Name $\qquad$ Exam \#2b

1 November 2019

1. Wadley (1946 Journal of Economic Entomology 38:651) reported percentage of flower buds attacked by boll weevils in 16 plots each treated with a different type of arsenical insecticide. The experiment was repeated in 5 different fields for a total of 80 plots. Are some insecticides more effective than others, after controlling for differences in location?

Define variables in a tabular format, as in the box.
scale $=$ nominal, ordinal, or cardinal cardinal $=$ interval or ratio scale.
A. name symbol scale

Using the symbols, write a general linear model relating the response variable to explanatory variable(s) and interaction terms (if appropriate).
List degrees of freedom beneath each term in the model,
Assume 1 measure of flower bud \% per plot.
$\mathrm{df}=\quad=\square+\varepsilon$

State the name of the analysis, from the following list.
t-test, one-way ANOVA, two-way ANOVA, three-way ANOVA
paired comparisons, randomized blocks, hierarchical (nested) ANOVA regression, multiple regression, ANCOVA (at least one nominal and at least 1 cardinal scale explanatory variable) none of the above.

Using the same symbols, write a general linear model given 2 measurements per plot.
List degrees of freedom beneath each term in the model.
$\mathrm{df}=\square=\square+\varepsilon$
2. J. Neter, W. Wasserman, and M.H. Kutner 1985 Applied Linear Statistical Models reported muscle mass in 8 women, in the 43-58 year age range.
Does muscle mass $M(\mathrm{~kg})$ decrease with age $A$ in this range? ( $H_{o}$ testing)
The question can also be phrased as:
How good is the evidence for a decrease in muscle mass with age in this range ?
Using the symbols above write a GLM to address this question.
$\qquad$ [2]

Show units below each symbol in your GLM.
Write the null hypothesis.

## $H_{o}$

Complete the ANOVA table


Calculate the explained variance $R^{2}=$
Calculate the likelihood ratio. $L R=$

Declare a decision about $H_{o}$ against a 5\% tolerance for statistical significance.

Choose one of the following methods of reporting statistical conclusions. (circle it).
Report the likelihood ratio as relative evidence:
"change with age was (__) times more likely than no change"
Report Type I error with a decision.
"the null hypothesis was (or was not) rejected at $\alpha=5 \%$."
Give a reason for your choice.
3. Cochran and Cox (1957 Experimental Designs Table 4.4) reported the breaking strength of cotton fibers from 5 blocks, each with 5 plots treated with a different level of potash ( $36,54,72,108$, or $144 \mathrm{lbs} \mathrm{K}_{2} \mathrm{O} /$ acre). Does cotton property (breaking strength) depend on level of potash, controlled for soil pH ?

Define variables in a tabular format, as in the box.
scale = nominal, ordinal, or cardinal cardinal $=$ interval or ratio scale.
A. name symbol scale A.

Using the symbols, write a general linear model relating the response variable to explanatory variables and interaction term.

$$
\begin{equation*}
\ldots=\ldots+\varepsilon \tag{4}
\end{equation*}
$$

Assume 2 measures of breaking strength and one measure of pH per plot. Show how to calculate the total degrees of freedom.

Complete the source column.
Complete the df column
of the ANOVA table.
C. source df

State the name of the analysis, from the following list.
t-test, one-way ANOVA, two-way ANOVA, three-way ANOVA
paired comparisons, randomized blocks, hierarchical (nested) ANOVA regression, multiple regression, ANCOVA (at least one nominal and at least 1 cardinal scale explanatory variable) none of the above.

