McWallyBurger® Simulation Consulting Proposal

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Introduction

There are a number of ways we can reduce the waiting times of customers. One of them is to open a new line for customers, so this may reduce the length of the drive-thru line. There are a number of ways this can be implemented; many restaurants currently have a drive-thru and a indoor option, so we will model our new line to be inside.

The primary benefit of adding this inside line is that it will reduce waiting time by allowing shorter lines for the same number of arrivals. Under the current set-up, if four customers arrive, they all have to line up in the same line, the drive-thru. The fourth person would have to wait for three people to be served before finally getting their service. With an inside line, these customers can theoretically split themselves up, lowering overall customer wait time. The additional line may also reduce the number of customers lost, since having a second line will reduce how often the drive-thru line reaches its limit.

Model Approach

The model will be implemented so that the inside line is independent from the drive-thru line, and customers will have a preference for which line they want when they arrive. If the drive-thru line is full, those who prefer the drive-thru may opt to go inside.

Our assumptions are as follows:

- Assume there will be no limit to the size of the inside line, but the limit of the drive-thru line remains the same.
- Assume the service time of inside line will have an expected value of 70 seconds, and be modeled by a probability density function of the form ate^{-bt}, where t is the time and a and b are constants. For this instance, we used $a = \frac{e}{e-2}$ and $b = 1$, then scaled by $\frac{e-2}{2e-5}$.
- Assume an arriving customer will prefer the inside line 50% of the time and the drive-thru the other 50%.
- Assume if the drive-thru is full when a customer preferring the drive-thru gets there, there is a 30% chance they will go inside, otherwise they'll leave without being served. (Angry Customer)

The simulation was changed to account for these changes. The G function is used for the service time of customers inside. The table displayed from the simulation now gives lengths of both the inside and outside lines, as well as departure times for both lines.

Results

The data given in this section are results from the simulation code, specifically from the "Averages and Distributions" section.

Average Waiting Time

This histogram was generated from 1000 days of average customer wait times for the day. The x-axis represents time in minutes in a .1 minute range, and the y-axis is number of days. Based on this data, we are 95% confident that the average wait time for any customer is approximately **2.00659** $\pm$ 0.0174862 minutes.

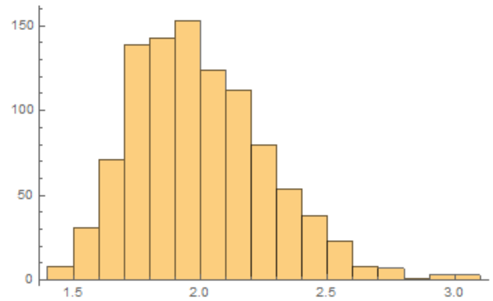

Figure 1: Distribution of average waiting times of a day (in minutes)

Average Customers Served

This histogram was generated from 1000 days of customers served in a day. The x-axis represents people served in intervals of 5 people, and the y-axis is number of days. Based on this data, we are 95% confident that the average number of customers served in a day is approximately **123.618** $\pm$ 0.689479 people.

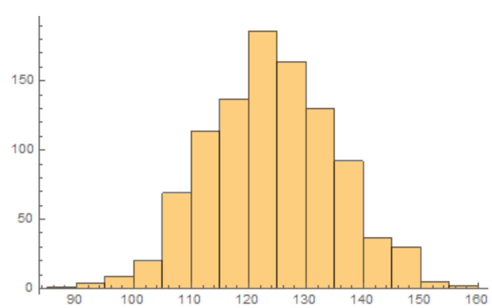

Figure 2: Distribution of average number of customers served in a day

Average Customers Lost

This histogram was generated from 1000 days of customers lost in a day. The x-axis represents people lost in intervals of 1 person, and the y-axis is number of days. Based on this data, we are 95% confident that the average number of customers lost in a day is approximately **0.535** $\pm$ 0.0640486 people.

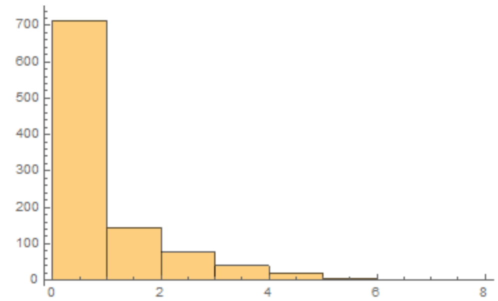

Figure 3: Distribution of average number of customers lost in a day

Average Overtime

This histogram was generated from 1000 days of overtime required to serve the remaining customers. The x-axis represents time in minutes in a .05 minute range, and the y-axis is number of days. Based on this data, we are 95% confident that the average number of customers served in a day is approximately **0.195544** $\pm$ 0.0307446 people.

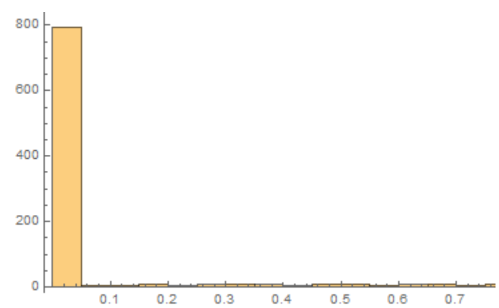

Figure 4: Distribution of overtime (in minutes)

Comparison

This section compares any significant differences between the results from the existing set-up and the results from the proposed set-up. This includes the average waiting time and the customers served and lost.

Average Waiting Time

In the original model, the restaurant had only one line: the drive-thru. With an average of a minute and a half service-time, the waiting time for customers who arrived during rush-hour increased significantly. The average waiting time for any customer in a day was approximately 3.47506 minutes. According to the proposed model, opening an inside line with an average service time of 70 seconds reduces this average by approximately **1.46847** minutes. In other words, customers are waiting in line on average about a minute and a half less.

Customers Served and Lost

In the original model, the drive-thru line was limited to five people. Anyone who arrived while the line was too long, particularly during rush-hour, could not be served. The average number of customers lost in a day was 17.921 people. In fact, given the average served was 105.815, this was about 14.4833% of the total demand lost to a long line. The proposed model adds a second line that has no limit. While some customers may not prefer the inside line, under our assumptions the inside line has an impact on the customers lost. The average number of customers lost is reduced by approximately **17.386** people, given our assumptions. This means the restaurant loses almost no demand to a long drive-thru line.

Conclusion

Comparing the results from the current set-up and our proposed model, we highly recommend to open an inside line at *McWallyBurger*®. Between the reduced waiting time per customer and the increase of served customers, as well as the decrease in lost customers, opening a line inside would greatly benefit the business.