# BIOL 300 Assignment 9, Spring 2012

## Chapter 13

16. *not assigned*: **(a)** We will use the Mann-Whitney U test for this. There are no ties for the PHA response, so assigning ranks is easy. $R_1 = 146$, $n_1 = 10$, $n_2 = 10$, so $U_1 = 9$, $U_2 = 91$, and $U = 91$. The critical value for $\alpha = 0.01$ for 10, 10 is 84, so $P < 0.01$.
    *assigned*: **(b)** The Mann-Whitney U test : $R_1 = 132$, $n_1 = 10$, $n_2 = 10$, so $U_1 = 23$, $U_2 = 77$, and $U = 77$. The critical value for $\alpha = 0.05$ for 10, 10 is 77, so $P = 0.05$.
    *not assigned*: **(c)** We assumed that the shapes of the two distributions were similar, which is supported by looking at the histograms for each group.

20. **(a)** Both distributions are roughly normal (not too skewed, probably), but the variance for the Kokanee is much greater than for the sockeye. Therefore, we could use Welch's *t*-test. The variance increases as the mean increases, so the log transformation might help.
    **(b)** With a log transformation, the standard errors are roughly equal, so we can use a two-sample *t*-test. $t = 12.1$, $df = 33$, $P < 0.0001$. We can reject the null hypothesis that these two have the same skin color.

21. **(a)** The log-transformed data are approximately normal with roughly equal standard deviations, so we can use a two-sample t-test. $s^2_p = 1.56$; $SE_{\bar{X}1-\bar{X}2} = 0.250$. $t = 5.30$, with 162 *df*. $P < 0.00002$. Yes, babies differ in their exposure to smoke.
    **(b)** If we back-transform the numbers, we see means of 3.53 to 13.20, for a ratio of 3.7 times more exposure in the less-strict households.
    **(c)** This is an observational study. (Babies were not assigned randomly to smoking or non-smoking households.)

22. **(a)** This distribution is skewed left, so the one-sample *t*-test is not appropriate. We can use the sign test instead.
    **(b)** 13 of the 15 samples have positive correlations, so we can calculate the probability of 13 of 15, 14 of 15, and 15 of 15 under the null hypothesis that positive and negative correlations are equally likely using the binomial distribution: $\Pr[13] = \binom{15}{13} 0.5^{15} =$ 0.0032. Summing the probabilities for 13, 14, 15 together, then multiplying by 2 (two-tailed test), we find that $P = 0.0074$, so we can reject the null hypothesis.

## Chapter 14

16. **(a)** Blocking. **(b)** Reduce sampling error (by eliminating the effect of date on the response variable).

19. Experimental studies randomly assign treatments to experimental units, reducing bias by breaking associations between confounding variables and the explanatory variable. This allows the causal relationship between the explanatory and response variables to be assessed. Random assignment is not possible in observational studies, and therefore they can never completely eliminate the effects of confounding factors.