Biology 4605/7220 Name_____
Quiz 5b 20 October 2004

In 1950, Marien (*Journal of the Bombay Natural History Society* 49:471) reported wing lengths (in mm) of males of 3 species of starling, *Sturnus contra*, *Sturnus ginginiamus*, and *Sturnus fusca*.
The number of birds measured was 11 *S. contra*, 12 *S. ginginiamus*, and 8 *S. fusca*.

1. Write a symbol for the
response variable (_Y_ = mm) and
explanatory variable (_X_ = *S.c., S.g., or S.f.*) [2]

2. Write a general linear model relating the response variable to the explanatory variable.

__Y__ = __β_o__ + β_X·X__ + residual__ [4]

Any symbol acceptable for Y and X, as long as the symbols in (1) appear in correct place in (2) Greek symbol Є or error both acceptable in place of the word residual .

3a. If the symbol for the true (parametric) wing length of *S. contra* is μ_{Sc}
then write a symbol for the true or parametric wing lengths of

S. ginginiamus ____μ_{Sg}___ *S. fusca* __μ_{Sf}_____ [2]

3b. Using these three symbols, write an H_A/H_o pair for testing whether wing length depends on species.

H_A: ____$\mu_{Sc} \neq \mu_{Sg} \neq \mu_{Sf}$_____[2]

H_o: _____$\mu_{Sc} = \mu_{Sg} = \mu_{Sf}$_____[2]

4. Complete the following table. [7]

df = degrees of freedom
SS = Sums of squares
MS = mean square = SS/df
F = observed F-ratio of mean squares
p = Type I error in accepting H_o

Source	df	SS	MS	F	p
Species	2	81	40.5	8.1	< 0.005
Residual	28	140	5		
total	30	221			

4b. The total df is 30. Show how this is computed. [1]
df = (11+12+8)-1 = 31-1 = 30