HW 6

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read_GPSbroadcast, broadcast2xv, adjust year, and read_rinex functions provided from class are used in this homework.

Initialize

```
clearvars -except function_list pub_opt
close all
c = 2.99792458e8; %m/s
```

Geometric Range

```
fprintf('1)\n')
fprintf('Broadcast file for 2014-09-12 is brdc2550.14n.\n\n')
eph = read_GPSbroadcast('brdc2550.14n');
%Week is col 19
%TOE is col 20

fprintf('2)\n')
GPS_Week = eph(1,19);
fprintf('GPS week is %d.\n', GPS_Week)
GPS_TOD = [1 03 00];
TOW = eph(1,20)+GPS_TOD(1)*3600 + GPS_TOD(2)*60 + GPS_TOD(3);
fprintf('GPS time of week is %d s.\n\n', TOW)

fprintf('3)\n')
[health,x,v,relcorr,satClkCorr] = broadcast2xv(eph,[GPS_Week TOW],21);
fprintf('PRN 21 position, in meters ECEF:\n')
fprintf('  %.2f\n',x(1))
fprintf('  %.2f\n',x(2))
fprintf('  %.2f\n',x(3))
fprintf('\n')
% disp(x)


fprintf('5)\n')
% User position is at Schriever AFB, home of the control segment
fprintf('User position is at Schriever AFB, home of the control segment\n\n')
userpos = [-1248596.2520 -4819428.2840 3976506.0340]'; %m

fprintf('6-7)\n')
prn_list = [21 22 26];
gps_vel = sqrt(3.986e5/26600);
```

```
range_store = zeros(length(prn_list),1);
clock_store = zeros(length(prn_list),1);
cntr = 1;
for ii = prn_list
[range0, range1] = compute_range(eph, ii, TOW, userpos);
range_diff = abs(range0 - range1);
fprintf('Uncorrected range for PRN %d:\n', ii)
fprintf('\t%.2f m\n', range0)
fprintf('TOF corrected range for PRN %d:\n', ii)
fprintf('\t%.2f m\n', range1)
fprintf('Difference in ranges for PRN %d:\n', ii)
fprintf('\t%.2f m\n', range_diff)
tof = range1/c;

fprintf('Approx time of flight is %.1e seconds.\n', tof)
fprintf('Approx in-track displacement of the satellite\n')
fprintf(' during that time is %.0f m.\n', gps_vel*1e3*tof)

range_store(cntr) = range1;
cntr = cntr+1;
fprintf('\n')
end
fprintf('All of the range differences make sense due to Tr-Tt\n')
fprintf(' and how far a satellite would move in that time.\n')
fprintf(' Satellites with longer range (like 22 and 26), have\n')
fprintf(' larger differences because the signal takes longer to travel.\n\n')
```

1)
Broadcast file for 2014-09-12 is brdc2550.14n.

2)
GPS week is 1809.
GPS time of week is 435780 s.

3)
PRN 21 position, in meters ECEF:
-7086902.85
-15271056.38
21122759.09

5)
User position is at Schriever AFB, home of the control segment

6-7)
Uncorrected range for PRN 21:
20912110.07 m
TOF corrected range for PRN 21:
20912129.58 m
Difference in ranges for PRN 21:
19.51 m
Approx time of flight is 7.0e-02 seconds.
Approx in-track displacement of the satellite
during that time is 270 m.

```
Uncorrected range for PRN 22:
 23345417.37 m
TOF corrected range for PRN 22:
 23345478.99 m
Difference in ranges for PRN 22:
 61.62 m
Approx time of flight is 7.8e-02 seconds.
Approx in-track displacement of the satellite
 during that time is 301 m.

Uncorrected range for PRN 26:
 22539874.02 m
TOF corrected range for PRN 26:
 22539817.47 m
Difference in ranges for PRN 26:
 56.55 m
Approx time of flight is 7.5e-02 seconds.
Approx in-track displacement of the satellite
 during that time is 291 m.

All of the range differences make sense due to Tr-Tt
 and how far a satellite would move in that time.
 Satellites with longer range (like 22 and 26), have
 larger differences because the signal takes longer to travel.
```

RINEX

```
%There are 7 observations in the file. P1 is the third one.
fprintf('8)\n')
fprintf('There are 7 observations in the file. P1 is the third one.\n\n');
fprintf('9)\n')
[ rinexv3 ] = read_rinex_obs('test.14o', prn_list);
fprintf('\n\n');

fprintf('10)\n')
C1_store = zeros(length(prn_list),1);
P1_store = zeros(length(prn_list),1);
TOW_measurements = rinexv3.data(rinexv3.data(:,2)==TOW,:);

for ii = 1:3
    [health,x,v,relcorr,satClkCorr] = broadcast2xv(eph,[GPS_Week TOW],prn_list(ii))
    C1_store(ii) = TOW_measurements(TOW_measurements(:,3) == prn_list(ii),8);
    P1_store(ii) = TOW_measurements(TOW_measurements(:,3) == prn_list(ii),6);
    clock_store(ii) = satClkCorr;
    fprintf('PRN %d C1 - R = %.2f m\n', ii, C1_store(ii) - range_store(ii))
    fprintf('PRN %d P1 - R = %.2f m\n', ii, P1_store(ii) - range_store(ii))
    fprintf('PRN %d clock error = %.2f m\n\n', ii, clock_store(ii))
end

fprintf('The code measurements vs the computed geometric range are\n')
fprintf(' pretty huge, up to 100s of km. But the error in the clocks\n')
fprintf(' appear to account for the discrepency, down to 10s of m.\n\n')
```

```
8)
There are 7 observations in the file. P1 is the third one.

9)
Parsing RINEX file test.14o
Returning data for PRNs: 21  22  26

ans =

   387    13

Total epochs: 131
Finished.



10)
PRN 1 C1 - R = 114964.84 m
PRN 1 P1 - R = 114963.94 m
PRN 1 clock error = -114972.36 m

PRN 2 C1 - R = -80051.33 m
PRN 2 P1 - R = -80052.21 m
PRN 2 clock error = 80061.29 m

PRN 3 C1 - R = 15552.06 m
PRN 3 P1 - R = 15551.67 m
PRN 3 clock error = -15543.79 m

The code measurements vs the computed geometric range are
 pretty huge, up to 100s of km. But the error in the clocks
 appear to account for the discrepency, down to 10s of m.
```

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