Biostat 140.668 Problem set 1

Meiosis, recombination, interference

1. Calculate the Haldane map function by brute force (i.e., without using Mather's formula). Use the fact that, under the no interference model, the number of crossovers in an interval of length d Morgans follows a Poisson distribution with mean d.

2. Prove the claim from the proof of Mather's formula:

   If $m|n \sim$ Binomial$(n, 1/2)$, then

$$\Pr(m \text{ is odd}|n) = \begin{cases} 0 & \text{if} \quad n = 0 \\ 1/2 & \text{if} \quad n \geq 1 \end{cases}$$

3. Find a combination of chromatid and chiasma interference such that the locations of crossovers on a random meiotic product still follows a Poisson process.