

Galactic Astronomy, Spring 2017

PROBLEM SET I

Deadline: 5PM OF WEDNESDAY, MARCH 29, 2017

1. **Distance independent quantity (5%).** Show that a star's effective temperature, T_{eff} , can, in principle, be determined without knowing its distance by expressing T_{eff} as a function of the star's bolometric magnitude, m_{bol} , and its angular diameter, θ .
2. **Star count (10%).** Show that, if the distribution of stars in space is uniform, the distribution of stars over absolute magnitude in a magnitude-limited survey is independent of the survey's limiting magnitude.
3. **Initial luminosity function (15%).** Suppose the star-formation rate in a population varies with time t as $e^{-\alpha t}$, and let the oldest star in the population have formed at $t = 0$. Show that the initial luminosity function, $\Phi_0(M)$, for such a case can be written as

$$\Phi_0(M) = \frac{e^{\alpha t} - 1}{e^{\alpha t_{\min}} - 1} \Phi(M),$$

where $t_{\min} = \min(t, \tau_{\text{MS}})$.