Biology 4605/7220/ST4581 Name_____
Exam #2 10 March 1995

1. (4) Let N be the number of points on this exam, and n be the number of questions. Compute the number of points per question.

$N_{\text{per question}}$ = _____

If 50 minutes are available for this exam, compute the number of minutes per point

$\text{Time}_{\text{per point}}$ = _____ minutes/point

Some questions will take longer to complete than others, an observation that we can quantify as the variance in time per point $\text{Var}(\text{Time}_{\text{per point}})$.

One strategy for completing a series of tasks under time limitation is to complete each task in the order they are presented (strategy I). An alternative strategy is to stop a task and move on to the next if a task exceeds the average time available (strategy II).

Which strategy will reduce the variance in time per point $\text{Var}(\text{Time}_{\text{per point}})$

strategy _____

By definition: increasing $\text{Mean}(\text{Time}_{\text{per point}})$ reduces points gained.
Assumption: increasing $\text{Var}(\text{Time}_{\text{per point}})$ increases $\text{Mean}(\text{Time}_{\text{point}})$.

Based on this assumption will increasing the $\text{Var}(\text{Time}_{\text{per point}})$ increase or decrease the points gained in a fixed period of time, such as 50 minutes ?

_____

2. (6) A dendrochronologist wants to know whether the width of tree rings in cores from spruce trees depends on elevation above sea level. Write a symbol, state an appropriate set of units, and then state the dimensions (M = mass, L = Length, T = Time) of the response and explanatory variables

	Symbol	Units	Dimensions
response variable	_____	_____	_____
explanatory variable	_____	_____	_____

3. (2) The explained variance r^2 is defined as the variance due to the model, as a fraction of the total variance, expressed in units of the sums of squares. The F-ratio used in hypothesis testing is defined as the variance due to the model, divided by the the residual variance.

$r^2 = SS_{model}/SS_{total}$
$F = MS_{model}/MS_{res}$

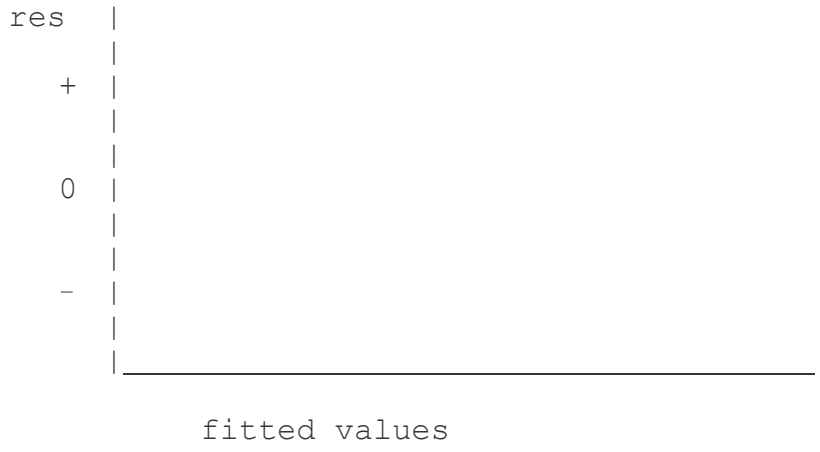
The variance, or mean square, is defined as the ratio of the sums of squares to the degrees of freedom. Hence:

$$F = \frac{SS_{model} / df_{model}}{SS_{res} / df_{res}} = \frac{df_{res}}{df_{model}} \cdot \frac{SS_{model}}{SS_{res}}$$

Write an equation for the inverse of r^2, as a function of the F-ratio and degrees of freedom

$1/r^2 =$ _____

4. (1) Within the following set of axes, draw a set of residuals indicating an unacceptable model (clear pattern of relation between residuals and fitted values).



5. (1) Computer programs such as Minitab, Systat, SPSS, and SAS partition the sums of squares, compute F-ratios, then use a theoretical distribution to compute p-values. Draw a histogram of residuals that indicate this p-value cannot be trusted (residuals unacceptable from computing p-value from F-distribution).

6a. (3) Steneck *et al* (*Ecology* 72:941) concluded that the depth to which limpets bite into macroalgae in the lab does not depend on species. Ths evidence was that the slopes relating bite depth to body size did not differ significantly among species (F = 1.892). Seven measurements were made for each of the three species.

	Symbol	Name
Assign a symbol and a name to the response variable	_____	_____
Assign symbols and names to the explanatory variables	_____	_____
	_____	_____

6b. (2) Write a general linear model corresponding to this analysis.

6c. (10) Complete the source and df columns of the ANOVA table for this analysis.