Test #1

STAT 875

Spring 2015

Complete the problems below. Make sure to fully explain all answers and show your work to receive full credit!

1. (37 total points) The shuttle.csv file (available on the graded materials web page) contains information about the temperature at lift off for a space shuttle and whether there was thermal distress observed. Below is how I read the data into R:

> set1 <- read.csv(file = "C:\\data\\shuttle.csv")

> head(set1)

temp TD

1 66 0

2 70 1

3 69 0

4 68 0

5 67 0

6 72 0

Using temperature (temp) as the explanatory variable and thermal distress (TD) as the response variable, complete the following.

* 1. (6 points) Estimate the logistic regression model.
  2. (10 points) Find the 95% profile LR confidence interval for the odds ratio involving temperature. Use a 5 degree DECREASE in temperature when calculating the interval. Interpret this interval with a phrase like “the odds of a success are …”

* 1. (7 points) Using words and equations, describe how a profile LR interval for the odds ratio in the previous problem is found. Do not use any R code in your explanation (i.e., an answer of “use the \_\_\_ function” will not receive any credit).

* 1. (7 points) Estimate the probability of thermal distress when the temperature is 70.
  2. (7 points) Plot the estimated probability of thermal distress as a function of temperature on the graph below.



1. (23 total points) Olestra is a fat substitute that was first used in the late 1990s. It is not used very often now due to gastrointestinal side effects that some people reported after consumption of food with Olestra. The paper

Cheskin, L., Miday, R., Zorich, N. and Filloon, T. (1998). Gastrointestinal symptoms following consumption of Olestra or regular triglyceride potato chips: A controlled comparison. *Journal of the American Medical Association* 279(2), 150-152.

examined a controlled experiment to determine if side effects truly occurred. Below is a 2×2 contingency table summarizing some of their results:

|  |  |  |
| --- | --- | --- |
|  | Side effects | No side effects |
| Olestra | 89 | 474 |
| Regular | 93 | 436 |

Using this data, complete the following:

* 1. (10 points) Using the standard formula for an estimated odds ratio, one can obtain the value of . Provide TWO separate one-sentence interpretations of this odds ratio and TWO separate one-sentence interpretations of its inverse. All interpretations should start with “the estimated odds of …”



* 1. (8 points) Calculate the 90% Agresti-Caffo interval for the difference of side-effect probabilities.
  2. (5 points) Interpret the interval from b) in the context of this problem.

1. (12 total points) Consider the Wald confidence interval for the difference of two probabilities:

 ± Z1-α/2

Suppose π1 = 0.4, π2 = 0.4, α = 0.05, n1 = 20, and n2 = 20. Write out the steps needed to find the exact true confidence level for this interval. Do not give any R code. Be specific with respect to any probability distribution(s) used.

1. (28 total points) Answer the following questions.
   1. (6 points) When is a confidence interval referred to as being “liberal”?

* 1. (7 points) Describe how the formula for the Agresti-Coull confidence interval comes about in relation to the Wald confidence interval.
  2. (8 points) Consider the logistic regression model of . Derive the odds ratio expression that is used to interpret the effect that x1 has on the response variable. Simply stating the odds ratio expression will not receive any credit.
  3. (7 points) Below is a plot of the true confidence levels for two 95% confidence intervals for π: A Clopper-Pearson interval and a Blaker interval. The sample size is n = 40. Why would the Blaker interval be preferred over the Clopper-Pearson interval for this situation? Explain. NOTE: The dashed lines for the Blaker interval are sometimes underneath the solid lines for the Clopper-Pearson interval in the plot.



1. (2 points extra credit) Tom Loughin is a professor at what university? Please remember that an Internet search for the answer is not allowed for the exam.