BIO 300 ASSIGNMENT #6

NOTE: This assignment is to help you study for the midterm on Thursday, October 28th and **will not be graded**.

Midterm study aids:
Example midterm: http://www.zoology.ubc.ca/~bio300b/midterm98withanswers.pdf
Formula sheet: http://www.zoology.ubc.ca/~bio300b/formulas.pdf
Study notes on the binomial distribution: http://www.zoology.ubc.ca/~bio300b/binomialnotes.html
Notes on the Poisson distribution: http://www.zoology.ubc.ca/~bio300b/poissonnotes.html
Readings in Zar and other links: http://www.zoology.ubc.ca:80/~bio300b/zar-4thedition-readings.html

1. Fifteen of 174 randomly-sampled individuals from a human population were found to be left handed.

   (a) Estimate the proportion of left-handed individuals in the population.
   (b) Calculate a standard error for this estimate.
   (c) Calculate an approximate 95% confidence interval for the proportion of left-handed individuals in the population.
   (d) What theorem justifies the use of the normal approximation in (c)?
   (e) Provide a general statement of this theorem.
   (f) Why would you recommend caution in interpreting the interval in (c)?

2. A nutritional study was carried out on laboratory rats to see whether they can detect and prefer a balanced protein diet. 72 rats were randomly sampled from a lab population. All were placed in separate cages, and were given a steady supply of two food types. Food A provided a balanced protein diet, while food B was identical except it lacked one essential amino acid. The foods were otherwise indistinguishable by colour and texture. After a period of several weeks, 44 of the 72 rats were found to prefer food A (the balanced diet), while the remainder preferred food B. With these data, test whether rats significantly preferred the balanced diet.

3. Two populations of sugar maple trees were compared for susceptibility to acidic soils. One population (Dorval) was a genetically modified strain, whereas the other population (Gaspé) was unaltered. Individual saplings of the two types were planted at random locations in a forest plot having acidic soil (pH=5.5). After three years of growth, the following data were obtained:

Survival	**Population**	**Frequency**
Survived	Dorval	41
Did not survive	Dorval	58
Survived	Gaspé	27
Did not survive	Gaspé	67

   (a) Test whether or not survival rates of the two populations differed in the acidic soil.
   (b) Assume that you were unable to reject H_0 in (a) above. Are you justified in concluding that the genetic modification had no influence on survival? Why or why not?

4. Female mammals have a pair of X-chromosomes in each somatic cell. One of these is randomly inactivated during development, such that each cell experiences only a single dose of X-linked genes. (Male mammals possess only a single X chromosome, so inactivation is not an issue). In a recent experiment with mice, researchers tested whether transcription of X_{ist}, a gene residing on the X chromosome, is necessary for normal X inactivation. They recorded activity of X-linked genes in tissues whose cells each contained one X chromosome with a normal X_{ist} gene and a second X chromosome with a X_{ist} gene whose transcription was experimentally disabled. Relative RNA levels (a measure of gene expression) in 5 independent tissue cultures were recorded as: 88.9, 65.8, 64.7, 72.5, 53.9. Mean relative RNA levels in normal tissues is known to be exactly 50. With these data, test whether or not disabling X_{ist} transcription affects expression of X-linked genes. State your assumption(s).

5. In a study of osmoregulatory physiology in coho salmon, blood sodium levels were measured in 10 randomly selected salmon following 24 hr. exposure to seawater. For each blood sample, two replicate blood sodium concentrations were determined (in µg/µl). With these data, compute a 95% confidence interval for blood sodium concentration in the salmon population following exposure to seawater. State your assumption(s).

Fish No.	**Blood sodium level** (µg/µl)
1	147, 145
2	152, 150
3	156, 153
4	143, 143
5	155, 153
6	160, 159
7	159, 155
8	153, 151
9	145, 150
10	152, 154