

Stat 545 Part II Homework # 2

Fall 2022 Rice University

Date of Assignment: November 2, 2022 (Wednesday)

Due Date: November 14, 2022 (Monday)

Instructions:

- Your answer to Problem # 1 must be prepared in Microsoft Word (with Equation Editor) or LaTeX.
- The analysis can be done using SAS or R. Please include your SAS/R code, copy and paste the raw output from the software, and interpret the result.
- Other problems can be answered by hand-writing but Word or LaTeX is preferred.
- The total points of all the problems equal to 90, but if you prepare the answer sheet with Word or LaTeX, an extra 10 points will be added to your score.
- Please staple all the answer sheets together in the right order and be sure to write your name on the first page.

Problem # 1. (30 points; 5 points for each of (a)-(f)) The data set `basketball.csv` shows, for each game in the 2010-2011 season of the National Basketball Association in which Rajon Rondo of the Boston Celtics played. Let x = the number of assists he recorded and y = whether the Celtics won ($1 = \text{yes}$). Using software, do the following

- (a) show that the logistic model fitted to these data gives $\text{logit}[\hat{P}(Y = 1)] = -2.235 + 0.294x$
- (b) show that $\hat{P}(Y = 1)$ increases from 0.21 to 0.99 over the observed range of x from 3 to 24
- (c) construct a $\alpha = 0.05$ level significance test and 95% confidence interval about the effect of x in the conceptual population that these games represent
- (d) Plot a figure of the fitted model, where the horizontal axis is the number of assists, and the vertical axis is the probability of winning the game.
- (e) Perform the Hosmer-Lemeshow test to check the goodness of fit

- (f) Perform a likelihood ratio test on the effect of x . Report the two log-likelihood values, test statistic, degree of freedom, and p-value.

Problem # 2. (10 points) Construct the log-likelihood function for the model $\text{logit}[\pi(x)] = \alpha + \beta x$ with independent binomial outcomes of y_0 successes in n_0 trials at $x = 0$ and y_1 successes in n_1 trials at $x = 1$. Derive the likelihood equations, and show that $\hat{\beta}$ is the sample log odds ratio.

Problem # 3. (20 points) Please finish Exercise 4.21 on page 160 of the textbook.

Problem # 4. (10 points) Please finish Exercise 4.22 on page 160 of the textbook.

Problem # 5. (10 points) Please finish Exercise 5.20 on page 202 of the textbook.

Problem # 6. (10 points) Please finish Exercise 5.18 on page 202 of the textbook.