MAE 593I GPS

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Homework 1

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**Part 1**

You will be provide 2 MATLAB® binary file (\*mat file) on eCampus. They will be accompanied by an associated README describing content details and format. Contents for each data set will include:

* A time history ECEF locations of GPS satellites;
* A time history of psuedorange measurements;
* Nominal guesses for position in ECEF and receiver clock bias;
* A time history of the true user position and clock bias;
* An estimate for user range error variance;

For each data set 1 and 2:

1. **Develop a MATLAB® function that implements the Linear Least Square positioning based on the model we derived in class.** You can use the code example in lecture 1 as a starting point. It should take as input

* Satellite Positions for one epoch;
* Psuedorange measurements for one epoch;
* Nominal guess for position and velocity for a given epoch;

Its outputs should be:

* ECEF position estimate and clock bias ( nominal + estimated delta)

Use your developed function to:

* Estimate position and clock bias epoch-wise;
* Estimate position and clock bias iteratively updating your nominal from the previous estimate;

Plot your results and compare your position estimates to truth for each case. Write this up in a presentable format.

Using the **xyz2llh.m** and **xyz2enu.m** functions provided on eCampus, transform your results to East, North, Up and repeat your comparison analysis, describe anything interesting that you notice.

Put your code an appendix of your report.

1. **Update your function to also output PDOP, GDOP, TDOP.**

* Using the provided URE sigma in the \*mat file, estimate errors of position time estimates;
* Compare the estimated position error from DOP and URE to errors with respect to the provide truths. Discuss;

Put your code an appendix of your report.

1. **Modify your function to accept a weighting matrix, W.**
   1. With modified function, use the **xyz2enu.m** function provided on eCampus and the relationships described in Appendix 4.A of Ch. 4 of the book to linearly weight the psuedorange measurements based on satellite ***elevation angle*** , **el**.
      1. Use 1/sin(el.) as your weighting function;
      2. Plot this weighting function and describe its purpose;
   2. Compare your results from #1 and #2 with the weighted solution.
2. **As a byproduct of #3, develop a MATLAB function to make ‘skyplot’ of the ( az, el ) in polar coordinates of the satellite time history.**

**Part 2**

1. **Download the C/A code generator MATLAB toolbox. Write a function that can identify if two PRN’s match.** 
   1. Use your function (which uses the free **cacode.m** function) to identify the CA code in **mysteryCA.mat** on eCampus. Report your results
   2. Describe the function and show plots describing how it identified the correct CA.
   3. Add noise +N\*randn(1,1023) for N=1:10 and test your function. Discuss how well PRN correlation holds up to Gaussian noise.