Biology 4605/7220 Name Key
Quiz #8b 12 November 2003

The General***ized*** Linear Model allows one to use non-normal errors.
Generalized Linear models are written as follows.

Identity Link: $Response = \mu + \varepsilon$

Log Link: $Response = e^{\mu} + \varepsilon$

Logit Link: $\frac{p}{1-p} = e^{\mu} + \varepsilon$

Power Link: $Response = \mu^{k}$

Error is	Canonical link is
Normal	Identity
Poisson	Log
Binomial	Logit

where μ is the systematic or structural model ($\beta_o + \beta_1 X_1 + \beta_2 X_2 \ldots etc$) ϵ is the error, and the canonical link is the link typically used with a particular error type.

1.Obligate cave-dwelling organisms (troglobytes) are potentially interesting models for a number of evolutionary questions, including those of population genetics. One question is the extent to which apparently isolated cave populations contain genetically-differentiated populations, and how cave populations are genetically related to surface populations. Kane et al (1992 *Evolution* 46: 272-278) studied 10 populations of the amphipod *Gammarus minus* and generated (in part) the following data:

Population	Gene Locus ACO-1		
	AA	Aa	aa
Spring	40	15	2
Cave	13	18	7
Cave 2	8	13	4

1a. Compute the odds of being heterozygous (Aa) for the spring and cave 2 populations.

	Spring	Cave 2	Odds ratio
Heterozygous	15/42	13/12	(13*42)/(12*15)

1b. Compute the odds ratio for Cave 2 relative to spring.

1c. Write a generalized linear model to test whether the odds of being heterozygous differ between all three populations.

$Odds = \frac{p}{1-p} = e^{\mu} + \varepsilon$ $\quad \ln Odds = \mu = \beta_o + \beta_{Pop} \cdot Pop$

1d. Complete the first two columns of the analysis of deviance table for your model. ---------->

Source	df
Intercept	1
Pop	2

2. An earth scientist is interested in the mineralogic composition of the schist on the Canadian shield . She obtains 45 samples, 5 at each of 3 depths in each of 3 types of schist. Define a symbol for the odds of finding garnet in each group of 5 samples. Write a generalized linear model to analyze whether the odds of finding garnet depends on schist type and depth in the bed.

$Odds = \frac{p}{1-p} = e^{\mu} + \varepsilon$ $\quad \mu = \beta_o + \beta_{Depth} \cdot Depth + \beta_{Type} \cdot Type + \beta_{Type*Depth} \cdot Type \cdot Depth$