Mini-Project 3: NYC Bike Share

Task 1 – Verification

Since I used simpy for this mini-project, my first step was to get familiar with the different components of simpy (resources, environment, etc). I then implemented each step separately. I first created a few stations, a small-time step, 2 riders, and 1 bike. I made sure that the rider was able to take a bike and leave. I then tested each layer as I implemented them.

Here are the requirements and how I implemented each:

• The n riders arrive randomly. Their interarrival times constitute an autonomous, stationary, and independent stochastic process, distributed exponentially with mean rate λ.

- I used np.random.exponential with a mean rate λ as the parameter

• When a rider arrives, she selects a bike station randomly. The probability of picking station i is pi .

- I tested this with hardcoded values and then I implemented the probabilities of the 81 NYC stations given

• The rider goes to station i. If a bike is available, she takes it. Otherwise, she must wait until a bike is available there. Allow for the possibility of an unlimited number of bikes at the station, which will be needed by one of the experiments below.

- I tested with 1 station, 10 bikes, and 10 riders to see if the waiting feature worked

• The rider chooses their destination randomly. The probability of selecting station j, given that the rider is at station i, is given by qi,j . It is possible that i = j, that is, the rider uses the bike but ends up returning it to the same station.

- I tested this with hardcoded values and then I implemented the raw data given to reflect the NYC stations

• The rider uses the bike for some amount of time before returning it. The amount of time she uses the bike is drawn from a log normal distribution with mean μ and standard deviation σ.

- I used the numpy function to implement this: np.random.lognormal(MU, SIGMA)

Task 2 – A baseline experiment

Simulation parameters: 3500 riders, λ = 2.38 riders per minute, and an average ride time of 16 minutes.

1. The probability of a successful rental is 100%. For 30 random trials, all of the riders were able to obtain a bike from the 81 start stations without waiting.
2. The average waiting time was 0 seconds since all of the riders were able to get a bike without waiting.

Task 3 – An “idealized” experiment

To find the minimum number of bikes that could be made available to meet demand fully, I initialized each station with 1 bike and dynamically added bikes as the riders waited. The implementation of the simulation runs off a randomized seed, so for each situation, the values differ a little. However, for a seed of 420, the following values makes sure that no rider waits (assuming the simulation parameters from above):

{'South Waterfront Walkway - Sinatra Dr & 1 St': 6, 'Grove St PATH': 7, 'Hoboken Terminal - Hudson St & Hudson Pl': 7, 'Hoboken Terminal - River St & Hudson Pl': 6, 'Newport Pkwy': 5, 'City Hall - Washington St & 1 St': 5, 'Newport PATH': 4, '12 St & Sinatra Dr N': 5, 'Hoboken Ave at Monmouth St': 4, 'Marin Light Rail': 4, 'Hamilton Park': 4, '14 St Ferry - 14 St & Shipyard Ln': 5, 'Liberty Light Rail': 4, 'Columbus Dr at Exchange Pl': 3, 'Harborside': 3, '11 St &

Washington St': 5, 'Washington St': 4, 'Sip Ave': 4, 'Hudson St & 4 St': 5, '8 St & Washington St': 4, 'Madison St & 1 St': 6, 'City Hall': 4, 'Warren St': 4, 'Newark Ave': 3, 'Columbus Park - Clinton St & 9 St': 4, 'Grand St & 14 St': 4, 'Church Sq Park - 5 St & Park Ave': 3, 'Columbus Drive': 3, 'Van Vorst Park': 3, 'Clinton St & Newark St': 3, 'Grand St': 3, 'Paulus Hook': 2, 'Manila & 1st': 4, '9 St HBLR - Jackson St & 8 St': 2, 'Bloomfield St & 15 St': 3, '4 St & Grand St': 3, '7 St & Monroe St': 3, 'JC Medical Center': 4, 'Clinton St & 7 St': 4, 'Willow Ave & 12 St': 4, 'Morris Canal': 3, 'McGinley Square': 3, 'Brunswick & 6th': 3, 'Jersey & 3rd': 5, 'Brunswick St': 3, 'Baldwin at Montgomery': 3, 'Adams St & 2 St': 3, 'Southwest Park - Jackson St & Observer Hwy': 3, 'Marshall St & 2 St': 2, 'Journal Square': 4, 'Madison St & 10 St': 3, '6 St & Grand St': 3, 'Dixon Mills': 3, 'Lafayette Park': 3, 'Riverview Park': 3, 'Stevens - River Ter & 6 St': 2, 'Mama Johnson Field - 4 St & Jackson St': 3, 'Pershing Field': 3, 'Hilltop': 2, 'Jersey & 6th St': 2, 'Essex Light Rail': 3, 'Monmouth and 6th': 2, 'Oakland Ave': 3, 'Adams St & 11 St': 1, 'Bergen Ave': 4, 'Fairmount Ave': 4, 'Montgomery St': 3, 'Christ Hospital': 2, 'Astor Place': 2, 'Heights Elevator': 3, 'Lincoln Park': 2, 'Leonard Gordon Park': 2, 'Communipaw & Berry Lane': 2, '5 Corners Library': 2, 'Glenwood Ave': 1, 'Union St': 2, 'Dey St': 3, 'Jackson Square': 1, 'Bergen Ave & Stegman St': 1, 'Grant Ave & MLK Dr': 1, 'JCBS Depot': 1}