# ASTRO 358: QUIZ 2 SOLUTION SET

Note: The solution set provided below often includes information between parentheses. This information is not required for full credit and includes extra details for your edification.

1a. Massive spiral galaxies typically have moderate to high gas fractions and are actively forming stars. Massive elliptical galaxies have little gas, and are not actively forming stars.

1b. A massive spiral typically hosts an outer stellar disk (which is highly flattened), an elongated stellar bar (which is triaxial in shape) and a central bulge (which may be spheroidal or disky). The outer disk of a spiral is more flattened than the stellar component of a typical massive elliptical galaxy.

1c. The Milky Way is a barred spiral galaxy.

1d. Stellar bars drive gas from the outer disk of a spiral galaxy into the central regions (inner kpc) of a galaxy, where the gas piles up and form stars in very luminous episode episodes of star formation (called starbursts). (A more general answer is: stellar bars redistrbute mass and angular momentum in both the baryons (gas and stars) and dark matter in a galaxy.)

2. Many S0s have been found to host a stellar bar: this feature can only be present in a stellar disk. [Another less convinicing answer: The surface brightness profile of many S0 galaxies decreases steeply in the center (like the steep profile of bulges in spirals), but falls much more slowly in the outer region (like the exponential profiles typical of the outer disk of spiral galaxies). This suggests the extended stellar component in some S0s is an outer stellar disk. ]

3a. Stellar disks have $V_c/\sigma > 1$ since they are supported by rotation. SST components, on the other hand, have $V_c/\sigma < 1$ as they are supported primarily by the random motions of stars.

3b. Stellar disks are supported by rotation (i.e., the force of gravity provides the centripetal force).

4a. Along the sequence from Sa to Sc: bulge-to-disk ratio decreases, patchiness increases, and spiral arms become more open.

4b. Such a galaxy would be classified as a late type spiral (Sc) according to its bulge-to-disk ratio, but an early type spiral (Sa) from its lack of patchiness. (The Hubble-Sandage classification sequence assumes all three trends in 4a occur in all galaxies simultaneously and thus, this galaxy does not fall neatly into any of the Hubble-Sandage types.)

5. A merger of two spiral galaxies of similar masses and moderate gas fractions would produce an elliptical galaxy.