You may find it helpful to consult a galactic astronomy text, such as Binney & Merrifield's *Galactic Astronomy*, to determine certain stellar values for this problem set.

- 1. A nearby galaxy is observed with both a direct imaging camera and an optical spectrograph over the wavelength range 3500 8500Å.
 - (a) How would you use the broad band images to determine the galaxy type? Describe the particular features and band-passes which would identify each type (elliptical, lenticular, spiral, irregular). Be thorough, and include sketches.
 (8 pts)
 - (b) How would you use the optical spectrum to determine the galaxy type? Describe the particular spectral features and wavelengths which would identify each type (elliptical, lenticular, spiral, irregular). Be thorough, and include sketches. (8 pts)
 - (c) Name one property of the galaxy, which depends upon our viewing angle, which could have a significant effect in your assessment. (2 pts)
 - (d) Describe, in broad terms, how to adapt your analysis technique for a galaxy at a redshift z of 0.8. (5 pts)
- 2. Consider a 10^{10} M_{\odot} elliptical galaxy made up entirely of M0 V stars.
 - (a) What would be the observed mass to light ratio, and how many stars would there be? (You may assume values of $M = 0.60 M_{\odot}$ and $L = 7.2 \times 10^{-2} L_{\odot}$ for the M0 dwarfs.) (3 pts)
 - (b) How many B0 V stars would you need to add to reduce the mass to light ratio to 2? (You may assume values of $M = 17.50 M_{\odot}$ and $L = 5.25 \times 10^4 L_{\odot}$ for the B0 dwarfs.) (3 pts)
- 3. You determine a period of 30 days for a Type I Cepheid variable, with apparent magnitude 18.7.
 - (a) What is the absolute magnitude of this star? (3 pts)
 - (b) How far away is this star? (3 pts)
 - (c) Where is this star probably located? (2 pts)
 - (d) If you had misidentified this star as a Type II Cepheid, by how much would your distance estimate be in error? (5 pts)