**Does Increasing the Number of Bikes Per Day Lead to More Total Rides Per Day?**

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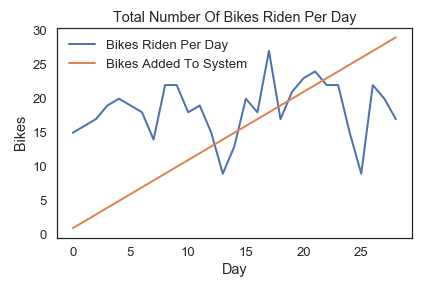
1. Objective

New York is one of the most densely populated states in the United States. As of 2020, there are over 19.5 million inhabitants. New York City alone holds 8.5 of the 19.5 million people in New York. When a large population of people occupies one area, traffic becomes one of the many problems. In New York, for every thirty minutes of commute, a person spends an extra sixteen minutes of commuting in the morning and an additional twenty-one minutes at night.  Over the course of one year, an average person spends approximately one-hundred and forty-two hours waiting in traffic. Preventing traffic is improbable, which is why other modes of transportation may be favorable. Walking is the customary way of getting from one destination to another, but this method takes too much time. Cities are beginning to normalize bike lanes, which allow people to travel by bike on a particular path in the street. Bike lanes provide a faster mode of transportation when compared to walking and less congestion than traveling by automobile. WeBikeNewYork has newly formed a start-up bike company that lends out bikes to people at Queens College and Queens Community College. Each location currently has eight bikes. We have decided to increase the number of bikes available, but we are undecided in how many will suffice which leads us to developing a model to answer our question. Does increasing the number of bikes per day lead to more total bike rides per day? In our simulation, we will only be incrementing the number of bikes available to Queens College and Queens Community College.

1. Methodology

To answer our question, we will be running a bike-share model where we add a new bike per day into our system for thirty-days. These bikes will only be available to those at Queens College and Queens Community College. When a bike gets added to our model, it goes into the free bike pile. When a college runs out of bikes, and a person needs to ride one, a bike moves from the free bike pile and into the designated college that needs it. We believe that allocating the new bikes into the free bike pile ensures that both colleges have access to a bike that enters the system. If we were to add a new bike directly to one of the universities every day, there is no guarantee that the bike gets used because a university that needs a bike may not have access to one since the bike is at the opposing college. We also added the probability of a person riding a bike. We mimicked this probability-based on New York traffic. There are certain times during the day when more people are traveling. A person is more likely to move during the hours between 3:00 pm to 7:00 pm in New York because these are known as our rush hours as opposed to 12:00 pm to 4:00 am. We increase the likelihood of someone using our bikes during New York rush hours, and we decrease the possibility of non-rush hours. All probabilities are real-world data gathered from a public data source that specializes in monitoring traffic based in New York . The collected data covers every hour of every day of the week. Our current model will begin with eight bikes at each location. The number of maximum rides on any given day is forty-eight since we model the chance of two people using a bike per hour. With the addition of a bike per day, we are now more capable of reaching the maximum amount of bike rides on any given day. We expect that as the number of bikes added to our system increases, the number of bike rides per day will also increase because a location will have a higher chance for a bike to be readily available for use with the addition of more bikes. We also expect that the highest number of total rides on a given day will reach at least thirty because, by day fifteen, there will be over thirty bikes in our system.

1. Results

A screenshot of a cell phone

Description automatically generated

The above charts display two of the results of various simulations that we ran. The y-axis represents the number of bikes, and the x-axis represents the day in the simulation. The blue line represents the total number of bikes ridden on a given day, and the orange line represents the number of bikes in our system on a given day. We noticed as the number of bikes added to our system increased, the number of bike rides per day stayed relatively the same.

1. Analysis

We had hypothesized that as the number of bikes added to our system increased, the number of bike rides per day would improve. We had also speculated that the highest number of total trips on a given day would reach at least thirty. From our simulation, we concluded that both of our hypotheses were incorrect. The inclusion of more bikes into our system does not always guarantee more rides per day because there are certain days and times throughout the week where user activity is more significant due to the high probability of traffic. We believe that our model simulates a short period reasonably well due to the constraint of thirty-days. If our model scaled to more than thirty-days, the results would not be relevant. A reason why the model would not scale well past thirty days is that we are limited to two bikes moving per hour. Two bikes per hour restrict us to a maximum of forty-eight bikes per day. As more bikes get added to our system, the majority of them remain idle. Therefore, we will need to allow more people to use our bikes. We can enable more people to ride our bikes through marketing and advertising. Since colleges have many people, we may introduce a probability of reaching various quantities of people through an adjacency list. One list will contain the number of people we can achieve, and the other list will include an associated probability of successfully marketing that group. The likelihood of successfully advertising to a small group of people will be higher, and the possibility of successfully reaching a larger group of people will be lower. The adjacency list will allow us to reach more people per hour as opposed to our two-person per hour model. The list containing the quantity of people needs to contain a reasonable amount of people since most colleges have less than thirty-thousand people. This includes students, faculty, and other people that visit the college. The list may start with one person as the smallest value and fifty people as the maximum value. Another reason why the model would not scale well is that the traffic data is gathered from all over New York. Localizing our traffic data between Queens College and Queens Community College would present a more accurate result since this would focus on a subset of New York traffic. Implementing these two changes would give a better and more realistic model that would allow us to take full advantage of the bike lanes between both locations. Overall, although the model may contain minor flaws, as a whole, it answers our question reasonably well.