October 30, 2006   Name:

Astronomy 102: Examination 3

Do not open the test until instructed to begin.

You must do this test on your own without consulting any outside notes. You may not discuss this test with anybody else either before or during your taking of the test. You are allowed a calculator for purposes of arithmetic, but you may not use any device that connects you to a network or allows you to communicate with any other people.

I confirm that I did not receive any help, nor did I reference any disallowed materials in doing this test.

Signature:

Instructions: Write your answers in the space provided. If you need additional space, continue on the back of each page, but indicate **clearly** that you have done so. No books, notes, or assistance from anyone is allowed. You are allowed to use, and will need, a calculator. Please **write legibly and be brief and to the point!** The exam has four questions; each question has equal weight.

(Equations and constants potentially useful for the test are on a separate sheet.)

1. Consider the term "Cosmic Distance Ladder." The fact that we use the term "ladder" suggests that there are a series of steps, or rungs, that one must climb in order to get to the top of the ladder. Explain why we use this term; be sure to mention (at least) distance measurement methods based on parallax, Cepheid variable stars, and thermonuclear supernovae. **NOTE:** I am not asking for a "vocabulary dump" or for comprehensive descriptions of all the terms mentioned in the problem. I'm asking for an explanation as to why the term "ladder" is an appropriate one. Please answer just the question asked, clearly and briefly....

2. Your eyes are 6cm apart. You hold your arm out at full extension and raise your thumb. If you open one eye and close the other, and then blink back and forth (always keeping just one eye open), you see your thumb jump back and forth in your field of view by a total angle of 4°.

   (a) Draw a picture that shows what was just described. Indicate where 6cm and 4° are on this picture.

   (b) Given these numbers, how long is your arm?

3. Assume that the Hubble Space Telescope (HST) can measure stars that are 10^{-11} as bright as the star Vega. Cepheid variable stars with long periods can be as luminous as $30{,}000 L_\odot$. What is the farthest galaxy whose distance could be measured by the HST with Cepheids under your assumption? Express your answer in Mpc; how does this distance compare to the distances to the Andromeda Galaxy (0.8Mpc) and to the Virgo Cluster (20Mpc)?

4. Recall that Cepheids are high-mass stars in one part of their giant stage. Consider the "most distant" Cepheid variable you observed in the previous problem. Assume that this is an $8M_\odot$ star. Consider the star's *current* state out in its host galaxy while the HST is observing the light just now reaching Earth. Is it likely that this star is still a Cepheid variable? If not, what is it now? Explain.