

## STAT 516 - Spring 2004 - Homework 7

Due: Wednesday, April 28<sup>th</sup>

1) This problem concerns the ability of pre-school students to associate objects with words. The experiment randomly assigned 24 pre-schoolers to be exposed to the objects by either TV, Audio Tape, or Picture Books. The time they were exposed to the material was either 5 min, 10 min, 15 min, or 20 min. Unfortunately, some of the children became distracted over the longer time spans and were unable to complete the experiment. The response variable is a score based on how many of the objects they could identify, and how accurate their identifications were. It is desired to analyze this data as an ANCOVA with the time being a continuous variable.

Medium Used	Time of Exposure			
	5 min	10 min	15 min	20 min
TV	49	50	43	53
	39	55	38	48
Audio	55	67	53	85
	41	58		
Written	66	85	69	85
	68	92	62	

a) Verify that the slopes of the regression lines are parallel (using  $\alpha=0.05$ ).

b) Write down the model equation you are using, and get estimates of the parameters in it. Identify these parameters so that a reader could understand what the equation was saying.

c) Check the assumptions.

d) In terms of your model equation and the statement of the problem, explain what hypotheses are being tested by the p-values in the Type I and Type III tests respectively. Assuming that the assumptions were true, say if you would accept or reject the null hypothesis in each case.

2) The data set on the web is from Feynman (1988) and is reported in Ramsey (1997). It concerns the relationship between the temperature at the time the space shuttle was launched and whether or not an O-ring seal on the space shuttle failed (a 1 indicates a failure and a 0 indicates a successful launch).

a) Analyze this data using logistic regression. Report the parameter estimates, and give the equation you would use to predict the probability of O-ring failure.

b) Use the Hosmer-Lemeshow Statistic to judge whether a logistic form seems appropriate for this data set. State your conclusion.

c) Why can't you put too much faith into the result you found in b)?

d) Assume that the logistic form is appropriate. Test whether there is a statistically significant relationship between temperature and O-ring failure at an  $\alpha=0.05$  level.

e) The temperature of the O-rings was estimated to be 29 degrees on January 27, 1986. What is the estimated probability of O-ring failure according to the model you fit.

f) What about the values of the independent variable makes you have some doubts about the accuracy of this prediction?