Project 2 Checkpoint Submission

Github Repo:
https://github.gatech.edu/hxu317/ComputerSimProject2

Backup Download Link:
https://drive.google.com/open?id=19ZreDh91WY5PPwCUpHYBNQY3gde5o60D

Team Members
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Data
NGSIM traffic data

Problem Description
Our simulation aims to enable the assessment of the average travel time for vehicles to traverse a portion of Peachtree Street, the corridor from 10th to 14th street, in midtown Atlanta traveling in a southbound direction. Our simulation will have all the intersections present in real life, as well as all the traffic lights. We aim to examine light and heavy traffic, to simulate real life scenarios where certain times are more populated than the rest.

Conceptual Model
Our simulations will consist of queueing network and cellular automata models, and will share characteristics and make the same assumptions to ensure that our results are comparable.

We will assume that all cars are the same size and shape, simplifying the differences in vehicles. Lanes in traffic will also be the same width to support the cars. We will also assume that the cars will all be moving at the same max speed for a given level of traffic, this is to emulate the real life effect of traffic on travel speeds. At lower levels of traffic, cars will be moving faster, and vice versa for higher levels of traffic. The exact speed will be determined later.

All of our main traffic will be traveling southbound, to simulate the real life orientation of Peachtree street. Furthermore we will have intersections with stop lights that simulate real life conditions. Stop signs will be simulated as traffic lights for simplicity. Cars will

also have the ability to merge into traffic on a right turn, or make a left turn if there is adequate space to do so.

Simulation Models
The simulation models will be split up as follows:
1. Event-oriented queueing model: Hanwen
2. Cellular Automata: Will
3. Queuing Networking model (activity scanning world view): Jiayi

1. Event-oriented queueing model
Model Assumptions
- 0.3 miles between 14th street and 10th street on Peachtree Street, traveling southbound
- Cars traveling at 20 mph
- Rate of cars entering the road is currently a random distribution between 0 and 20 seconds
- Average time for a new vehicle to enter the road is 60 seconds

To-do: Looking for advice on this section!
- Graphical representation
- Traffic lights - Reason this is not included in checkpoint is uncertainty in where traffic lights are located, also unable to get traffic lights working with current simulation
  - Plan to change simulation to include a list of cars, this would also allow for GUI
- Visual guide on what is going on during the simulation.

2. Cellular Automata
Layout of CA:
- Each section of each lane is a cell

Model assumptions:

- .3 miles between 14th and Peachtree to 10th and Peachtree travelling southbound (google maps)
- Average car is 16ft long
  (https://www.quora.com/What-is-the-average-length-of-a-car-in-feet)
- typically space of a car between each car, so each cell is 16ft * 2 = 32 ft long
- .3 miles = 1584 ft

- 1584 ft / 32 ft = 49.5 cells, round up to 50
- 2 lane road
- road model is therefore (50 x 2)

We'll keep track of velocities in a similarly shaped array.

- A velocity of -1 means unoccupied
- A velocity > -1 represents how many squares this car will travel in a timestep

We'll use timesteps t = 1 sec. For a car going 50mph = 73.33fps = 2.3 cells / t. Since we need integers we'll round this down to 2 cells / t (~43.6 mph)

3. Queuing Networking model (activity scanning world-view)
Ideas of Activity Scanning:
B-type event: cars entering the lanes, traffic lights change
C-type event: car moving, car stopping.

The action of the car moving is triggered when conditions are met:
- Traffic lights: green

The action of the car stopping is triggered when conditions are met:
- Traffic lights: red
- Distance of the car to the traffic lights is smaller than a threshold

Model Assumptions:
- 3 miles between 14th and Peachtree to 10th and Peachtree travelling
- 10th-11th: 1 mile, 11th-12th: 1mile, 12th-14th: 1 mile
- Only 1 lane.
- Car arrivals: 1 car is generated every 6 seconds
- Only traffic lights on 11th, 12th street => 2 traffic lights
- Maximum speed of cars: 45mph

Running the simulation for total 360s and check the states at each timestep 1s. The traffic lights changes every 20s on 11th street and 30s on 12 street.
The average speed of the cars that finished the 3 miles travelling is calculated as 30.08 mph.