Semester 1 2012   Lecturer: Michael Stewart

Tutorial Week 7

1. Complete any unfinished work from the week 6 tutorial.

2. If gene frequencies are in Hardy-Weinberg equilibrium, the genotypes AA, Aa and aa occur with $Bin(2, \theta)$ probabilities. Suppose that genotypes are determined for a sample of 190 people, with observed frequencies of each as shown below:

AA	Aa	aa
10	68	112

   Letting x_i equal the number of a's in the genotype of individual i, we model the *original data* $x_1, x_2, \ldots, x_n$ as values taken by $n = 190$ independent $Bin(2, \theta)$ random variables. The table above is a summary of the original data.

   (a) Compute three estimates of θ, based on the counts above:
      i. $\hat{\theta}_1 = \frac{1}{2}\bar{x}$ where $\bar{x}$ is the mean of the *original data*;
      ii. $\hat{\theta}_0 = 1 - \sqrt{n_0/n}$ where n_0 is the observed number of zeroes (i.e. of AA's);
      iii. $\hat{\theta}_2 = \sqrt{n_2/n}$ where n_2 is the observed number of twos (i.e. of aa's).
   (b) Obtain standard errors for each estimate obtained above (see Lecture 20).