Biology 4605/7220 Name Key
Quiz #9c 20 November 2002

1. Austin and Clarke (1991 *Journal of Dairy Research* 58:219-229) investigated the calcium ion activity in cooled and aged reconstituted and recombined milks. They measured calcium ion activity and pH for 5 samples taken in each of 18 categories resulting from 3 categories of milk composition and 6 categories of heat treatment. Does calcium ion activity depend on pH, composition, and heat treatment? Assign symbols to variables. Assuming no interaction terms, write a general linear model to address this question.

Name	Symbol
Calcium ion activity	[Ca]
milk composition	Mtype
heat treatment	trt
pH	pH

Source	df
Mtype	2
trt	5
pH	1
error	81
total	89

GLM $[Ca] = \beta_o + \beta_{Mtype} \cdot Mtype + \beta_{trt} \cdot trt + \beta_{pH} \cdot pH + error$

Complete the first two columns of the ANOVA table (above).

2. For a 2 allele locus we let p = frequency of one allele in the parental generation, and q = 1 – p = the frequency of the other allele. At Hardy Weinberg equilibrium, the expected proportion of homozygous and heterozygous offspring is given by
$\hat{p} = (p+q)^2 = (p^2 + q^2) + 2pq$
where $(p^2 + q^2)$ is the expected frequency of homozygous offspring
2pq is the expected frequency of heterozgygous offspring.

For 1000 offspring, compute the expected proportion ($\hat{p}$) of homozygous and heterozygous offspring at Hardy-Weinberg equilibrium, when p = 0.2 in the parents. Compute the expected frequency $\hat{f} = 1000\,\hat{p}$.

$\hat{p}$ =		$\hat{f}$ =	
0.68	homozygous	680	
0.32	heterozygous	320	

3. Compute the goodness of fit G for the following frequencies of offspring relative to Hardy -Weinberg equilibrium with p = 0.7 in the parents.

$G = 2\,\Sigma\, f \ln(f/\hat{f})$ where $\hat{f}$ is the value expected from theory.

$$G = 2\left(480 \ln\left(\frac{480}{420}\right) + 520 \ln\left(\frac{520}{580}\right)\right) = 14.62$$

Expected $\hat{f}$	Observed f	
420	480	heterozygous
580	520	homozygous