ASTR 1001.2

Assignment 3.

1. The birth mass of a small star in a close binary system does not determine its ultimate destiny. As its higher-mass companion evolves into a red giant (or supergiant), it will overflow its Roche lobe and transfer mass to the smaller companion. The addition of mass to the smaller companion shifts it higher on the main sequence and changes its evolutionary track.

2. Before the days of photography (pre ~1890 for astronomy), when astronomers detected a star that did not show up on existing charts, it was labeled as a "new" star. Deep survey images did not exist to show that a much fainter star was the actual source of the "nova" phenomenon. That might explain why astronomers considered them "new."

3. Massive stars burn hydrogen at a much greater rate than do lower mass stars since $L \sim M^4$. Thus, although it has more fuel available for nuclear processing, its lifetime is still proportional to $1/M^3$. The lifetime for nuclear processing therefore decreases very rapidly the more massive a star is.

4. Cepheids make good distance indicators because: (i) they are very luminous, so can be detected to very large distances, much greater than the limit of ~100 parsecs for accurate parallax measurement, (ii) their intrinsic brightness (luminosity) is closely related to their period of variability, which is a simple matter to establish from repeated observations of a Cepheid's apparent brightness.

5. The neutrinos from supernova SN 1987A were produced during the implosion of the stellar core to produce a neutron star, while the light from the subsequent explosion originated when the shock wave from the event reached the star's outer envelope. The delay between detection of the neutrino burst and the light burst represents the actual time delay between when these events took place during the event.

6. Astronomers assume that all stars in a cluster formed at approximately the same time. Since high-mass stars evolve much more rapidly than low-mass stars, when all of the stars in a cluster are plotted in an H-R diagram, there will be some "turnoff point" on the main sequence where massive stars are beginning to evolve into supergiant or red giants. That point correlates exactly with the ages of the stars in the cluster, so a "higher" turnoff point for the main sequence implies a younger star cluster, while a "lower" turnoff for the main sequence implies an older star cluster, whose all of the massive stars have evolved past the main-sequence stage.