Homework Assignment #1

1. Consider a star with a radius equal to that of the Sun that emits as an ideal blackbody with a temperature of 6000 K and is at a distance of 50 pc.
   (a) What is the absolute bolometric magnitude of this star?
   (b) Calculate the star’s distance modulus and apparent bolometric magnitude.
   (c) Estimate the V-band apparent magnitude.

2. Phillips, prob. 1.6, p. 42.

3. Assuming that each emits a pure blackbody spectrum, determine the $U - B$ and $B - V$ colors of stars with temperatures of 44,500 K (O star), 9,000 K (A star), 6,000 K (G star), and 3,000 K (M star). Assume that the filter response is narrow enough that you can approximate the integral over the spectrum and filter response curve by the value of the Planck function at the central wavelength of the filter times the filter bandwidth. Ignore interstellar dust and the Earth’s atmosphere. Use the flux calibrations for the Johnson photometric system: $f\lambda(0) = 4.22 \times 10^{-9}, 6.40 \times 10^{-9}$, and $3.75 \times 10^{-9}$ erg cm$^{-2}$ s$^{-1}$ Å$^{-1}$ for the $U$, $B$, and $V$ bands, respectively.
   How accurately do the colors need to be measured in order to distinguish between these different stellar classes? Express your answer in terms of the fractional error in flux.

Extra Homework Problem for Graduate Students