Mathematics & Statistics in Forest Science

PROBLEM SET 1

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

[a] $4 \times 3^2 - 3(2.2 - 0.9)$ [c] $e^{2.131}$ [e] $e^{[\ln 3.1415]}$

[b] ln 100.3 [d] $ln(2.5\ X^2)$ [f] if $f(X) = 3.75 \cdot X^{0.7}$, 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: 13.0, 9.2, 11.9, 10.7, 14.0, 10.9, 13.8, (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] $\sum X$

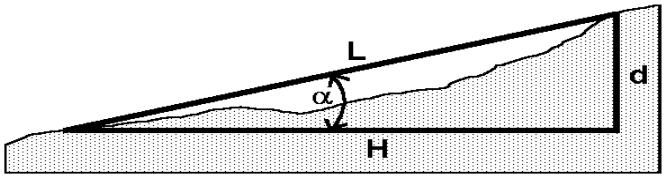
[f] $\bar{X}$

[g] $\sum X^2$

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

[i] $\sum (X - \bar{X})^2$.

3. You traveled upslope and away from your crew partner for some distance. The two of you held taught a measuring tape spanning the distance to find it measured exactly 110 feet (see "L" in figure below). You then determined the angle (alpha) from horizontal at which the tape was being held and found it to be 17 degrees. Find the Horizontal component (H) of your distance traveled. (Note: segment d is perpendicular to segment H.)



4. The following data (in.) representing tree trunk diameter at breast height (DBH, i.e., diameter at 4.5 ft above general ground level) were collected from a randomly sampled group of 19 trees in a forest.

4.3, 9.3, 5.7, 13.3, 4.8, 15.9, 3.6, 3.9, 6.7, 6.5, 7.5, 8.7, 8.9, 4.6, 5.9, 4.2, 4.6, 6.1, 5.7

Find the mean, the variance, the standard deviation, and the standard error.

5. Thirty (30) eucalyptus trees were chosen at random from a plantation and measured for height. The sample data yielded a sample mean of 40 meters with a standard deviation of 2.5 meters. Derive a 90% confidence interval for the population mean height of eucalyptus trees in this plantation.

Logarithms

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

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
$\log_a x = \log_b x / \log_b a$
$\log_{10} x = \log_e x / \log_e 10$
$\log_e x = \log_{10} x / \log_{10} e$
$\log_e x = 2.302\ 585\ 093 \log_{10} x$
$\log_{10} x = 0.434\ 294\ 482 \log_e x$

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.