BIO 300 ASSIGNMENT #12

NOTE: This assignment is to help you study for the final exam and **will not be graded**; however, you are responsible for knowing how to do the problems.

1. A researcher was interested in the relationship between cell size and genome size in reptiles. In a literature search she found means for both cell size and genome size in 70 different reptile species. She used these 70 means to estimate the correlation between cell size and genome size.

   (a) Can the researcher assume that the 70 observations are independent?
   (b) After correcting for the problem in (a), using the method of independent contrasts, she calculated a sample correlation of $r = 0.55$ between contrast in cell size and contrast in genome size. Calculate a 95% confidence interval for the true (population) correlation. (Note: Correction has resulted in a sample size of $n = 69$ contrasts in cell size and genome size, one less than the original 69 species).
   (c) What assumptions are necessary to produce the confidence interval in (b)?

2. Mice that lack CD40 (a gene expressed on B-cell lymphocytes) are unable to make IgG antibody responses. A recent experiment tested whether IgG function can be restored in CD40 knockout mice by injecting soluble CD40 in vitro. The following are serum antibody titres for 12 knockout mice before and after injection with CD40:

Serum antibody titres

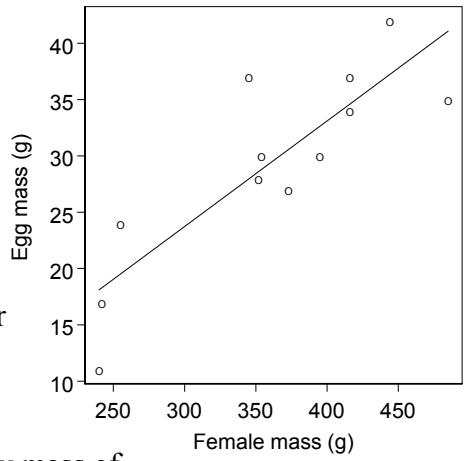
Before injection	After injection with CD40
108	773
121	331
102	627
109	817
62	623
95	608
138	530
104	480
103	629
68	757
59	985
73	851

a) Did mean serum antibody titres in CD40 knockout mice increase after injection? Test this using the most powerful test available, making all necessary assumptions
b) What assumptions did you make in (a)?
c) Suggest an improvement to the design of this experiment.
d) Test whether the two measurements are correlated. Assume that the standard parametric assumptions of linear correlation **cannot** be met.

3. A biologist studying a bird of prey compared body mass of a random sample of individual females with the total mass of eggs laid. The data are presented below.

Egg mass (g)	37	30	42	27	34	11	24	35	37	17	28	30
Female mass (g)	345	395	444	373	416	240	255	485	416	242	352	354

a) Estimate the linear regression equation to predict egg mass from female mass. Provide an R^2 for your estimate.
b) Test the null hypothesis of zero slope in (a).
c) What assumptions are you making in (b)?
d) Is the above regression a random effects or a fixed effects? Explain
e) Use the equation to predict mean egg mass of females weighing 300 g. Provide a standard error for your prediction.
f) Calculate a 95% confidence interval for your prediction in (e).
g) What method would you use to predict mean body mass of females having a 40g egg mass?



4. Consider the 2-factor analysis of variance (ANOVA):

(a) For analysis of what kind of experiment is the 2-factor ANOVA more appropriate than the single-factor ANOVA?
(b) What are the null hypotheses tested in a 2-factor ANOVA?
(c) What are the assumptions of 2-factor ANOVA?
(d) What steps would you take in (c) to ensure that the assumptions are met?

5. Do births occur as frequently on weekends as on weekdays? At a western hospital there was a total of 932 births in 20 consecutive weeks. Of these births, 216 occurred on weekends. Does this number deviate significantly from the random expectation?

6. A researcher wanted to know whether individuals of a particular species of cricket are randomly distributed over a large study area. What procedure would you recommend the researcher use to test this?