

## Project 1: Fire station location

Math 647, Spring 2009

*Due Monday, 2/23*

An issue which is vitally important in urban planning is the location of various emergency services. We will suppose that Bryan, TX, closes all of its fire stations and wishes to find optimal locations for new ones. To simplify the problem, I'll ask you to do the project in two parts: first, the optimal location of a single fire station, and second, the optimal locations of two fire stations. The way we will judge how good a location is by trying to minimize the average response time to an alarm. We'll also want to estimate the maximum response time to a fire to a house in an out-of-the-way location. It's clearly impractical to compute the average response time directly (i.e., compute the response time for each house and then average over all houses). (Actually, it's probably doable with a lot of computing power, but that's not how I want you to do the problem.) One approach might be to concentrate on neighborhoods as units rather than houses, and then weight by the number of houses in the neighborhood (estimated by the area of the neighborhood on the map). A slightly different approach would be to take a large number of fairly evenly spaced locations and assume that those are where the fires would be. Estimating the maximum response time is much more straightforward: look at outlying points of neighborhoods. For this assignment, I want you to:

1. determine the location of a single fire station in Bryan with the minimum average response time to a fire.
2. determine the maximum response time if the single fire station is in that location.
3. determine the locations of two fire stations which give the minimum average response time, along with a map showing which parts of the city are covered by which fire station.
4. determine the maximum response time if the two fire stations are in those locations.

You will have to make a lot of assumptions to get anywhere on this project. For instance, the speed that a fire engine can go on a road depends on the type of road that it is. It could easily be going 90 mph on the bypass, but this is not possible on residential streets. You might want to divide streets into 3 types: highways, main thoroughfares, and residential streets, and assume appropriate speeds on each type. On the city map, main thoroughfares are in red, so that might help. At any rate, make clear what you are assuming. Feel free to use Google Maps or similar software to estimate travel times. Also feel free to drive around and see what's actually going on. Obviously it's not practical to determine response time exactly, but in spite of not being able to solve the problem exactly, we still have to find a place to put the fire stations!