Homework 1

QSCI 482: Hypothesis Testing & Estimation for Ecologists & Resource Managers

1. Evaluate or simplify the following expressions, either numerically or symbolically as appropriate.

[a] $7 \times 2^2 - 3(2.2 - 1.7)$

[b] $ln\ 7.3$

[c] $e^{2.31}$

[d] $ln(4.5\ X^2)$

[e] $e^{[\ln 5]}$

[f] if $f(X) = 1.75 \cdot X^{1.7}$, find $f(1.95)$

2. Often, a data set is described symbolically as X_1, X_2, …, X_n, representing the order in which the data were collected. Using the following data set: 14.0, 10.2, 12.8, 11.9, 15.2, 11.9, 14.7, (X_1, X_2, …, X_n, respectively) compute:

[a] $\sum_{i=1}^{3} 2X_i^2$.

[b] $\sum_{i=4}^{7} (X_i - i)$

[c] $\sum_{i=1}^{3} X_i X_{i+1} - i$

[d] $\sum_{i=5}^{7} (X_i - 2)/X_i$

[e] $\sum X$

[f] $\overline{X}$

[g] $\sum X^2$

[h] $\left(\sum X\right)^2$

[i] $\sum \left(X - \overline{X}\right)^2$.

3. The population of body weights for a small mammal is normally distributed with a population mean of 33.0 g [grams] and a population standard deviation of 6.5 g. (Consult Appendix Table B.2 in Zar.)

[a] What is the probability that an individual drawn at random from this population has a weight of at least 39 g?

[b] What is the probability that an individual drawn at random from this population will have a weight less than 39 g?

[c] What proportion of this population has a weight between 22 and 44 g?

4. Consider a certain population of insects. The body weights for this species are distributed as a normal random variable with a population mean (μ) of 127 mg [milligrams] and a population standard deviation (σ) of 22.1 mg.

[a] If a random sample of size 20 is drawn from this population, what is the probability that the sample average will be between 125 and 129 mg?

[b] How large a sample size would one have to take to end up with a standard error of the mean no greater than 2.5 mg?

APPENDIX TABLE B (*Continued*)

Logarithms

$\log_a a^x = x,\ a^x \geq 0$
$\log_a xy = \log_a x + \log_a y$
$\log_a b^x = x \log_a b$
$\log_a (x/y) = \log_a x - \log_a y$
$\log_a 1 = 0$
$\log_a a = 1$

Note that logarithms are not defined for negative quantities.

$\log_{10} \pi = 0.497\ 149\ 873$
$\log_e \pi = 1.144\ 729\ 886$

Change of base
$\log_a x = \log_b x / \log_b a$
$\log_{10} x = \log_e x / \log_e 10$
$\log_e x = 3.302\ 585\ 093 \log_{10} x$
$\log_{10} x = 0.434\ 294\ 482 \log_e x$

Summation relationships

$$\sum_{i=1}^{n} Y_i = Y_1 + Y_2 + \cdots + Y_n$$

$$\sum_{i=1}^{n} Y_i = \sum_{i=1}^{k} Y_i + \sum_{i=k+1}^{n} Y_i$$

$$\sum_{i=1}^{n} cY_i = c \sum_{i=1}^{n} Y_i \text{ where } c \text{ is a constant}$$

$$\sum_{i=1}^{n} c = nc$$

$$\sum_{i=1}^{n} (X_i + Y_i) = \sum_{i=1}^{n} X_i + \sum_{i=1}^{n} Y_i$$

Helpful hints for Q.1 & 2

Source:

Avery, TE and HE Burkhart. 2002. Forest Measurements. McGraw-Hill Co.