1. (13 points) In a two island model with immigration rates 0.1 and 0.2 into the islands, whose initial gene frequencies of an allele are respectively 0 and 1, what will be the equilibrium gene frequency? (Hint – find a quantity $a$ which has the property that if $p_1$ and $p_2$ are the frequencies of the allele in the two islands that the weighted average $ap_1 + (1-a)p_2$ stays unchanged from one generation to the next. Also see if you can derive an equation for how the quantity $p_1 - p_2$ changes. Then see if you can put all that together to find the equilibrium gene frequency on both islands, in terms of the initial gene frequencies on those islands). Do the genes present initially on the two islands contribute equally to the ultimate gene pool?

2. (12 points) With three alleles, find a set of gene frequencies in two populations which give more heterozygotes than would be expected under Hardy-Weinberg proportions for at least one of the heterozygous genotypes, if we sample from an equal mixture of the two populations, and each is in Hardy-Weinberg proportions.