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 ___ + $\beta_X \cdot X$ ___ + residual_____[4]

Any symbol acceptable for Y and X, as long as the symbols in (1) appear in correct place in (2)   Greek symbol ϵ 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