1. (a) Draw a realistic sketch of the celestial sphere for an observer at 40° N latitude. Indicate the position of a star with a declination of +60° and an hour angle of 19 hr 30 min. Be sure to show the horizon, the visible celestial pole, the celestial equator, the zenith, the meridian and the star’s hour circle. Show also the position of a star with an hour angle of 22 hr and −20° declination.

(b) Sketch the Astronomical triangle for the first star, indicating the values of the known sides and angles.

(c) Compute the altitude and azimuth of these two stars.

(d) How long will it be until the second star sets (i.e., altitude = 0°)? Give your answer in both sidereal and solar hours.

(e) For what length of time is the second star above the horizon (from horizon to horizon)?

2. (a) The astronomical coordinates of the University of Maryland Observatory are: latitude = 39° 00' 06" N, longitude = 76° 57' 16" W. What is the longitude of the Observatory in time units?

(b) Find the local sidereal time at the University of Maryland Observatory at 10:10 PM EDT (Daylight Saving Time) on the night of October 6, 2010.

(c) At this same instant, what is the local sidereal time at the Kitt Peak National Observatory near Tucson, Arizona? (Look up the exact longitude!)

(d) Use one of the internet catalog sites (for example, NASA’s Extragalactic Database NED) to find the right ascension of the galaxy M 31 (Andromeda). What is the hour angle of M 31 for this date and time, as seen from the U MD Observatory? As seen from Kitt Peak?

3. (a) The Right Ascension and Declination of the center of the Sun for 10 October 2010 are $\alpha = 13^h1^m08.3^s$, and $\delta = -6^\circ31'11.2''$ according to the Astronomical Almanac. The latitude of the University of Maryland is $\phi = +39^\circ00'06''$. The apparent radius of the Sun in this day is $R = 16'0.96''$.

How long will any fraction of the Sun stay over the horizon? Express the result in standard hours (not sidereal hours). Assume that refraction effects due to the atmosphere (which we have not yet discussed in the course) are unimportant.

(b) What is the Azimuth of the upper tip of the Sun at the instant it touches the Eastern horizon (i.e., the instant of sunrise)? How far from the East cardinal point is it?

For all the above, please show your work.

Due: 7 October 2010