Orf 467

Transportation Systems Analysis

Fall 2016/17

HW-6 Analysis of aTaxi Flows in and out of aTaxi Stands and their Empty Repositioning Throughout the Day

Due: Precept Monday/Tuesday, Dec 5/6, 2016

We have 5 things to accomplish in order to be able to begin to investigate how large the aTaxi fleet will need to be to provide mobility for various areas of the USA's aTaxi trips assuming a DD=300, CD=3, P2P, 25% Max Circuity level-of-service.

We need:

1. The ride-sharing analysis for all pixels for DD=300, CD=3, P2P, 25%MC for various 'contiguous areas'. A 'contiguous area' is one in which we can be serving all the trips that remain in that area. (If a trip goes outside, it doesn't get served)
    a. Choose a contiguous area, name it, display it, list all of the pixels that are contained in it and perform the ride sharing analysis for each pixel.
2. Create a file containing the departure time and occupancy of each aTaxi departing from each pixel and its final arrival pixel and arrival time throughout your contiguous area for a typical day. (Demand for aTaxis to load up with rider(s) by location (pixel) by ToD)
3. Assume aTaxis are infinitely large (can accommodate all traveling groups.)
    a. Determine the Initial Distribution of aTaxis that will be needed so that no repositioning needs to be done throughout the day, yet all trips will be served. What is that Fleet size?
    b. Determine the number of aTaxis moving during any minute of the day. Plot that histogram. Find the largest value (That is the Minimum Fleet size). What is its value and at what time does this condition occur?
    c. What is the Overnight Empty Vehicle Repositioning
4. Assume that your atTaxis can accommodate at most only 3 passengers.
    a. Redo the ride-share analysis and regenerate the aTaxis movements throughout the day. (redo step 2 above)
    b. Redo 3a
    c. Redo 3b
5. Suggest a "simple "back-of-the-envelope" empty vehicle management strategy to be used during the day that would allow the Fleetsize to be closer to the minimum Fleetsize.

Please refer to Shirley Zhu's Thesis (Zhu'16MakingTransportationGreat_Thesis.pdf) and *Interplay_Between_Fleet-size,_LoS and_EmptyRepositioning* S. Zhu & A. Kornhauser for background.

More on this assignment…

Addendum to HW 6 (Due before you leave campus)

The Nationwide PersonTrips are in 3,596 sub-county files:

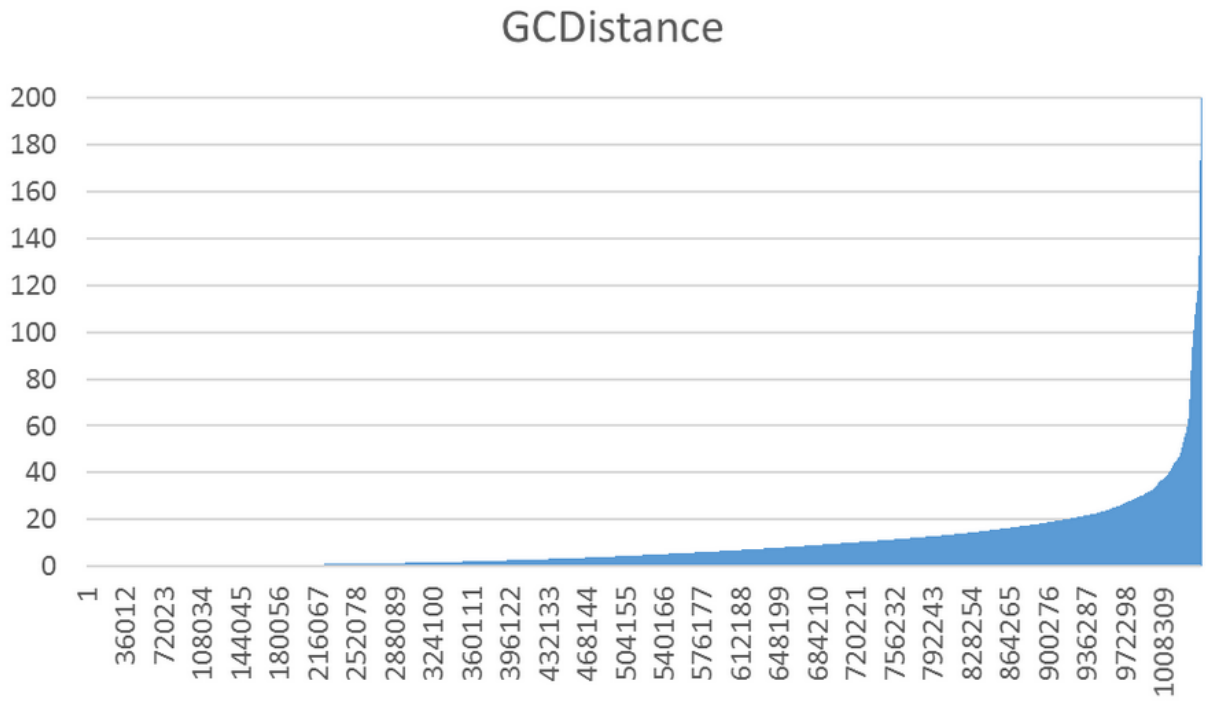
http://orf467.princeton.edu/NationWideTrips'16/NationWidePersonTrips_oPixel_oTime_SubCounty/

(for example: the first file of county with a FIPS code of 01001 is....http://orf467.princeton.edu/NationWideTrips'16/NationWidePersonTrips_oPixel_oTime_SubCounty/NewRecoveredOriginPixel01001_1.csv)

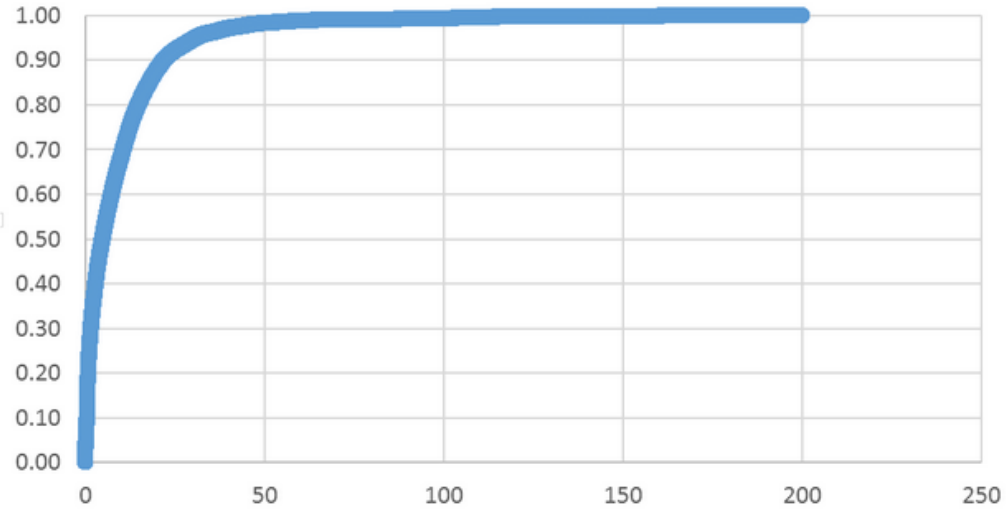
What is missing from these files are long trips (GreatCircleDistance > 200 miles. Kyle is still working on these trips. We may not be able to blend the to/from closestAirport/AmtrakStation access trips before January. So, let's move on without them.

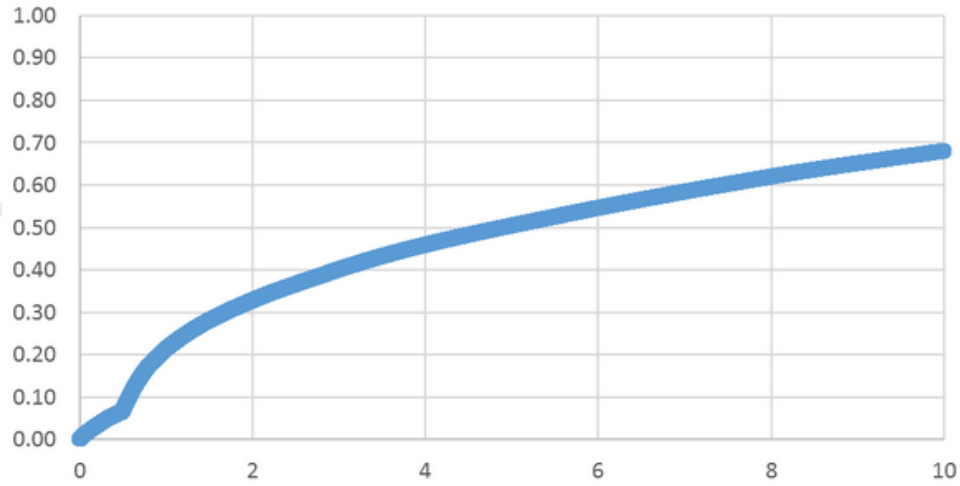
Each of these files should be completely openable in excel in that they contain at most a little over 1 million trips (rows). (The largest is ...06037_19 contains 1,044,314 personTrips in the 19th sub-county group of Los Angeles County.

Distance distribution for 06037_19



Cumulative trip length distribution for 06037_19

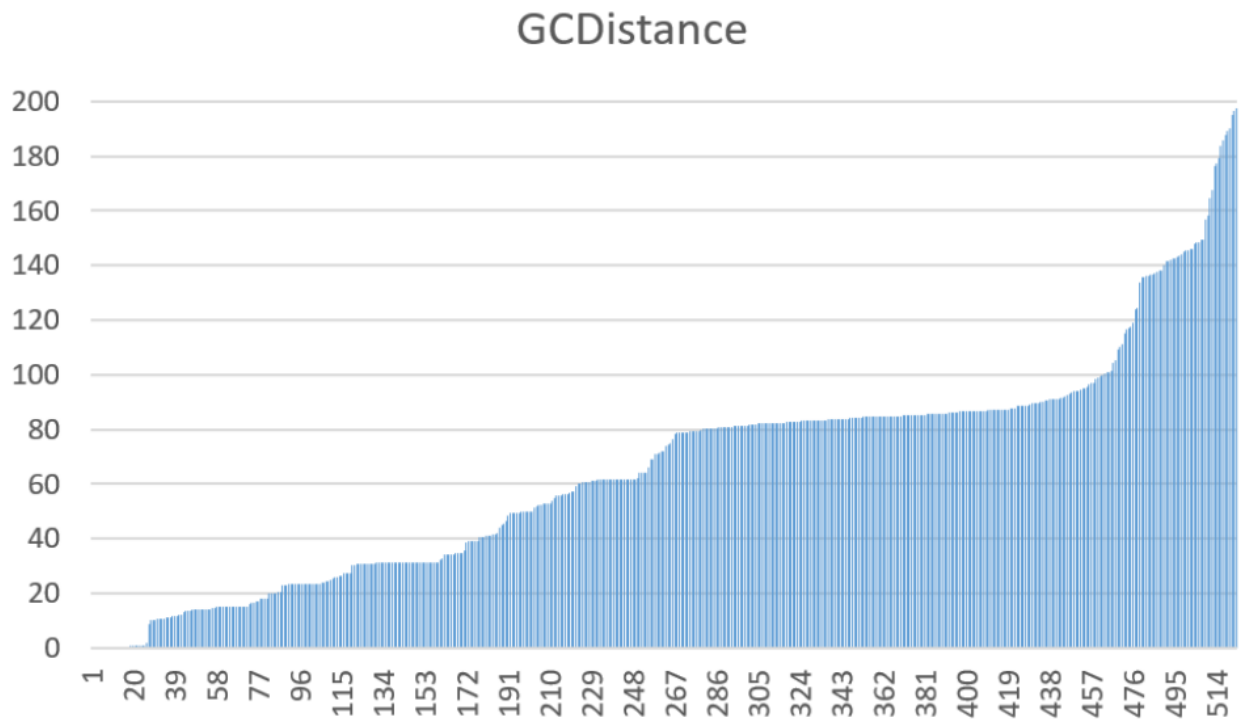




20% of trips are under 1 mile in length, ~32% are under 2 miles in length. Since this is Los Angeles County where no one walks I suspect that it may be characteristic of many/most counties??

The smallest is ...48269 (King County TX (Population 286). 523 originating trips.

personTripLength distribution (it is very different in shape from that of LA county:



Anyway... For that reason, I'd like us to break up our analysis of each county into 3 groups of trips:

1: **Walking**: Less than 0.5 miles GreatCircleDistance (GCD)

2: **Short-Haul aTaxi Service**: $0.5 \leq GCD \leq 2.0$ (maxCircuity and CD may be larger, DD may be smaller)

3: **Normal aTaxi Service:** GCD > 2.0

For each pixel in your county(ies)

I. Separate out the **Walk** trips and display them on a google map using something like balloons (size proportional to # originated, centered on pixel center (or a heat map (color pixels, or shyscraper map or some sort of animation by time of day or ??? Also plot the distribution by GCD and by time-of-day (ToD)

II. For the **Short-Haul** trips: Plot the trip length distribution as well as the ToD distribution for the county(ies) AND do the ridesharing analysis with the following LoS: (compute for each AVO and plot the Occupancy @ Departure v # departures AND generate the VehicleTripFile for each LoS

a. DD = 180, CD = Inf, maxCircuity = Inf

b. DD = 300, CD = Inf, maxCircuity = Inf

3. Assume we have 6 passenger aTaxis. Do 1 & 2 above with the extra condition that once the aTaxi is full, depart it and summon a new one for the next arriving passenger and start the departure clocke anew.

4. Do the same but assume a more appropriate sized vehicle for your county (What is that size?)

III. **Normal** aTaxi:

a. Perform the AVO analysis and generate the resulting VehicleTripFile for an LoS: DD=300, CD=3, MaxCiruity=0.25%, aTaxis of infinite size. Be sure to plot the distribution of departedVehicles v Occupancy@Departure. What does this suggest as to the 'optimum vehicle capacity.

b. Redo the above assuming we have only 5 passenger aTaxis (departing the taxi as soon as it has 5 people in it.

c. Redo the above assuming we have 3 passenger aTaxis. How different is the AVO and the "realizedDD" (actual time between 1st arrival for service and the actual time of departure)

d Redo the analysis above assuming we have your 'optimum' vehicleCapacity from a above for your county(ies)

http://orf467.princeton.edu/NationWideTrips'16/NationWidePersonTrips_oPixel_oTime_SubCounty/