# Homework 8 GPS Activity – RINO 120/130 Phys 501 (9 Pts)

A GPS (Global Positioning System) is a way to locate yourself on the surface of the globe by using a receiver and a suite of at least two dozen special NAVSTAR polar-orbiting spacecraft.
http://en.wikipedia.org/wiki/Global_Positioning_System

The receiver calculates the time difference between the signals received from pairs of spacecraft and calculates the user's position. A "line of position" with the difference between two signals as fixed yield a hyperbola. By using more than one spacecraft, you can get at "triangle of uncertainty" as the intersections of the three hyperbolas. With four spacecraft or more, it can get a 3D position too (including altitude) but that is less accurate (why?).
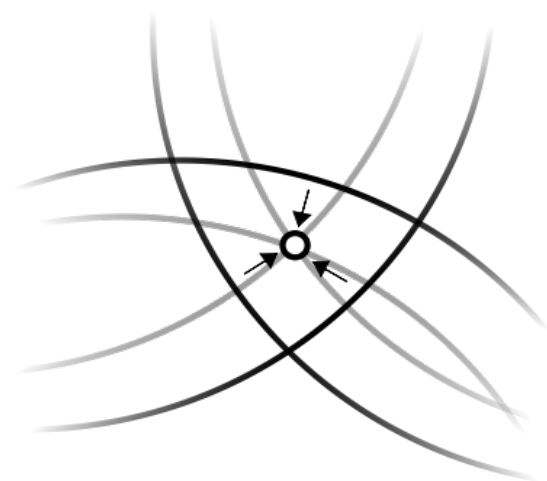
(1 pt) Position is usually given in latitude and longitude (i.e. 29° 42.527'   (degrees and decimal minutes). Or 29° 42' 31.6" (degrees, minutes and seconds). "Google-Earth" also gives fractional degrees (29.123456°). **(Be able to calculate from one to the other!)** A larger N latitude is (obviously) more north; a larger W longitude is more west, but generally positive longitude is EAST so Houston is technically negative longitude. The circumference of the Earth is 40,000 km so a minute of latitude is (40000/(360*60)) = 1.85 km (the definition of a nautical mile). So, each thousandth of a minute is just less than 2 m. The distance of a minute of longitude varies with latitude. At the equator, a minute of longitude is the same as a minute of latitude. But at higher latitudes, the circumference is 40,000 km times the cos (lat).   Cos (30°) = .866, so here in Houston a minute is 1.85 x .866 = 1.6 km or almost exactly a mile, and a thousandth of a minute = 1.6 m. How far is a millionth of a degree of latitude? (4 E 4/ 360 E 6) = 1.1 E -4 km = 0.11 m.   So, if your GPS accuracy is 50 feet, how many thousandths of a minute of latitude is that?

_____

(If you don't have a Rino, specify here how your GPS locates the spacecraft. If you are using just your phone, skip this but do answer the previous question).

1. Take a GPS unit outside (with a clear view of the sky unobstructed by buildings and heavy tree cover). Turn on by pressing the power button between the two antennas. One antenna (shorter) is the GPS receiver; the other is to talk to other users. Set your name on the GPS so that others can find you. If you are using a Rino, set your frequency to channel "4". Other GPS units just have one antenna.

2. Wait for unit to lock onto at least four spacecraft (the "birds" in the lower section of the "radio" screen will go from moving to stationary). The unit will tell you whether it has a 2D lock (only 3 spacecraft) or 3D (four or more), and the accuracy of its fix (49 ft, 25 ft, etc).

3. Click the page button (on side, below PTT) to cycle among the display pages.   Press and hold the center joystick to have it save your present location as a waypoint. Click the right button to use the joystick to zoom in and out of the map; click the left button to increase or decrease volume. When using the walkie-talkie talking to another user, your position will show up on their map! (if it is set up, which I think is the default). Create a fun hide and go seek activity!

Geocaching (find two if you don't do the Rice GPS course) (4 pts ea)

1. **Geocaching** is the game of finding small hidden stashes (caches) of trinkets, generally with a log book for you to record your find. Be sure, after you've put your name into the logbook, to seal it up to put it back where you found it! For a great list of caches near any locality, go to http://www.geocaching.com and put in the zip code you want to find something near. Be sure to register! When you find a cache, sign the logbook, and take a trinket if they say you can. Then sign the logbook on the web site. You can also hide your own cache and put it on the web site! *(I told you about the Goode Co armadillo… check that out but it doesn't count).*

Find at least one geocache:

Put the info for the geocache: _____

url for the geocache: _____

lat/long where you found it: _____

details of where you found it, what you found, etc.: _____

_____

_____

(4 points)

2. **Second Geocache:**

Find another geocache:

Put the info for the geocache: _____

url for the geocache: _____

lat/long where you found it: _____

details of where you found it, what you found, etc.: _____

_____

_____

Rice GPS course (in place of external geocache #2) (4 pts)

I've created a short GPS course on the Rice campus…
Fill in the last column by walking the "GPS ROUTE" and answering the question in the second column or describing the closest object.

Point	Name	Lat	WEST Long	
HBH N door	HBH N	29°42.547	95°26.751	
SW corner		29°42.923	95°24.759	Greenbriar and University
SE corner		29°42.663	95°24.050	Main & University
NE corner	Sunset & Rice	29°43.234	95°23.625	Sunset & Rice
NW corner	Greenbriar & Rice	29°43.050'	95°24.755'	Greenbriar & Rice
Gate 3		29°42.924	95°23.816	Main & McGregor
Gate 4		29°43.213	95°24.083	Main St.
GPS ROUTE	**Question**			**Answer the question here**
001	HBH south door trash can			Put in the coordinates
002	What do you do here?	29°43.235	95°24.087	
003	What is on the sign?	29°43.243	95°23.996	
004	What angle?	29°43.235	95°23.978	
005	Name on Bench	29°43.169	95°23.974	
006	Name on pedestal	29°43.168	95°23.994	
017	What do you smell?	29°43.152	95°24.016	
018	What kind of tree?	29°43.121	95°24.039	
019	The artwork is composed of ?	29°43.039	95°24.066	
020	How many owls (get wet)?	29°43.023	95°24.174	
021	What time of day do you come here?	29°42.990	95°24.256	
022	What do you do here?	29°43.062	95°24.255	
023	Name on curb	29°43.086	95°24.196	
024	How many greenhouses?	29°43.135	95°24.175	
025	Fountain under Brockman			Put in the coordinates
026	Back to HBH	29°43.137	95°24.186	Which door?