**Week 3: Lab (Application of Queuing Theory)**

**Scenario/Summary:**

In the realm of business, organizations in most cases will look for ways to improve the customer experience when services and products provided; however, sometimes we have to wait for such services for longer periods of time we do not desire. Although not perfect, organizations will use techniques based on queuing theories to measure wait times in which customers have to wait in order to be helped or serviced, and based on the measurements, management and leadership attempt to make decisions to improve or reduce these waiting times. In this lab, you will have the opportunity to learn about common queuing models and their results to make decisions. To get started, complete all steps below.

1. Using a minimum of three academic sources of research, prepare a minimum of three pages covering theory behind queuing models behind Kendall notation, including
   1. M/M/s;
   2. M/M/s with finite queue length;
   3. M/M/s with finite arrival population; and
   4. M/G/1.
2. In the conclusion of this paper, you will reference and apply understanding gathering feedback on various cases beginning with Step 3 using models covered in initial research and the Q.xlsx data file. All data files associated with the book can be accessed through the website below.

Cengage Brain, (2016). Book data files: Spreadsheet Modeling and Decision Analysis: A Practical Introduction to Business Analytics. (7th ed.). Files are located under Course Home 🡪 Course Resources.

1. Using the M/M/s model, consider a service station specializing in oil changes that has an average of three vehicles arriving per hour to receive basic oil changes. Each oil change takes exactly 15 minutes to complete from start to finish. The service station has two oil service technicians.

For this case, what is the probability a customer would have to wait, and based on this probability, what ideas would you suggest to lessen this probability if you were the owner of this service station?

1. Using the M/M/s model with finite queue length, use the same case from Step 3 and assume that a maximum of three vehicles can wait in queue due to space available allowing vehicles to be parked in line to the service area.

For this case, based on the probability of the model that a customer balks and the probability a customer may have to wait for services, would you as the owner look for ways to expand the waiting area assuming options are present to do so? Why, or why not?

1. Using the M/G/1 model, use the same case from Step 3 and assume that we are in a non-perfect world, and each oil change takes an average service time of 15 minutes (0.25 hours) to complete from start to finish but with an 8-minute standard deviation (0.133 Hours).

For this case, the standard deviation indicates some potential issues with efficiency, and as the owner of the service station, would it be worth an investment to purchase new maintenance technology to support oil changes in efforts to reduce the standard deviation and improve efficiency.

1. Using the M/M/s model with finite population, a major rental company supplies forklifts to contractors servicing major industries in the local area. Although contractors rent these forklifts, each forklift breaks down at a rate of 0.03 per hour, which is also the rate in which forklifts arrive back at the rental company for repair. The three repair technicians for the rental company are able to service broke down forklifts at a rate of 1/12 or 0.083 forklifts per hour. At present, the rental company has a total population of 20 forklifts.

For this case, there is an increasing demand for forklift rentals, and based on the results of the model in this case and based on a population of 20 forklifts, could the rental company handle an increase of population to 30 forklifts. If not, what changes would you make assuming that increasing to 30 forklifts is needed to meet the industry demands for contractors in the local area needing to rent these forklifts.

1. In the conclusion of the paper, integrate all of your suggestions for the cases above from Steps 3 through 6 correlating back to your research based learning on queuing.
2. Save both your assignment files in Microsoft Word and Excel, and name the files Week\_3\_Lab following by your first and last name initials. For example, the file name for John Doe would be Week\_3\_Lab\_JD.
3. Submit both the Microsoft Word and Microsoft Excel assignment files to the Week 3 Lab Dropbox.

**Week 3: Lab (Grading Rubric)**

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| **Category** | **Description** | **Points Earned** |
| Topic Selection | The topic clearly identifies various queuing techniques as instructed. | 5/5 |
| Bibliography | The bibliography includes at least three references. References are authoritative and do not include anonymous authors. Web pages, if used, are clearly written by experts in the field (expert qualifications are given in the summaries). At least three references are peer-reviewed, scholarly papers. The bibliography is in APA format and is free of typographical, grammar, spelling, and formatting errors. | 5/5 |
| Paper: Formatting | The paper is in 12-point Times New Roman font, double-spaced, and includes a cover page, table of contents, introduction, body of the report, summary or conclusion, and references. The Final Paper conforms to APA format. | 5/5 |
| Paper: Organization and Cohesiveness | The paper includes an introduction that generates interest in the topic and previews the main points to be covered, a body that develops each main point, and a conclusion that summarizes the main points covered. There is a logical flow of ideas throughout the paper. There is a clear thesis statement for the paper and a clear topic statement for each major section. Appropriate transitions are used between topics and subtopics. | 5/5 |
| Paper: Editing | The paper uses a professional writing style and is free of typographical, spelling, and grammar errors. | 5/5 |
| Paper: Content | The paper is of the required length and fully addresses topics provided. Topic areas should include M/M/s, M/M/s with finite queue length, M/M/s with finite arrival population, and M/G/1. Examples and supporting details are provided for each main point. Authoritative sources are cited as support. The paper is at least 80% in the student’s own words (i.e., no more than 20% direct quotations from a source). | 35/35 |
| Excel: Technology | Proper use of the Q data file is observed demonstrated application and uses of M/M/s, M/M/s with finite queue length, M/M/s with finite arrival population, and M/G/1. | 30/30 |
| **Total** | **A quality paper will meet or exceed all of the above requirements.** | **90/90** |
| **Comments** |  | |