12.540 Homework #3   **Due Wed April 30, 2003**

Question 1: GPS Point position estimation

At the end of this message is a link to a RINEX data file. Using the range data (either C1, P2 (optional) or ionospheric free range) estimate the position of ground station either by least-squares or Kalman filtering. The GPS site is stationary in this data set so a single position will represent its coordinates. The range measurements are in meters. Times in the data files are GPS time based on the (non-synchronized) receiver clock. You may assume that broadcast ephemeris is error free and the clock corrections reported by the satellites (af0,af1,af2) are also error free. (Do not forget to account for the light propagation time of the GPS signals).

The follow part of the message is RINEX data file. The data portion has the following format:

```
  0  1 20 18 48  2.0000000  0  7G15G 3G19G27G31G11G13
 -- GPS TIME of meas.-----  L  #  -- PRN OBS -------- (G Denotes GPS)
```

L is a loss of power flag (should usually be zero)

\# is the number of satellites, followed by the list of PRN observed.

The layout of the data is given by The TYPES OF OBSERV record in the header
There are 5 observations per line, so in this case with 7 observable types
each data entry takes 2 lines (per satellite observed)

```
     7    L1    L2    C1    P1    P2    S1    S2          # / TYPES OF OBSERV
```

L1 and L2 are the phase measurements (cycles),

C1 is the C/A code pseuodrange measurement (m),

P1 and P2 are P-code range measurements. In this file there are no P1 measurements and the P2 measurements are the C/A code range plus the (P2-P1) range difference obtained by cross correlating the L1 and L2 signals.

S1 and S2 are the signal-to-noise ratios at the two frequencies.

```
Data records:
  -174785.22256    -24667.69855  22552789.1174                      22552795.3754
 -- Data ----FS   -- Data ---FS  --- data --FS  -- data ----FS  -- data ----FS
```

The data are as shown and the FS is a flag (F) and signal to noise ratio on scale 1-10 (S). A value of 1 for means loss of lock and blank or zero means good data (you can ignore these flags in this homework.)

The full definition of the RINEX standard can be found at:

ftp://igscb.jpl.nasa.gov/igscb/data/format/rinex2.txt

The data file to be processed is etab0160.02o