ASTRONOMY 1100. INTRODUCTION TO ASTROPHYSICS

Assignment 1.   **Due Date: January 29, 2014.**

1. Suppose that you live at latitude 30°N. What is the elevation of the Sun above the southern horizon (its altitude) at local noon on the date of the Winter Solstice? Explain your reasoning.

2. Where on Earth must you be located to see the south celestial pole at the zenith? Determine the maximum possible elevation of the Sun above the horizon (*i.e.* its maximum altitude) at that location. On what date is the maximum altitude of the Sun reached?

3. The star Regulus (α Leonis) is located at 10^h 08^m of right ascension and $+12°$ declination. Determine on what date (to within a few days) Regulus will be on the meridian at local apparent midnight.

4. Suppose that an umbral eclipse of the Moon occurs on the night of December 22, the Winter Solstice. Determine approximate values for the right ascension and declination of the Moon at mid-eclipse.

5. Suppose that the Moon revolved about the Earth in the same orbit as at present, but in the opposite direction. Would the synodic month be longer or shorter than the sidereal month in such a situation? Explain your reasoning. How long would the synodic month be if such a situation existed?

6. One trajectory that can be used to send spacecraft from the Earth to Venus is an ellipse that has aphelion at the Earth and perihelion at Venus. The spacecraft is launched from Earth and coasts along such an ellipse until it reaches Venus, on the other side of the Sun from the Earth. There a rocket is fired either to put the spacecraft into orbit around Venus or to cause it to land on the surface of Venus.

   a. Calculate the semi-major axis of the ellipse corresponding to such a trajectory. Draw a picture showing such an elliptical orbit along with circles to represent (approximately) the orbits of Earth and Venus. Remember that the semi-major axis is *half* the length of the long axis of the ellipse. [The semi-major axes for Earth and Venus are 1.000 A.U. and 0.723 A.U., respectively.]

   b. Calculate how long it will take in days for the spacecraft to make such a one-way trip from Earth to Venus.