AS2001
Nucleosynthesis and the Chemical Evolution of the Universe
Tutorial 4

Question 1

Assume that the mass distribution of stars created in a typical burst of star formation is described by Salpeter's Initial Mass Function ($\Phi(M) \propto M^{-\frac{7}{3}}$) in the range $0.1M_\odot < M < 20M_\odot$ with no stars produced outside this range. Calculate the fraction of stars which will go supernova (i.e. $M > 8M_\odot$) by number and mass, i.e. calculate $f_N(8M_\odot)$ and $f_M(8M_\odot)$ as defined in the lecture.

Consider a galaxy with a constant star formation rate of 20 $M_\odot$ / year. On average, how many supernovae per year do you expect in this galaxy?

Question 2

From its old stellar population an irregular galaxy is observed to be at least 10 Gyr old. Radio observations show that the gas mass of the galaxy is $7 \times 10^{10} M_\odot$ whereas optical observations yield a total mass of $10^{11} M_\odot$. Assume that a typical burst of star formation lasts for 0.1 Gyr and proceeds at a rate of 100 $M_\odot$ / year. Assume further that 10 % of the mass of a given generation of stars is returned to the ISM. What must have been the average frequency of starbursts in this galaxy? If it continues to form stars like this when will it exhaust 95 % of its gas reservoir?