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STAT 608 Homework 07 Summer 2017

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NAME:

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STATISTICS 608
Homework 608 S17 07
Due: *11:59 PM, July 20, 2017*

Question 1 [10]

Download the attached data *Oral.xls* (or *Oral.txt* if that suits your software better).
The data come from a study of the oral condition of cancer patients. Twenty five patients were divided into two groups (TRT) at random: One group received a placebo (TRT=0) while the other group received aloe juice treatment (TRT=1). The initial cancer stage (STAGE) of each patient, was recorded at the beginning of the study. The oral condition at the end of the sixth week (TOTALCW6), which is the dependent variable, was also recorded.
Assume that in both treatment groups the regression of TOTALCW6 on STAGE is linear and that all the usual distributional assumptions are satisfied. *Test at the* 5% *level of significance the null hypothesis that the slopes of the two regression lines are identical.*
Describe concisely, in the form of a few bulleted remarks, the method that you apply and report any statistics that you consider relevant in making the hypothesis test. (Don't present me with all your R or SAS input and output.)

Question 2 [4+4+2=10]

In an experiment to test the effect of a toxic substance on insects, the data were fit to a logit model

$$\log \frac{p(x)}{1-p(x)} = \beta_0 + \beta_1 x.$$

Here x denotes the dosage level and $p(x)$ the probability that an insect exposed to that dose will die. The maximum likelihood estimates of the parameters were $\hat{\beta}_0 = -2.643$ and $\hat{\beta}_1 = 0.674$, the latter with a standard error of 0.039.

2.1 If 200 insects are each exposed to dosage level $x = 3$, how many of them can be expected to survive?

2.2 Estimate the factor, ϕ, by which the odds on dying increases if the dosage level is increased by 1 unit.

2.3 Find a 90% confidence interval for ϕ.

Question 3 [10]

Work Exercise 9.4.2 (a), page 328, in the textbook.

Question 4 [3+2]

A linear regression model

$$Y_t = \beta_0 + \beta_1 X_t + e_t \tag{1}$$

was fit to some time-series data by ordinary least squares. The residuals $\hat{e}_1, \ldots, \hat{e}_n$ from the fit were then used to create two new variables, namely Y with values $\hat{e}_2, \ldots, \hat{e}_n$ and X with values $\hat{e}_1, \ldots, \hat{e}_{n-1}$. A linear "regression through the origin" was then run with Y as dependent variable and X as predictor. The slope estimate was 0.412 with a standard error of 0.133. Assume that the e_t in (1) follow a standard $AR(1)$ model

$$e_t = \rho e_{t-1} + \epsilon_t,$$

where the ϵ_t are independent with a common standard normal distribution.

4.1 Estimate the first order autocorrelation ρ of the AR model. Explain clearly your calculations.

4.2 Can the output be used to obtain a valid standard error for the estimate in **4.1**, YES or NO ? Explain your answer.