

Name: Kay

FO-2133 Forest Measurement
Exam 1 - 2007

TREE #	DBH	Hgt	Hgt ²
1	11.2	76	5776
2	12.0	78	6084
3	12.1	79	6241
4	12.2	81	6561
5	12.3	82	6724
6	12.6	85	7225
7	13.2	88	7744
8	13.6	89	7921
9	13.6	90	8100
10	14.0	92	8464
Sum	126.8	840.0	70840.0
Mean	12.68	84	

	Y	X	Y ₂	X ₂	XY	(Y- \bar{Y}) ₂
	4.33073	0.08929	18.75525	0.00797	0.38667	0.00038
	4.35671	0.08333	18.98091	0.00694	0.36306	0.00058
	4.36945	0.08264	19.09207	0.00683	0.36111	0.00037
	4.39445	0.08197	19.31118	0.00672	0.36020	0.00000
	4.40672	0.08130	19.41917	0.00661	0.35827	0.00001
	4.44265	0.07937	19.73715	0.00630	0.35259	0.00024
	4.47734	0.07576	20.04654	0.00574	0.33919	0.00007
	4.48864	0.07353	20.14786	0.00541	0.33005	0.00004
	4.49981	0.07353	20.24829	0.00541	0.33087	0.00002
	4.52179	0.07143	20.44657	0.00510	0.32298	0.00000
Sum	44.28828	0.79214	196.18501	0.06303	3.50500	0.00172
Mean	4.42883	0.07921				
CSS=SS_i			0.03982	0.00028	-0.00326	

s ²	31.11
s	5.58
s _{xbar}	1.767
t	2.262
half CI	3.98
SE%	4.95%
CV%	6.61%

$b_1 = -1.64 = \frac{-0.00326}{0.00028}$
 $b_0 = 5.35 = \frac{4.42 - (-1.64)(0.07921)}{1 - \frac{0.00172}{0.03982}}$
 $s_{y,x} = 0.0147 = \sqrt{\frac{0.00172}{9}}$

1. Using the data and partial computations above, compute the variance, standard deviation, standard error of the mean, half of a 95% confidence interval, sampling error, and coefficient of variation for the height (Hgt) data on 10 sample trees.

- a. variance = $\frac{70840.0 - (84)(840)}{10-1} = 31.11$ (5)
- b. standard deviation = $\sqrt{31.11} = 5.58$ (5)
- c. standard error of the mean = $\sqrt{\frac{31.11}{10}} = 1.76$ (5)
- d. t-value for 95% CI = $(9, .05) = 2.262$ (5)
- e. half the 95% CI = $(1.76)(2.262) = 3.98$ (2)
- f. 95% sampling error = $\frac{3.98}{84} = 4.75\%$ (2)
- g. coefficient of variation = $\frac{5.58}{84} = 6.64\%$ (1)

Name: Key

2. Using the data and partial computations above, compute a regression equation for the model:

$$\ln(hgt) = b_0 + b_1 (dbh^{-1})$$

A. The resulting linear equation is: $\ln H = 5.35 - 11.64 (DBH^{-1})$ (10)

B. The Index of Fit for the equation is: 0.957 (5)

C. The Standard Error of the Regression Estimate is: 12.0147 (5)

D. The resulting non-linear equation is: $H = 211.61 e^{(-\frac{11.64}{dbh})}$ (5)

3. Define the following terms:

A. DBH is: diameter db. at 4 1/2 ft from ground on high side. (5)

B. basal area is: cross sectional area of tree at breast height expressed in square feet. (5)

4. The quadratic mean dbh of the 10 sample trees in the data set is: 12.71 (5)

$$\sqrt{\frac{\sum dbh^2}{n}} = \sqrt{\frac{1614.9}{10}} = 12.71$$

5. Height measurement:

You just checked your Suunto clinometer with the peg method and found the double-error between 2 trees was -7.2 ft at a distance of 90 ft.

$$\frac{-7.2}{2} / 90 = -.04$$

A. The percent error of the clinometer is computed (1) to be: -4 % (5)

Using the percent scale, you measure the total height of one of the peg-method trees at the specified distance above.

the reading at the top = +95 ft
the reading at the ground line = +5 ft

$$H = (+.04) \left[\frac{90}{10} \right] [90-5]$$

B. The correct height of the tree is computed to be: 79.56 = 80 ft (10)

6. A growth sample tree was measured as follows:

dbh = 12.5 inches; 1x-bark thickness = 0.75 inches; 10 year radial growth = 0.80 inches
single bark thickness = 0.03 + 0.05(dbh_{ib})

A. The past dbh of the tree was: 10.4 inches (5)

$$\begin{array}{r} 12.5 \\ - 2(0.75) \\ - 2(0.80) \\ \hline dbh = 9.4 \end{array}$$

B. dbh growth for 10 years was: 2.1 inches (5)

$$\begin{array}{r} 1x bark 0.03 \\ + 1.47 \\ \hline 1.50 \end{array}$$

7. The basal area of a tree that is 12.5 inches dbh is: 0.852 ft² (5)

$$\begin{array}{r} dbh = 9.4 \\ + 1.2 \\ \hline 10.4 \end{array}$$

8. The Girard Form Class of a tree with a dbh = 16.0', dob at 17.0 ft = 14.8", dib at 17.0 ft = 13.6" is computed to be: 85 % (5)

$$\frac{13.6}{16.0} \times 100 = 85$$

Equation Formula Sheet

$$\bar{x} = \frac{\sum_{i=1}^n x_i}{n}$$

$$s^2 = \frac{\left[\sum_{i=1}^n x_i^2 - \frac{(\sum_{i=1}^n x_i)^2}{n} \right]}{(n-1)}$$

$$s^2 = \frac{\left[\sum_{i=1}^n x_i^2 - \bar{x} \sum_{i=1}^n x_i \right]}{(n-1)}$$

$$s = \sqrt{s^2}$$

$$CV\% = \left(\frac{s}{\bar{x}} \right) (100)$$

$$s_{\bar{x}} = \sqrt{\frac{s^2}{n} \left(1 - \frac{n}{N} \right)}$$

$$\bar{x} \pm (t_{\alpha, n-1}) s_{\bar{x}}$$

$$SE\% = \left(\frac{t_{\alpha, n-1} s_{\bar{x}}}{\bar{x}} \right) 100\%$$

$$SS_y: \sum y^2 = \sum Y^2 - \frac{(\sum Y)^2}{n}$$

$$b_1 = \frac{\sum xy}{\sum x^2} = \frac{SP_{xy}}{SS_x}$$

$$SS_x: \sum x^2 = \sum X^2 - \frac{(\sum X)^2}{n}$$

$$b_0 = \bar{Y} - b_1 \bar{X}$$

$$SP_{xy}: \sum xy = \sum XY - \frac{\sum X \sum Y}{n}$$

$$TSS \quad SS_y = \sum y^2$$

$$ESS = \sum (Y - \hat{Y})^2$$

$$RSS \quad \frac{(SP_{xy})^2}{SS_x} = \frac{(\sum xy)^2}{\sum x^2} = b_1^2 \sum xy$$

$$I^2 = \left(1 - \frac{\text{Error SS}}{\text{Total SS}} \right)$$

$$S_{y,x} = \sqrt{\frac{\sum (Y - \hat{Y})^2}{n-2}} = \sqrt{\frac{ESS}{n-2}} \quad S_{y,x} = \sqrt{\frac{\sum y_i^2 - b_1 \sum xy}{n-2}} = \sqrt{\frac{ESS}{n-2}}$$

$$\text{height} = \left(1 - \frac{\% \text{ error}}{100} \right) \left[\frac{\text{horizontal distance}}{\text{index distance}} \right] (\text{Reading@top} - \text{Reading@bottom})$$

Student's t-Table

The Distribution of t

df	Probability = α								
	0.5	0.4	0.3	0.2	0.1	0.05	0.02	0.01	0.001
1	1.000	1.376	1.963	3.078	6.314	12.706	31.821	63.657	636.619
2	0.819	1.061	1.386	1.886	2.920	4.303	6.965	9.925	31.598
3	0.765	0.978	1.250	1.638	2.353	3.182	4.541	5.841	12.941
4	0.741	0.941	1.190	1.533	2.132	2.776	3.747	4.604	8.610
5	0.727	0.920	1.156	1.476	2.015	2.571	3.365	4.032	6.856
6	0.718	0.906	1.134	1.440	1.943	2.447	3.143	3.707	5.959
7	0.711	0.896	1.119	1.415	1.895	2.365	2.998	3.499	5.405
8	0.706	0.889	1.108	1.397	1.860	2.306	2.896	3.355	5.041
9	0.703	0.883	1.100	1.383	1.833	2.262	2.821	3.250	4.781
10	0.700	0.879	1.093	1.372	1.812	2.228	2.764	3.169	4.587
11	0.697	0.876	1.088	1.363	1.769	2.201	2.718	3.106	4.437
12	0.695	0.873	1.083	1.356	1.782	2.179	2.681	3.055	4.318
13	0.694	0.870	1.079	1.350	1.771	2.160	2.650	3.012	4.221
14	0.692	0.868	1.076	1.345	1.761	2.145	2.624	2.977	4.140
15	0.691	0.866	1.074	1.341	1.753	2.131	2.602	2.947	4.073
16	0.690	0.865	1.071	1.337	1.746	2.120	2.583	2.921	4.015
17	0.689	0.863	1.069	1.333	1.740	2.110	2.567	2.898	3.965
18	0.688	0.862	1.067	1.330	1.734	2.101	2.552	2.878	3.922
19	0.688	0.861	1.066	1.328	1.729	2.093	2.539	2.861	3.883
20	0.687	0.860	1.064	1.325	1.725	2.086	2.528	2.845	3.850
21	0.686	0.859	1.063	1.323	1.721	2.080	2.518	2.831	3.819
22	0.686	0.858	1.061	1.321	1.717	2.074	2.508	2.819	3.792
23	0.685	0.858	1.060	1.319	1.714	2.069	2.500	2.807	3.767
24	0.685	0.857	1.059	1.318	1.711	2.064	2.492	2.797	3.745
25	0.684	0.856	1.058	1.316	1.708	2.060	2.485	2.787	3.725
26	0.684	0.856	1.058	1.315	1.706	2.056	2.479	2.779	3.707
27	0.684	0.855	1.057	1.314	1.703	2.052	2.473	2.771	3.690
28	0.683	0.855	1.056	1.313	1.701	2.048	2.467	2.763	3.674
29	0.683	0.854	1.055	1.311	1.699	2.045	2.462	2.756	3.659
30	0.683	0.854	1.055	1.310	1.697	2.042	2.457	2.750	3.646
40	0.681	0.851	1.050	1.303	1.684	2.021	2.423	2.704	3.551
60	0.679	0.848	1.046	1.296	1.671	2.000	2.390	2.660	3.460
120	0.677	0.845	1.041	1.289	1.658	1.980	2.358	2.617	3.373
∞	0.674	0.842	1.036	1.282	1.645	1.960	2.326	2.576	3.291