

HW #4
BIOSTAT 705 Spring 2018
Due on 4/18

1. An automobile company wishes to study the effects of differences between drivers (factor A) and differences between cars (factor B) on gasoline consumption. Four drivers were selected at random; also five cars of the same model with manual transmission were randomly selected from the assembly line. Each driver drove each car twice over a 40 miles test course and miles per gallon were recorded. (Data is given in HW4-prob1.dat file on sakai).
 - a) Suppose a two-way ANOVA model with an interaction term was fit to address the study question. Should a fixed, random, or mixed effects model be fit? Justify your choice.
 - b) For the model you chose in part (a), write down the model equation and all associated assumptions. Describe each term in the model as they relate to the experimental scenario. How many parameters need to be estimated?
 - c) Test whether or not the two factors interact. State the hypotheses, form of the test statistic (i.e. numerator MS and denominator MS), p-value, and conclusion of the test.
 - d) Test the main effects for each factor. State the hypotheses, form of the test statistic (i.e. numerator MS and denominator MS), p-value, and conclusion of the test.
 - e) The owner of the automobile company is convinced that some drivers know how to handle larger vehicles better than others; as such, they will be able to get good gas mileage out any type of vehicle. Do your findings from part (c) and part (d) support this claim? Explain your reasoning.
 - f) Provide point estimates of σ_α^2 and σ_β^2 . Which factor appears to have the greater effect on gasoline consumption?

2. In a pilot follow-up study, 159 subjects were randomly selected and asked whether they actually received a flu shot. The outcome variable y is coded 1 if subject received flu shot and 0 otherwise. The following predictors were collected: Age (continuous), health awareness index (continuous) which higher values indicating greater awareness, gender (1=male, 0=female). (Data is given in HW4-prob2.dat file on sakai).
- a) Find the maximum likelihood estimates β_0 , β_1 , β_2 and β_3 . State the fitted *logit* model.
 - b) Estimate the adjusted odds ratio for each predictors in the model. Interpret these estimates. Test each of estimated odds ratio at 0.05 level of significance.
 - c) What is the estimated probability that a male subject aged 55 yrs with health index of 60 will receive a flu shot.
 - d) Use the Wald test to determine whether gender can be dropped from the model in (a). State your conclusion and report the p-value.
 - e) Use the likelihood ratio test to determine whether gender can be dropped from the model in (a). State your conclusion and report the p-value. How your results differ from that you obtained in (d).