BIO 434 Assignment 4

1. If a particular locus mutates from Z to z at a rate 3 x 10^{-6} and from z to Z at rate 6 x 10^{-8}, what is the equilibrium allele frequency of Z in an infinitely large population, with no selection or migration?

The frequency is given by $\hat{p} = \frac{\nu}{\mu + \nu} = \frac{6 \times 10^{-8}}{3 \times 10^{-6} + 6 \times 10^{-8}} = 0.0196$.

2. Most protein-coding genes have a forward mutation rate (normal to mutant) that is at least an order of magnitude greater than the reverse mutation rate (mutant back to normal). Why should this be the case?

There are many ways to mutate a gene so that it doesn't work so well. But for every one of those mutations there are only a few ways to fix it to return it to wild type efficiency.

3. What is the equilibrium heterozygosity in a population of effective size 50 if *new* neutral mutations are introduced at rate 10^{-5} by mutation?

$$H = \frac{4N_e\mu}{1 + 4N_e\mu} = \frac{4(50)(10^{-5})}{1 + 4(50)(10^{-5})} = 0.001996.$$