Stellar Evolution – Hints to exercises – Chapter 1

1.2 Basic assumptions

(a) $d \approx 6.10^7 R_\odot$, $(R/d)^2 \approx 3 \cdot 10^{-16}$ times weaker.
Hint: Think about mass transfer, collisions, mergers etcetera.

(b) Hint: which stars produce heavy elements and lose a lot of mass?

(c) $a/g \approx 2 \cdot 10^{-5}$ at the equator.

1.3 Mass-luminosity and mass-radius relation

(a) Hint: What temperature is needed to ignite H fusion?

(b) See Section 1.1.

(c) $x \approx 3.8$, $y \approx 0.7$.

(d) Hint: Assume that a constant fraction of the total mass of the star can actually be used as fuel. How much energy can the star produce in total? How much energy does the star radiate away per second? Calibrate your expression knowing that the lifetime for the Sun is $1.0 \cdot 10^{10}$ yr. (N.B. In Exercise 2.5 you will derive an expression for the lifetime from first principles.)

1.4 The ages of star clusters

Hint: What is the luminosity of the most massive star which is still on the main-sequence? Use the mass luminosity relation to obtain the mass, then use your expression for the age of a star a function of its mass.