

## 11.2: Biometrics Lab #2

### One-way ANOVA Computer Lab

Name: \_\_\_\_\_

#### Experiment 1

A forester working with uneven-aged northern hardwoods wants to know if there is a significant difference in total merchantable sawtimber volume (m<sup>3</sup>ha<sup>-1</sup>) produced from stands using three different methods of selection system and a 15-yr cutting cycle. The following data are the total merchantable volume from 7 sample plots for each method. If you find a significant difference (reject H<sub>0</sub>), then test the multiple comparisons for significant differences. Report the findings using all available information.  $\alpha=0.05$ .

Single Tree	Group Selection	Patch Strip
108.6	104.2	102.1
110.9	103.9	101.4
112.4	109.4	100.3
106.3	105.2	95.6
101.4	106.3	102.9
114.6	107.2	99.8
117	105.8	103.5

Write the null and alternative hypotheses.

H<sub>0</sub>: \_\_\_\_\_

H<sub>1</sub>: \_\_\_\_\_

Open Minitab and label the first column as Volume and the second column as Method. Enter all of the volumes in the first column and the methods in the second:

Volume	Method
108.6	Single
110.9...	Single...
104.2	Group
103.9...	Group...
102.1	Patch
101.4...	Patch...

Select **STAT>ANOVA>One-way**. In the **Response** box select Volume, and in the **Factor** box select Method. Click on the **Comparisons** box. Select Tukeys, family error rate "5." This tells Minitab that you want to control the experiment-wise error using Tukey's method while keeping the overall level of significance at 5% across all multiple comparisons. Click OK.

State the p-value from the ANOVA table \_\_\_\_\_

Write the value for the S<sup>2</sup><sub>b</sub> \_\_\_\_\_ and the S<sup>2</sup><sub>w</sub> (MSE) \_\_\_\_\_

Do you reject or fail to reject the null hypothesis? \_\_\_\_\_

Using the Grouping Information from the Tukey Method, describe the differences in volume produced using the three methods.

\_\_\_\_\_

Now refer to the Tukey 95% Simultaneous Confidence intervals for the multiple comparisons. What is the Individual confidence interval level? \_\_\_\_\_. This is the adjusted level of significance used for all the multiple comparisons that keeps the 5% level of significance across the total experiment.

Using these confidence intervals, describe the estimated differences in sawtimber volume due to the three different treatments.

**Example:** The group method results in greater levels of sawtimber volume compared to patch. The group method yields, on average, 0.327 to 10.073 m<sup>3</sup> more sawtimber volume per plot than the patch method.

Compare “Single” and “Patch,” and “Single” and “Group.”

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## Experiment 2

A plant physiologist is studying the rate of transpirational water loss (ml) of plants growing under five levels of soil moisture stress. This species is an important component to the wildlife habitat in this area and she wants to make sure it survives in an area that tends to be dry. She randomly assigns 18 pots to each treatment (N = 90). She is measuring total rate of water transpiring from the leaves (ml) per pot per unit area. Is there a significant difference in the transpiration rates between the levels of water stress (days)?  $\alpha = 0.05$ .

0 DAYS	5 DAYS	10 DAYS	20 DAYS	30 DAYS
7.78	7.15	9.1	4.72	1.05
8.09	9.12	5.86	3.53	1.29
7.27	7.67	9.45	4.96	1.11
11.35	10.82	7.14	5	0.83
11.94	12.31	6.87	3.82	1.08
10.89	9.76	8.72	4.36	1.09
10.93	8.46	8.58	2.91	0.75
9.16	11.01	9.93	4.91	0.99
7.83	7.54	9.28	4.99	0.71
8.6	9.48	6.65	4.95	1.02
9.32	9.47	10.55	3.28	1.01
6.46	10.2	7.93	3.53	1.08
8.12	6.04	7.68	5.37	1.99
10.47	7.99	5.42	6.54	3.01
5.98	8.05	4.99	5.51	2.61
6.9	7.42	5.29	4.24	2.99
7.57	5.76	7.65	4.39	2.62

0 DAYS	5 DAYS	10 DAYS	20 DAYS	30 DAYS
9.17	7.78	4.75	4.16	1.98

Write the null and alternative hypotheses.

H0: \_\_\_\_\_

H1: \_\_\_\_\_

State the p-value from the ANOVA table \_\_\_\_\_

Do you reject or fail to reject the null hypothesis? \_\_\_\_\_

Using the Grouping Information using the Tukey Method, describe the differences in water loss between the five levels of water stress (0, 5, 10, 20, and 30).

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Now refer to the Tukey 95% Simultaneous Confidence intervals for the multiple comparisons. What is the Individual confidence interval level? \_\_\_\_\_ This is the adjusted level of significance used for all the multiple comparisons that keeps the 5% level of significance across the total experiment.

Using these confidence intervals, describe the estimated differences in water loss between the five different treatments.

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### Experiment 3

A rifle club performed an experiment on a randomly selected group of first-time shooters. The purpose was to determine whether shooting accuracy is affected by method of sighting used: only the right eye open, only the left eye open, or both eyes open. Fifteen shooters were all given similar training except in the method of sighting. Their scores are recorded below. At the 0.05 level of significance, is there sufficient evidence to reject the claim that the three methods of sighting are equally effective?  $\alpha = 0.05$ .

Right	Left	Both
13	10	15
9	18	16
17	15	15
13	11	12
14	15	16

Write the null and alternative hypotheses.

H0: \_\_\_\_\_

H1: \_\_\_\_\_

State the p-value from the ANOVA table \_\_\_\_\_

Do you reject or fail to reject the null hypothesis? \_\_\_\_\_

Give a complete conclusion.

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Why do you think you were not able to identify any differences between the sighting methods?

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