Biometry Take Home Exam 2

Spring 2010

Name:______________________________

Instructions: A copy of this exam (exam2.pdf) and data sheets (exam2data.xls) are on the class website. The worksheets are in the same order, left to right, as the exam questions below, top to bottom. In writing up each question, pretend that these are your data and that you're preparing your analysis for a talk at the upcoming CEEB symposium. Attending the symposium are several prominent keynote speakers from outside UK, and you would very much like to impress them with the fact that you would make an excellent future postdoc in their laboratories. With that in mind, be sure to make your analysis as clear as possible. Include in your write up your model statements (from full to whatever model you're left with, reduced or not), your summary statistical tables, graphs that drive home your results, and your conclusions based on the data and hypotheses at hand.

1. Partridge and Farquhar (1981) undertook a study of costs of male reproduction in the fruit fly, *Drosophila melanogaster*. They hypothesized that males would invest more energy in reproduction the more females there were to mate with, and if those females were virgins as opposed to pregnant, and that this increased energy expenditure would shorten their reproductive lifespan. They used 5 experimental treatments: No Females, 1 Pregnant Female, 8 Pregnant Females, 1 Virgin Female, and 8 Virgin Females. Previous research had indicated that male longevity is positively correlated with male body size (thorax length), so they measured male thorax length as a covariate in their data. Your task is use ANCOVA to analyze their data, which are contained in the Longevity vs Mating Number worksheet in your excel file.

2. A high school intern (Paul Laurence Dunbar Math, Science and Technology Center) undertook a project that examined the ontogeny of sexual dimorphism in the livebearing fish, *Limia perugia*, and quantified this as caudal peduncle depth versus standard length. She was particularly interested in modeling this sexual dimorphism with the allometric equation: $Y = b_0X^{b1}$, where Y is caudal peduncle depth and X is standard length. B1 is called the "allometric coefficient," and its magnitude indicates positive allometry ($b_1 > 1$, isometry ($b_1 = 1$) and negative allometry ($b_1 < 1$). Although these parameters (b_0, b_1) can be estimated by nonlinear regression, Eakin took advantage of the fact that taking logs of both sides of this equation makes it linear: $\log Y = \log b_0 + b_1 \log X$, and that the "allometric coefficient," b_1, can be estimated as the slope of the log-log linear regression line. A snapshot of her data are in the Sexual Dimorphism worksheet in your excel file, where she presents data for a cohort of juveniles about halfway to their final adult body size. Your job is to determine whether or not for this snapshot of her data the two sexes are dimorphic in their allometric coefficients for caudal peduncle depth versus standard length.

3. Paruelo and Laurenroth (1996) are interested in whether or not the relative abundance of C3 versus C4 plant species (logC3) depends on latitude, longitude and their interaction. Your task it analyze their data with multiple regression (note that General Linear Model procedures easily accommodate interaction terms, and use OLS to estimate your partial regression coefficients). Is there collinearity in your analysis? Can you deal with it, and still answer their question?

4. Jafaar et al (unpublished) are interested in whether or not male sexual harassment (forced male mating attempts per minute per female) affects female survival in the western mosquitofish, *Gambusia affinis*. They divided females into two treatments: high harassment (1.7 forced mating attempts/min) versus low harassment (0.9 forced mating attempts per min), and included body size (log initial weight) as a covariate. Use logistic regression, or a Generalized Linear Model with proper linking function to analyze your data.