Name(s)

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Project Number

J0319

Project Title

Coffee, Plane, and Juice Queues: Can Little's Law Reduce the Wait?

Abstract

Objectives/Goals

The purpose of my study was to test Little's Law and the science of queuing theory. If queuing theory can be used to predict the real life behavior of people standing in line, it could then be used to analyze queue efficiency and minimize queue sizes (depth).

Background: Little's Law states that the average number of people in a queue will be equal to the average arrival rate multiplied by the average time spent in the system. The only necessary assumption is that the queue is at steady state. If proven valid, this law gives business owners a tool to use for reducing their long queues.

Methods/Materials

Identified five suitable queues to observe: three different coffee shops, one airport ticket counter and one juice shop queue. Recorded three core inputs every minute (the total amount of people in the system, average arrival rate and the average server time) for each queue over a period of several hours. Computed the summary statistics and used Marcovian queueing theory to calculate a result to be compared with that predicted by Little's Law. I then used related queuing formulas to analyze the relative impact to each queue of making various adjustments.

Results

1)Little's Law was found to be valid for five different queue systems over
five different days.
2)Little's Law was more accurate for predicting behavior in longer lines than in shorter ones.
3)Reducing the server time was more effective at minimizing the wait time than increasing the number of servers.

Conclusions/Discussion

Little's Law can predict the behavior of real life business situations. After overcoming numerous challenges to accurately measure queue characteristics, the predicted number (Little's Law) agreed closely with the observed number. Given this result, queueing theory was then used to analyze alternatives for shortening the waiting time. This experiment shows that simple spreadsheet queue models may help business owners explore options for improving queue performance.

Summary Statement

My project demonstrates that Little's Law and related queueing theory is scientifically correct and can help optimize real life queue performance.

Help Received

Dad helped with stopwatch while taking data. Also, helped me make sense of the queueing theory equations.