ASTR110, Spring 2015 Name and class meeting time_____

This is your seventh assignment using the *Starry Night* software.

This is due in class by Tuesday, May 19th, 2015

You may turn this in any time prior to the due date. Homework is due at the start of class. **Late homework will not be accepted!** If you will be unable to make it to class to turn this in, you must give it to me before the end of class on the day it is due. **It will not be accepted if turned in at the mailboxes in the administration building!**

Remember, although you may discuss these exercises with other students, the work you hand in should be your own. Students who turn in answers which are substantially the same as those of other students will receive between 0 and 50% of the points they would otherwise score.

Exercise F5: The Solar Neighborhood

Open the **SkyGuide** pane, and navigate to
Student Exercises > F: The Stars
> F5: The Solar Neighborhood

Question 1: (Go to 1: The light year) Stop the motion. Put the cursor on stars that you think are close to the Sun. List the names of the stars visible in this screen that are no farther than 11 light years from the Sun. **Only include stars you see here; do not look up stars in lists of nearby stars.** Note: the 10 light year sphere on the screen might not be exact.

Question 2a: (Go to 2: Stellar distances) List the apparent magnitudes and distances of the following 4 stars. **Again, use the numbers you get from this program, do not use reference works to look these up.**

Altair

Antares

Arcturus

Vega

Question 2b: Which one ***appears*** brightest to the eye (based on apparent magnitude)?

Question 2c: All the stars in the questions above are within approximately one magnitude of each other, meaning they appear very roughly the same brightness (within a factor of 2.5 of each other). Which is the most luminous? How do you know? (No calculation is necessary.)

Question 3a: (Go to 4: The view from Alpha Centauri) Stop the motion. Use the ^ arrow above the screen to move approximately 20 light years away from the Sun and Alpha Centauri. What happens to the ***shapes*** of the big and little dippers (the "bowls" of Ursa Major and Ursa Minor)?

Question 3b: Explain what happened in question 3a. Hint: What are constellations? Are they real structures?

Exercise F6: The Hertzprung-Russell Diagram

Open the **SkyGuide** pane, and navigate to
Student Exercises > F: The Stars
> F6: The Hertzprung-Russell Diagram

Note: do not change the star field!

Also note: After starting the correct portion of the exercise, you must follow the instructions (given below) to open the status bar and to make the H-R diagram visible on the left. You should probably use the controls there to increase the brightness. When you move the cursor into the image of the sky, all the stars shown in the image will appear on the H-R diagram. Putting the cursor on a star in the image will highlight its location in the H-R diagram. Clicking on a star in the H-R diagram will light up its name in the image (it is possible that some names will be just off the screen).

The instructions given in the program are repeated here. To answer the questions, you must click on the **Status** tab to open the Status pane. It is two spaces above the **SkyGuide** tab. Expand the Hertzsprung-Russell and H-R Options layers, if necessary. Under the **H-R Options** layer select **Gridlines**, **Main sequence**, **Regions** and **Spectral class**.

Question 1: (Go to 2: The Hertzprung-Russell diagram) List the evolutionary type (white dwarf, main sequence star, giant, or supergiant) for the following named stars visible on the screen when you begin this question. Put your cursor on the star and the star will be highlighted in the H-R diagram. Also list the approximate spectral class (OBAFGKM). If the star falls between two spectral classes, use the letter just to the left. Then switch the x-axis of the H-R diagram to temperature (shown as Kelvin temperature divided by 1000) and list the *approximate* temperature. **Estimate the actual temperature of the stars; remember to multiply by 1000.** Between the temperatures shown on the graph, try to estimate the temperature of the star. **Again, use the numbers you get from this program, do not use reference works to look these up.**

Star	Evolutionary Type	Approximate Spectral Class	Approximate Temperature (in Kelvins)
Antares			
Alphecca			
Altair			
Nunki			
Rasalhague			
Shaula			
Yed Prior			

Question 3: Which characteristics best describe the star Antares?

- ☐ **a.** blue and hot
- ☐ **b.** red and hot
- ☐ **c.** blue and cool
- ☐ **d.** red and cool

Question 4a: Put your cursor in the image of the night sky and move it around to different stars. List the names of three additional stars in the image, a main sequence star, a giant, and a supergiant. Which one was hardest to find?

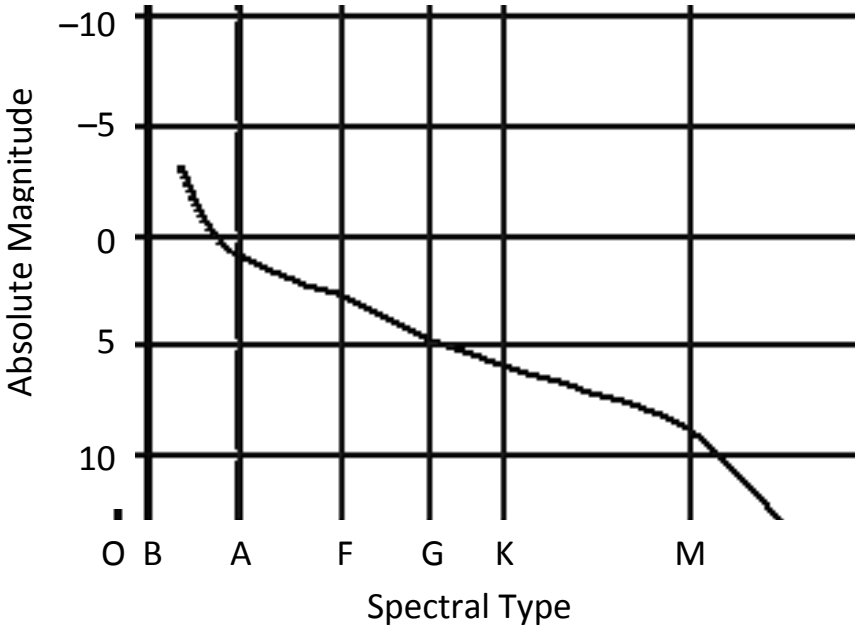
Question 4a: What is the reddest giant or supergiant shown in the H-R diagram? First use the "View" menu to "Hide horizon." Click on the reddest star in the H-R diagram, and its name should appear in the image of the sky. Unfortunately, a few of the names don't seem to show up; list the reddest star whose name appears.

Question 4b: What is the most luminous star shown in the H-R diagram? If you click on it in the H-R diagram, its name should appear in the image of the sky.

Question 6a: Imagine we are observing a visual binary star. That means that both stars are at the same distance from us, in orbit around each other. We'll call them Star X and Star Y. Star X is orange, while Star Y is blue. Which one has a higher surface temperature?

Question 6b: The orange star, Star X, has a luminosity of approximately 10000 solar luminosities (absolute magnitude ≈ −5). The blue star, Star Y, has a lower luminosity of approximately 100 solar luminosities (absolute magnitude ≈ 0). Explain how the cooler star can have a higher luminosity than the hotter star?

Question 6c: Star X is spectral class K, and Star Y is spectral class A. On the copy of the H-R diagram given below, first indicate the location of the main sequence stars, giant stars, and supergiant stars.
Then, plot Star X and Star Y on this diagram at the approximately correct locations. What evolutionary type of star are Star X and Star Y (main-sequence star, giant, or supergiant)?



Question 6d: Assume the two stars comprise a binary star system, so they were formed at the same time, and they are the same age. One has evolved more than the other. Which one is it? Why has one evolved faster than the other?