ASTR345 Assignment 1 - due Mon Sep 8, 2003

Write a computer program that will calculate the altitude and azimuth of a celestial object given its RA, dec, and the date and time (ignoring daylight savings time). The altitude and azimuth can be specific to Pullman. You can write in any computer language you choose. Fully comment your code and include a list of variables. You should submit your code, plus the following results:

1. Determine the alt-az of the bright star Antares (RA 16h 29m 36s, dec -26d 26m 26s) on Sept 8 at 12 noon (PST).
2. Determine what time this star rises and sets, and at what time it reaches its maximum altitude (you can just plug in values for this, don’t feel obliged to program this up unless you really want to).
3. Perform the same calculations for the star Capella (RA 05h 16m 55s, dec +46d 00m 11s).

You can find the answers on the internet, of course, but I will be testing your results against the algorithm I have given you. Different algorithms will produce slightly different results.

For this program you will need the spherical trigonometric transformation relations between the equatorial and horizontal systems. These are found in Appendix 10 of Zeilik & Gregory. Two difficulties you will have to overcome are (1) I want azimuth reported in degrees east from north, and (2) you must deal with unit conversions, since most computer languages deal with angles in radians.

You will need the latitude and longitude of Pullman (46.75 N, 117.12 W). You will also need to know how to calculate the Local Mean Sidereal Time (LMST). This can be done using the method found in the Observer’s Handbook 2003. I reproduce that method below.

The 2003 Greenwich Mean Sidereal Time (GMST) for day 0 at 0h Universal Time (UT) of each month is given in the table. “Day 0” is the last day of the previous month.

<table>
<thead>
<tr>
<th>Jan</th>
<th>Apr</th>
<th>Jul</th>
<th>Oct</th>
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</thead>
<tbody>
<tr>
<td>6.6168</td>
<td>12.5307</td>
<td>18.5103</td>
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<td>May</td>
<td>Aug</td>
<td>Nov</td>
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<td>8.6538</td>
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<td>Jun</td>
<td>Sep</td>
<td>Dec</td>
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<td>10.4937</td>
<td>16.5390</td>
<td>22.5843</td>
<td>4.5639</td>
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</tbody>
</table>

GMST (hours) = (GMST at 0h UT on day 0) + 0.065710d + 1.002738t

LMST = GMST - west longitude

In the above equations, d is the day number of the month and t is the time of day in hours. You will have to add or subtract 24 hours from your LMST as necessary.

To see if you are on the right track, you can check your results against mine for the star Procyon (RA 07h 39m 28s, dec +05d 13m 06s). On Sept 8 at noon (Pacific Standard Time), I get

- LMST of 11:21:24.2
- alt = 26.93°, az=246.98°
- rise time = 2:05am
- set time = 2:48pm
- (upper) transit time = 8:27am.