Randomness in Biology [2014 Aug Term]

Homework 5: Assigned Oct 1. Due Oct 8.

1. Radioactive decay is governed by the following Master equation

$$\frac{d}{dt}p_n = \gamma(-(n)p_n + (n+1)p_{n+1})$$

where *n* represents the number of radioactive nuclei in a lump of uranium, and p_n is the number of lumps with precisely *n* radioactive nuclei. We derived in class that the equation for the mean is:

$$\frac{d}{dt} < n > = -\gamma < n >$$

(a) Derive the equation obeyed by the second moment $< n^2 >$.

(b) Starting with $p_n = \delta(n - n0)$, i.e. only $p_{n0} = 1$, all others are 0, solve for the first and second moments as functions of time.

(c) If we started with a large number of lumps of equal size, at what timepoint would the size of the lumps be most variable in absolute terms?