Astro 321: Problem Set 7

Mass Functions and Bias

Consider the Jenkins et al (2001) mass function:

$$\frac{dn}{d\ln M} = 0.315 \frac{\rho_m}{M} \frac{d\ln\sigma^{-1}}{d\ln M} \exp[-|\ln\sigma^{-1} + 0.61|^{3.8}]\,. \tag{1}$$

and dig out your code for computing $\sigma(M)$ from the previous problem set.

- Modify your code to also calculate $d\ln\sigma^{-1}/d\ln M$. Hint: again start with the tophat in R and compute $d\sigma_R^2/d\ln R$ by differentiating the window under the integral; the rest is just chain-ruling $M(R)$.
- Integrate the mass function above $3\times 10^{14} h^{-1} M_\odot$. What is the number density of such (cluster sized) objects in h^3 Mpc^{-3} in the same cosmology as the previous problem sets?
- The bias as a function of mass is given in Press-Schecter theory as

  $$b(M) = 1 + [\delta_c^2/\sigma^2(M) - 1]/\delta_c\,. \tag{2}$$

  Take δ_c the threshold for spherical collapse to be $\delta_c = 1.68$. Plot $b(M)$ from $10^{11} M_\odot$ to $10^{16} M_\odot$. By integrating over the mass function, find the average bias of objects $> 3\times 10^{14} h^{-1} M_\odot$.