

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>	<u>Explanatory is</u> <u>Random or Fixed</u>
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scale = nominal, ordinal, or cardinal  
cardinal = interval or 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  $\beta_o$ ) 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.

1. Does degree of tremor depend on cigarette smoking? C. L. Hull (1924 *Psychological Monographs* 33:161) measured tremor (number per minute) after smoking from pipes with tobacco (12 subjects) or from pipes with warm moist air (12 subjects).

A. 

<u>name</u>	<u>symbol</u>	<u>scale</u>	<u>Random or Fixed</u>	[2+1]
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B. \_\_\_\_\_ = \_\_\_\_\_ +  $\epsilon$  [2]

C. \_\_\_\_\_ = \_\_\_\_\_ + \_\_\_\_\_ [3]

D. [1]



4. The **generalized** 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 example of errors that are normal. [2]

Draw an example of errors that are homogeneous. [2]

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

5. Describe how to carry out a randomization test, where the statistic is species diversity, and you wish to test whether the diversity of life on the seafloor increases with ocean depth. [2]

6. For the following situations, state whether a randomization test is needed (yes/no).  $n$  = sample size,  $p$ -value calculated from F-distribution,  $\alpha$  = criterion for rejection null hypothesis  $H_0$ . [4]

<u><math>n</math></u>	<u>p-value</u>	<u><math>\alpha</math></u>	<u>normal ?</u>	<u>errors</u>		<u>randomize?</u>
				<u>independent?</u>	<u>homogeneous?</u>	
109	0.006	0.05	yes	yes	no	_____
12	0.047	0.05	no	no	no	_____
9	0.001	0.05	no	no	no	_____
8	0.041	0.05	yes	yes	yes	_____