NOTE ABOUT HW5

==========

1. Given file: lighttime_truth.mat

- Why/What: State (pos_x, pos_y, pos_z, vel_x, vel_y, vel_z, time)
- Units: position in km, velocity in km/s, time in seconds
- How to use it: You can use given initial state of Satellite, apply LT correction and compare it with given values in lighttime_truth.mat
- Purpose: Helps to build LT correction part used in final project
- Aditional References: Attached LT correction slides, Refer Born book
- EXTRA HELP: Can also use it as a seed and check your propagator results for low/high-fidelity force models for 6 hours, 24 hours given in **PropagationDiff_VsGMAT.xlsx**

2. Given file: LEO_Data_Apparent.mat

- What: Station_ID, time [seconds], range [km], range_rate [km/s]

3. Given file: A_t0.mat

- Contains A_matrix at t0 which is Jacobian of F (Xdot) w.r.t. to X (state)

```
% Position: x y z;  Velocity: u = xdot; v = ydot; w = zdot;

% Coefficient of Drag: C_D

% X: State vector (7,1); X = [x; y; z; xdot; ydot; zdot; C_D]

% F = Xdot (7,1); F = [F1:u; F2:v; F3:w; F4:a_x; F5:a_y; F6:a_z; F7:CD_dot];

% NOTE: Assuming C_D_dot = 0
```

4. Given file: H_Tilde_t0.mat

- Contains H_tilde matrix at t0 which is 2 by 7.
- It is partial of observation model (range, range-rate) wrt state (position, velocity, CD)
- You can see how observable is the parameter CD and why it is usually difficult to esitmate for it?

5. Given file: Phi_21600_0.mat

- STM at last time step at 21600 seconds

Tip 1: Use EKF with LT-correction & all low/high-fidelity models.

- (Can work with 6 state then move on to 7 state if your integrator is breaking down)
- Please have switch-case to run different fidelity force models in your propagator
- Expected RMS error at final epoch: (47) m in range, (5E-5) m/s in range-rate
- NOTE: These were sample results of some earlier student's code given for reference

Tip 2: Get a better IS and test your propagator.

1. Use IS given in LT-corr-state.mat & just propagate & fix big errors in your force models
2. Use BLS & obtain a "good" IS, take a tolerance of 'm' level for it to converge quickly

Tips are for you to try. It is not compulsory. But they will help you for your final project code.

Some questions to think of:

1. Is there time-dependent error or structure in your residuals? If so, where is it coming from? Usually comes from some error in code.
2. What is amount of error in ECEF2ECI transformation in earlier assignment?
3. Error in modeling LT-correction?