HW8 Problem 2

```matlab
fprintf('\n');
clearvars -except function_list hw_pub toolsPath
close all
CelestialConstants; % import useful constants

planets = {Mercury, Venus, Earth, Moon, Mars, Jupiter, Saturn,...
    Uranus, Neptune};
line_style = {'g', 'm', 'b', 'k--', 'r', 'r-.', 'b--',...
    'k', 'c'};
h = 800;
figure('Position',[0 0 hw_pub.figWidth hw_pub.figHeight])
for idx = 1:length(planets)
    planet = planets{idx};
    ss_rate{idx} = 360/planet.P_days; %deg/day
    fprintf(['Sun-synchronous nodal regression rate for ' ...
        planet.name ...
        ': %.3e deg/Earth day\n'], ss_rate{idx})
    r = h + planet.R;
    p = r;
    n = sqrt(planet.mu/r^3)*180/pi*day2sec;
    i_vec = 0:0.01:180;
    nodal_regression_rate = -3*n*planet.R^2*planet.J2/2/p^2*cosd(i_vec);
    reg_rate_cell_array{idx} = nodal_regression_rate;
    plot(i_vec, nodal_regression_rate, line_style{idx},'LineWidth',2)
    hold on
    target_i{idx} = acosd(ss_rate{idx}*2*p^2/(-3*n*planet.R^2*planet.J2));
    names{idx} = planet.name;
end
legend(names, 'Location', 'northwest')
xlabel('Inclination (deg)')
ylabel('$\dot{\Omega}$ (deg/Earth day)','interpreter', 'latex')

for idx = 1:length(planets)
    planet = planets{idx};
    fprintf(['\n' planet.name ': Target Inclination: '])
    if ss_rate{idx} > max(reg_rate_cell_array{idx})
        fprintf('Not achievable')
    else
        fprintf('%.2f degrees', target_i{idx})
    end
end
fprintf('\n')
```

```
Sun-synchronous nodal regression rate for Mercury: 4.092e+00 deg/Earth day
Sun-synchronous nodal regression rate for Venus: 1.602e+00 deg/Earth day
Sun-synchronous nodal regression rate for Earth: 9.856e-01 deg/Earth day
Sun-synchronous nodal regression rate for Moon: 1.318e+01 deg/Earth day
Sun-synchronous nodal regression rate for Mars: 5.241e-01 deg/Earth day
Sun-synchronous nodal regression rate for Jupiter: 8.313e-02 deg/Earth day
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Sun-synchronous nodal regression rate for Saturn: 3.350e-02 deg/Earth day

Sun-synchronous nodal regression rate for Uranus: 1.177e-02 deg/Earth day
Sun-synchronous nodal regression rate for Neptune: 6.020e-03 deg/Earth day

Mercury: Target Inclination: Not achievable
Venus: Target Inclination: Not achievable
Earth: Target Inclination: 98.60 degrees
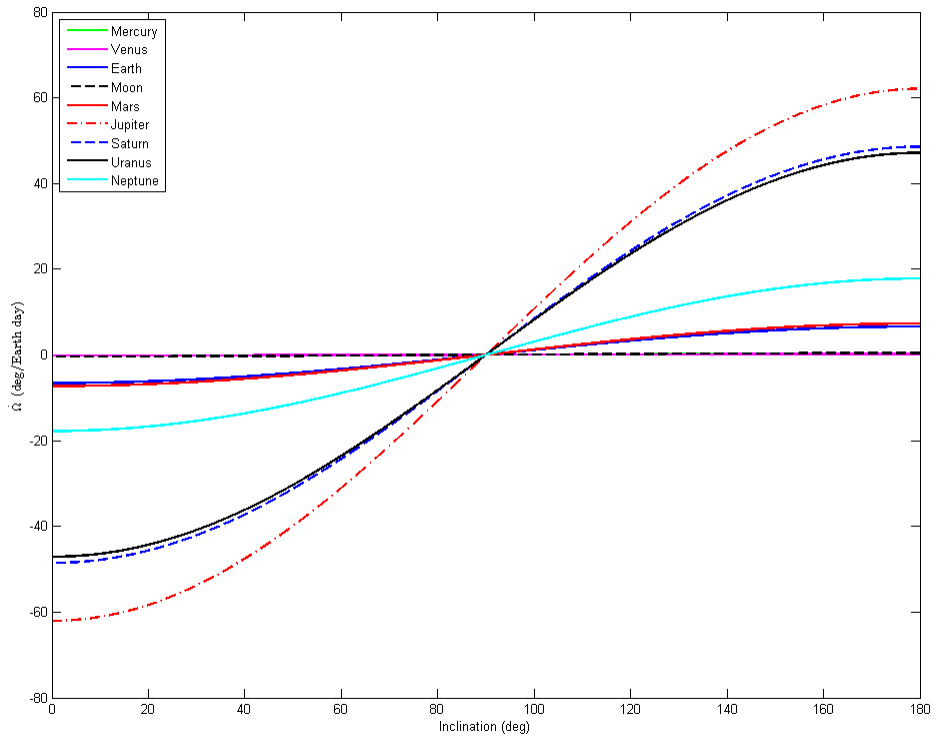*Moon: Target Inclination: Not achievable*
Mars: Target Inclination: 94.12 degrees
Jupiter: Target Inclination: 90.08 degrees
Saturn: Target Inclination: 90.04 degrees
Uranus: Target Inclination: 90.01 degrees
Neptune: Target Inclination: 90.02 degrees

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