Goal

In this exercise, you will write a computer program that will convert a star's position from equatorial coordinates (RA, dec) to galactic coordinates (bII, lII).

Procedure

1. First, you will need a list of stars with measured positions. Take the 10 closest stars from Appendix 4 of Zeilik & Gregory (α Cen through Luyten 789-6).

2. Correction #1: precession. You need to convert their positions from the listed epoch (1975.0) to the present epoch (2005.x). Estimate the value of the present epoch to one decimal place in years. Then use the precession formulae:

   \[
   \begin{align*}
   \text{Annual precession in RA} &= 3.0750 + 1.3362 \sin(\text{RA}) \tan(\text{dec}) \text{ seconds} \\
   \text{Annual precession in dec} &= 20.043 \cos(\text{RA}) \text{ arcseconds}
   \end{align*}
   \]

   where all angles are in degrees.

3. Other corrections: would include the proper motions of the stars, and the effects of precession on the galactic coordinate system. We will ignore these corrections.

4. Apply the precession correction (#1) to each of the 10 stars.

5. Now, convert their (RA, dec) coordinates to (bII, lII) using the transformation equations given in Appendix 10 (part III) of Zeilik & Gregory. Present your results in tabular form. Report your answers in decimal degrees.

6. Look at your table, and answer the following questions. You do not have to perform any calculations to answer them.

   (a) Which star is located closest to the direction of the galactic center?
   (b) Which star is located closest to the direction of the anti-center?
   (c) Which star is located in a direction furthest north of the galactic plane?
   (d) Which star is located in a direction furthest south of the galactic plane?

General comments

You can write in any computer language you choose. Fully comment your code and include a list of variables. You must submit your code. Be aware that most computer applications use radian measure for angles.

Be careful to invert your trig ratios correctly: use both the sine and cosine relations for galactic longitude to place the star in the correct quadrant.

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.