Lab 1 — Statistics for Laboratory Scientists II

Due: 12 Apr 2006

Note: The data are available as comma-delimited files at the following:

`http://www.biostat.jhsph.edu/~kbroman/teaching/labstat/fourth/labs.html`

1. (Taken from Sokal and Rohlf, *Biometry*, 3rd ed., pg 699)
   In a cross between two varieties of the bean *Phaseolus vulgaris* [Smith, *Hilgardia*, 12:553–621, 1939], the following counts for 8 phenotypes were obtained:

Phenotype	**count**
Purple/buff	63
Purple/testaceous	31
Red/buff	28
Red/testaceous	12
Purple	39
Oxblood red	16
Buff	40
Testaceous	12
Total	**241**

   Is there evidence *against* the hypothesis that the underlying frequencies are in the following ratios?

   18 : 6 : 6 : 2 : 12 : 4 : 12 : 4

   (a) Calculate the LRT and χ^2 test statistics.

   (b) Obtain P-values using the appropriate asymptotic approximation.

   (c) Obtain P-values by computer simulation using the R function `rmultinom()`.

   (d) What do you conclude?

2. (Data from Carroll, *J Med Entomol* 38:114–117, 2001)

   Consider the following data, used as an example in the very first lecture in the first term of this course. (A tick was placed on a clay island surrounded by water, with two capillary tubes: one treated with deer-gland-substance and one untreated. The choice of tube that each tick made was noted.)

Tick sex	**Leg**	**Deer sex**	**treated**	**untreated**
male	fore	female	24	5
female	fore	female	18	5
male	fore	male	23	4
female	fore	male	20	4
male	hind	female	17	8
female	hind	female	25	3
male	hind	male	21	6
female	hind	male	25	2

   Is there evidence for a difference among the 8 experimental conditions in the probability that the tick chooses the treated tube?

   (a) Apply a χ^2 test.

   (b) Apply a likelihood ratio test.

   (c) Apply Fisher's exact test.

   (d) What do you conclude?