

All hail a cab!

(Disclaimer: for legal and moral reasons, all geographical locations and company names used in this problem statement are entirely fictional. *Please make sure that your solution manuscript clearly states this. Any similarity to real companies and places should be deemed a coincidence; such similarities, however, may be useful in determining reasonable parameter values for your model.*)

Mythical is a vibrant college town in the middle of Dompkins County (upstate NY).

Local landmarks & destinations include parks, gorges and waterfalls, a lake, downtown with shops, restaurants & theaters, a large university, a smaller liberal arts college, a shopping mall, and the Mythical-Dompkins Regional Airport. The geographic layout is such that most locals own and use cars on a daily basis. Still, a significant portion of the population relies on public transportation and taxicabs. This is particularly true for those with lower incomes and temporary residents (e.g., the students). All others use taxis infrequently -- primarily when traveling to/from the airport or the bus station. Unfortunately, many customers are unhappy with both the quality and the price of services offered by the local taxi companies. Numerous complaints can be found on Yelp and in other online forums. The well-established companies believe that several unlicensed upstarts (operating as “liveries”) are primarily responsible for this low customer satisfaction. The city and county officials are interested in improving the situation. But since the problem is complex, they would appreciate your help in assessing the current needs and the likely consequences of any reforms.

In your analysis, you should keep in mind the complicated structural division: the actual “City of Mythical” is a smaller geographic entity, surrounded by the larger “Town of Mythical”. The informally defined “Greater Mythical” includes both the city and the town + several adjacent areas (including the shopping mall and the airport) governed by the rules and regulations of adjacent towns/villages, Dompkins County & NY state.

*Please address sub-problem 1 + **any two** of the remaining three sub-problems.*

1. What is the total number of cabs needed to serve the “Greater Mythical” area ?
The goal is to ensure that
 - a) the average customer waiting time is ≤ 15 minutes;
 - b) less than 10% of customers end up waiting more than 25 minutes.
2. As of right now, all taxi ride prices originating **and** terminating within “the city” are determined by the city government (the city map is divided into zones, with the

corresponding zone-to-zone prices listed in the eCode on the city website). Suppose the city decided to switch to meter-based prices: you pay \$2.50 to board a cab, and then X cents per each mile. What is the value of X that would leave the revenues of taxicab companies roughly the same as they are right now? What are the advantages and disadvantages of switching to meters?

3. The local taxi market is currently dominated by Mythical Dispatch, Inc – a conglomerate of three companies with a single dispatch center and 2/3 of all the cabs **officially licensed** in the city. Suppose these 3 companies had to operate independently from each other. Estimate the impact on the average wait times and on prices of the non-regulated rides (e.g., between downtown and the airport).
4. What would be the likely consequences of strengthening the regulations against unlicensed/livery companies (currently controlling about 1/7 of **all** cabs in the city) ?