Biology 4605/7220 9 November 2015

Name____

Exam #2a

For each of the following situations (1 through 3):

(A) Define variables in a tabular format, as follows.

<u>name</u> <u>symbol</u> <u>scale</u> Explanatory is <u>Random or Fixed</u>

scale = nominal, ordinal, or cardinal cardinal = interval <u>or</u> ratio scale.

- (B) Using the symbols, write a general linear model relating the response variable to explanatory variable(s) and interaction terms (if appropriate).
- (C) Beneath each term in the model (except β_o) write the degrees of freedom.
- (D) 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 none of the above.

2. O.L. Lacey (*Statistical Methods in Experimentation*, New York: MacMillan, 1953) wished to determine whether adding vitamin B_1 to the diet increases the growth of guinea pigs, where growth is defined as weight gain in grams. 10 animals are treated, 10 are not.

| A. | name | symbol | scale | Random or Fixed | [2+1] |
|----|------|--------|-------|-----------------|-------|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| В | = | | | + <i>E</i> | [2] |
| C | = | | | | [3] |
| D. | | | | | [1] |

1. H.A. Wallace and G.W. Snedecor (1931 *Correlations and Machine Calculations*, Iowa State University Press) provide data on value of land (\$) in relation to corn yield (bushels/acre) and pig brood stock (brood sows/1000 acre) for farms in 25 Iowa counties. Does land value depend on corn yield and pig brood stock ?

| A. | name | symbol | scale | Random or Fixed | [3+2] |
|----|------|--------|-------|-----------------|-------|
| | | | | | |
| | | | | | |
| | | | | | |
| В | = | | | + <i>E</i> | [3] |
| C | = | | | | [4] |
| D. | | | | | [1] |

3. B. Ostle and L.C. Malone (1988 *Statistics in Research* Iowa State University Press) provide data from an experiment by Mr. X, who sprayed apple trees with different concentrations of a nitrogen compound, then determined the amounts of nitrogen (mg/dm²) remaining on the leaves. The experiment was executed with three levels (low medium high) of nitrogen, resulting in 6 measurements from the first experiment, and 6 from the second. Taking into account differences between experiments, does the amount of unabsorbed nitrogen (amount remaining) depend on level of nitrogen applied ?

| A. | name | symbol | scale | Random or Fixed | [3+2] |
|----|------|--------|-------|-----------------|-------|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| В | = | | | + <i>E</i> | [4] |
| C | = | | | | _ [5] |
| D. | | | | | [1] |
| | | | | | |

4. For the following situations, state whether a randomization test is needed (yes/no). n = sample size, p-value calculated from F-distribution, α = criterion for rejection null hypothesis H_o [4]

| | rs | _ | | | | | | |
|------------|--------------|--------------|---------|------|----------------|----------|--|--|
| randomize? | homogeneous? | independent? | normal? | | <u>p-value</u> | <u>n</u> | | |
| | no | yes | yes | 0.05 | 0.003 | 135 | | |
| | no | no | no | 0.05 | 0.044 | 12 | | |
| | no | no | no | 0.05 | 0.001 | 8 | | |
| | yes | yes | yes | 0.05 | 0.04 | 9 | | |

5. Describe how to carry out a randomization test, where the statistic is Shannon Weaver species diversity, and you wish to test whether the diversity differs between two habitats.

[2]

6. The general**ized** linear model allows error distributions such as binomial, Poisson, normal, and others. The General Linear Model assumes errors that are independent, identically distributed (=homogeneous), and normal.

| Draw an exam | ple of errors that | t are not homogeneous. | [2] |
|--------------|--------------------|------------------------|-----|
| | 1 | | |

| Draw an example of errors that are not normal. | [2] |
|--|-----|
|--|-----|

Draw an example of errors that are non-independent. [2]