Assignment #12

Due on Wednesday, April 21, 2010

Read Chapter 6 on *Modeling Bacterial Resistance* in the class lecture notes, starting on page 65, at `http://pages.pomona.edu/~ajr04747/`

Read on *The* χ^2 *distribution* in Allman and Rhodes (pp. 234–237).

Do the following problems

1. It is proposed to fit the Poisson distribution to the following data

x	0	1	2	3	$x \geqslant 4$
Frequency	20	40	16	18	6

   (a) Compute the corresponding chi–square goodness of fit statistic
   Suggestion: In estimating the mean of the distribution assume that $P(X \geqslant 4)$ can be approximated by $P(X = 4)$.

   (b) How many degrees of freedom are associated with the chi–square distribution used in this test?

   (c) Do the data support the rejection of the Poisson model?

2. The Mendelian *Principle of Segregation* in Genetics states that "parents pass on each of their alleles to progeny separately and with equal likelihood," see page 234 in Allman and Rhodes. Consider the classical problem from Mendelian genetics of crossing two types of peas.

   (a) round and yellow;
   (b) wrinkled and yellow;
   (c) round and green; and
   (d) wrinkled and green

   (i) Use the Principle of Segregation to determine the probabilities for each of the classifications.

   (ii) Suppose that from 160 independent observations the frequencies of the respective classifications are 86, 35, 26 and 13. Are these data consistent with the Mendelian theory? Justify your answer.

3. A certain genetic model suggests that the probabilities of a particular trinomial distribution are $p_1 = p^2$, $p_2 = 2p(1-p)$ and $p_3 = (1-p)^2$, respectively, where

$$0 < p < 1.$$

If X_1, X_2 and X_3 represent the respective frequencies in n independent trials, explain how we could check the adequacy of the genetic model.

4. Problem 6.2.22 on page 242 in Allman and Rhodes.

5. Problem 6.2.24 on pages 242 and 243 in Allman and Rhodes.