ASTR 170 ASSIGNMENT 4
Due: May 7th 2010

N.B. There are 10 questions. Students should attempt ALL questions.
TIPS: Read the questions carefully, answer all questions, check any calculations.

1) Where can we look to find new stars being formed? List three probable triggers for star formation.

2) What are the two processes by which H is converted to He in stars? Which process is more important in the Sun? Which process is more important in a 10 $\text{M}_\odot$ star?

3) What is hydrostatic equilibrium, and why is it an important concept for understanding the structure of stars? What is the source of the inward force on a star’s material, and what produces the main outward force?

4) Draw and label a Hertzsprung-Russell (H-R) diagram, indicating the locations of the main sequence and the different types and evolutionary stages of stars discussed in lecture.

5) Why do massive stars have short lifetimes? Why do very low mass stars have very long lifetimes?

6) Explain how we can estimate the age of a star cluster from its H-R diagram.

7) Why will the Sun become a red giant, and how will its structure change in the process?

8) Describe how heavy elements (heavier than H and He) form in stars. What is the heaviest element that can be produced by nuclear fusion in an energy-producing reaction?

9) What happens when a star like the Sun dies? What happens when a star ten times more massive than the Sun dies?

10) The luminosity of a star scales very roughly as $L \sim (M_{\text{star}})^{3.5}$, and the lifespan of a star scales roughly as $T \sim 1/(M_{\text{star}})^{2.5}$. The Sun has a mass of $M_{\odot}$, a luminosity of $L_{\odot}$, and a total lifespan of about 10 billion years. What would the luminosity and lifespan of a 50 $M_{\odot}$ star be? What would the luminosity and lifespan of an 0.5 $M_{\odot}$ star be?