1. Why was it a surprise to discover a Jupiter sized gaseous planet (i.e. a “hot Jupiter”) in an orbit smaller than that of Venus around another star system? (3 pts)

   The hot Jupiters have low density implying that they are composed of light gases (H & He mostly) like the giant planets in our solar system. But we know that the inner volume around sun-like stars is cleared of volatile gases early in their evolution, implying that these planets could not have been formed where we see them. This requires that they much have been formed further out from the central star and have since migrated inward toward the central star. If this has happened in other star systems, why hasn’t it happened in ours? Several theories have been proposed to explain how planets can migrate inward, but the dicotamy between our solar system and the ones recently discovered is not fully understood.

2. Give at least two ways in which the properties of newly detected planetary systems differ from our solar system. (2 pts)

   a) Most have very massive gaseous planets close to the central star
   b) Most planets have highly elliptical orbits

3. Among the following stars, which ones are most likely to be the home of advanced life? O, B, M, and K stars (3 pts)

   Give two convincing reasons for your answer

   K stars because 1) they have a lifetime greater than 5x10⁹ years, adequate for advance civilizations to evolve; 2) they have a reasonably large habitable zone so there is a good likelihood that a planet will be in located in this zone; 3) the temperature is high enough that adequate UV light will reach a planet in the habitable zone
4. What are two indirect methods of detecting planets around a star? (2 pts)
   a) Periodic Doppler shifts of the star
   b) Sinusoidal proper motions of the star relative to the background stars
   c) Periodic dimming of the star due to transits of a planet