Project 3: Data Science

Grocery Store Simulation

# Analysis of Simulated Data

## Method

Using the provided arrival.txt file, generate statistics to recommend a mix of regular, express, and closed lanes. Assume the goal is to decrease the time customers spend waiting in line. There are a maximum of twelve lanes, each designated as either ‘regular’, ‘express’, or ‘closed’. Having more lanes open costs more money to operate. Calculate how much longer each customer would have to wait if one or more lanes were closed.

## Results

The following results used the provided arrival.txt file with the Project3 simulation program. The arrival.txt file provided 3000 customers, with an average of 23.88 items each.

It was found that the optimal lane setup was to have 9 regular lanes and 3 express lanes (12 total), which resulted in an average wait time of 12.77 minutes for each customer. On average, each customer had 5.07 other customers in line ahead of them and took on average 2.92 minutes to checkout. Changing to 10 regular and 2 express lanes resulted in an average wait duration of 17.53 minutes, while 8 regular lanes and 4 express lanes increased this to an average wait duration of 33.66 minutes.

Reducing the lane count to 3 express lanes and 8 regular lanes (11 total) resulted an average wait duration of 36.14 minutes. 2 express lanes and 9 regular lanes resulted in an average wait duration of 44.18 minutes, while 4 express lanes and 7 regular lanes increased even further to 65.48 minutes.

## Recommendations

Given that there are at most 12 lanes, it was found that to minimize customer wait duration, a combination of 9 regular lanes and 3 express lanes reduced average customer wait duration to ‘only’ 12.77 minutes. This is far from ideal, however, given that the maximum wait duration was a staggering 37.69 minutes.

If one lane were to be closed, giving 8 regular lanes and 3 express lanes, the average wait time rises to 36.14 minutes. By reducing the costs of maintaining a checkout lane, customers are burdened with an additional 23.37 minutes of average wait time, with a maximum wait duration to 119.30 minutes.

If it were possible to add an additional checkout lane, resulting in 10 regular lanes and 3 express lanes, the average customer wait time would reduce to only 2.18 minutes, with a max wait duration of 12.23 minutes at most.