ASTR 367
HW 1

1) $L = 100W$

$L_\odot = 3.846 \times 10^{26} W$

$F_\odot = 1361 \ W/m^2$ (Prša et al, 2016)

$$\frac{100W}{4\pi d^2} = 1361 \ W/m^2 \Rightarrow d = \left(\frac{100}{4\pi \cdot 1361}\right)^{1/2} = 0.076m = 7.6cm$$

2) a) $d = \frac{1}{p} = \frac{1}{0.379''} = 2.64\,pc = 8.15 \times 10^{18}\,cm$

b) $m - M = 5 \log d - 5$

$= 5 \log(2.64) - 5 = -7.89$

3) a) $m - M = 5 \log d - 5 = -2.89$ (from #2)

$M = m + 2.89 = -1.53 + 2.89 = 1.36$

b) $\frac{L_s}{L_\odot} = 10^{0.4(M_\odot - M_s)}$

$M_\odot = 4.75$ (bolometric)

$M_s = 1.36$

$\frac{L_s}{L_\odot} = 10^{0.4(4.75 - 1.36)} = 22.70$

c) $A - 10^4 K$

d) $L = 4\pi R^2 \sigma T^4 \quad \Rightarrow \quad R = \left(\frac{L}{4\pi\sigma T^4}\right)^{1/2}$

$\frac{R_s}{R_\odot} = \left(\frac{L_s}{L_\odot}\right)^{1/2} \left(\frac{T_\odot}{T_s}\right)^2$

$T_\odot = 5800 K$

$\frac{R_s}{R_\odot} = (22.70)^{1/2} \left(\frac{5800}{10^4}\right)^2 = 1.60$

4) Bluer! Hotter!

5) a) $L = A\sigma T^4$

$A = 1.4 \times 10^4 \text{ cm}^2$

$T = 98.6^\circ F = 310\ K$

$\sigma = 5.67 \times 10^{-5} \text{ erg s}^{-1} \text{ cm}^{-2} \text{ K}^{-4}$

$L = 1.4 \times 10^4 \cdot 5.67 \times 10^{-5} \cdot 310^4$

$= 7.33 \times 10^9 \text{ erg s}^{-1}$

b) $\lambda_{max} = \frac{0.2598}{T} \text{ cm} = \frac{0.2598}{310} \text{ cm} = 0.000935 \text{ cm}$

$= 9.35 \text{ mm} - IR$

6) a) Assume $m_{min} = -1$

$$\frac{F_{25}}{F} = 10^{0.4(m - m_{25})}$$

$$= 10^{0.4(-1-25)}$$

$$= 2.51 \times 10^{-12}$$

b) $m - M = 5 \log d - 5$

$$d = \frac{150 \times 10^6 \text{ km}}{3.08 \times 10^{13} \text{ km/pc}} = 4.87 \times 10^{-6} \text{ pc}$$

$$M = -27 - 5 \log (4.87 \times 10^{-6}) + 5$$

$$= 4.56$$

$$m = M + 5 \log (3) - 5$$

$$= 4.56 + 5 \log (3) - 5$$

$$= 1.94$$