israel Medical	15	3
Tufts Medical	10	4
Massachusetts General	7	2

| Boston Medical | 15 | 5 |
| Brigham and Women's | 20 | 3 |

Analyze the results of this simulation by repeating parts (a) – (e) of part 1 using the above values.

3. In the word document, explain your methodologies and conclusions.

4. In the word document, provide your opinion regarding a few major quantitative and qualitative differences between the outputs of simulations (1) and (2) above.

5. In the word document, explain how the information obtained from your simulation can be used for planning purposes.

6. In the word document, explain in your opinion, how each simulation can be changed to provide additional useful information.

Format & Guidelines

Complete Parts 1, and 2 of the Project Instructions above. Each part must be in a different file.

Complete Parts 3, 4, 5 and 6 as part in your report. The report should follow the following format:

   (i)   Introduction

   (ii) Analysis

   (iii) Conclusion

And be a minimum of 1000 words and be presented in the APA format.

Reference:

1. University Health and Counselling Services. Northeastern University. Emergencies. Retrieved from: https://www.northeastern.edu/uhcs/medical-services/emergencies/

2. Taylor III, B.W. (2011) Introduction to Management Sciences. Prentice Hall. Upper Saddle River, NJ

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Rubric

Category	Exceeds Standards	Meets Standards	Approaching Standards	Below Standards
R: Problem Modeling & Set-up ALY6050-CO1	Completely and concisely modeled the problem in Excel (or R) for each method	Accurately modeled the problem in Excel (or R) for each method	Correctly modeled the problem in Excel (or R) for each method, but the model lacks detailed insight into the problem or the set-up is awkward.	Modeled the problem in Excel (or R) for each method, but there are some gaps in the problem modeling and setup
R: Problem Solution & Accuracy ALY6050-CO1	Efficiently obtained correct and accurate solutions in Excel (or R) by using the appropriate analytic tools of the software	Obtained complete and accurate solutions in Excel (or R) by using the appropriate analytic tools of the software	Obtained correct solutions in Excel (or R) using the appropriate analytic tools of the software, but the application of the tool is awkward.	Obtained a solutions in Excel (or R) by using the appropriate analytic tools of the software, but the solution is not complete.
Word/Report: Problem Description & Introduction ALY6050-CO3	Provides a thorough and concise summary of the problem descriptions and introduced the problem using rich and significant ideas	Provides an accurate and succinct summary of the problem descriptions and problem introduction	Provides an accurate summary of the problem descriptions and problem introduction, but the description is too wordy or not succinct	Provided a summary of the problem descriptions and problem introduction, but it is inaccurate or incomplete
Word/Report: Description of Problem Analysis ALY6050-CO3	Provides a thorough and precise description of the analytic concepts and theories used in analyzing the problem	Accurately describes the analytic concepts and theories used in analyzing the problem	Describes the analytic concepts and theories used in analyzing the problem, but description lacks appropriate detail or precision	Describes the analytical concepts and theories used in analyzing the problem, but descriptions are incorrect or the analytical concepts and theories are incorrect
Word/Report: Description of Conclusions ALY6050-CO3	Provides conclusions and results obtained in the project using a high level of critical thinking and reasoning	Provides relevant conclusions and results obtained in the project that reflect critical thinking and reasoning	Provides conclusions and results obtained in the project, but not all conclusions or results are relevant to the problem or not all conclusions reflect good reasoning	Provides conclusions and results obtained in the project, but they are irrelevant and reflect a lack of critical thinking

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Category	Exceeds Standards	Meets Standards	Approaching Standards	Below Standards
Word/Report: Writing Mechanics, Title Page, & References	Completely free of errors in grammar, spelling, and punctuation; and completely correct usage of title page, citations, and references. The report contains a minimum of 1000 words	There are no noticeable errors in grammar, spelling, and punctuation; and completely correct usage of title page, citations, and references. The report contains a minimum of 1000 words	There are very few errors in grammar, spelling, and punctuation; and completely correct usage of title page, citations, and references. The report contains a minimum of 1000 words	There are more than five errors in grammar, spelling, and punctuation; or the usage of title page, citations, and references are incomplete; or the report contains less than 1000 words