ECE 6390 Radiolocation Scavenger Hunt 2

Late for Dinner

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1 Introduction

Your are running late for your anniversary dinner. Your significant other has called you from outside the restaurant where you are supposed to meet for a romantic outing. Unfortunately, your spouse's cell phone call is cut-off before you can catch the name of the restaurant. Your return calls keep dumping to voice mail. If you miss this dinner, it will be a very dangerous situation indeed. Far more dangerous than if your plane had crash-landed in the Atlantic without an EPIRB.

You have one thing going for you. Your spouse's cellular phone has a trial GPS chip inside that records pseudoranges calculated from 4 received GPS signals and then calculates user position. Since you are an electrical engineer, of course you can hack a digital cell-phone in seconds. You discover that, through some quirk of Springularizon's protocol, your handset somehow has your spouse's pseudoranges recorded in memory. You must use these pseudoranges to find the location of the restaurant.

2 Technical Data

Below are the satellite subpoint coordinates and psuedo-ranges for the 4 GPS satellites whose signals are received by a positioning radio:

	Sat 1	Sat 2	Sat 3	Sat 4
Lon	-62.3256°	-85.2234°	-90.9760°	-95.0234°
Lat	43.2345°	35.5521°	29.0510°	40.7777°
PR/c	0.000000000 s	-0.001587009 s	-0.001373255 s	-0.001092284 s

Note that all pseudo-ranges are given relative to the first satellite position (absolute time delay, of course, is unknown). Calculate the longitude, latitude, and altitude for the GPS receiver based on this data. Use 6380.00 km as the mean earth radius, 20,200.00 km as the GPS satellite altitude, and $c = 299860.00$ km/s in your calculations.

3 Deliverables

You must prepare a web-based report or presentation that documents your solution to this problem so that other engineering spouses can learn from your cleverness. The web report should be in html-format with all files submitted in-class on a CD or through e-mail[1]. Your report will be graded completeness, **technical writing**, technical correctness, professional content, and creative use of web presentation. I will likely post a couple unique solutions and high-quality projects to the web.

Some interesting questions to address in your final web report/presentation:

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[1] e-mail submissions must be ZIPped and are only recommended for files less than 4 MB total

- How did you solve the range equations?

- Are there any ambiguities in your technique? How did you address them?

- Can you place a confidence interval on your position estimate?

- What factors that we did not consider might affect a realistic GPS ranging estimate?

4   Final Clue

The actual longitude/latitude of the GPS receiver is a restaurant in Atlanta on the corner of two streets. The concatenated first words in the street names (e.g. "fersttechwood" or "peachtreepeachtree") unlocks the mystery document on the RLSH web page. The restaurant location is inside the perimeter.