Stat 490, Spring 2025 Due: Friday May 2, 11:59 PM

Homework 5

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Collaboration policy: you are free to discuss the problems with others, though it is strongly recommended that you try the problems on your own first. Copying is not allowed, and write-ups must be your own explanations in your own words.

Computation: you can use appropriate R codes (in this case April25stardata.R) and functions posted on Canvas or write your own codes or use any software of your choice for computational purposes. You can also use any output of the R codes from the notes directly as an input to your solutions and perform the rest of the computations manually.

Problem 1

In the education experiment discussed in class and reported in Angrist et al. (2009), one outcome of interest was the GPA of the freshmen after year 2 (Y_2), although the incentives were given in the first year only. In this problem, you will infer the causal effects of the two incentives on Y_2 using the data obtained from the 1347 units for which the outcome Y_2 was recorded.

(i) Obtain a visual comparison of the observed outcomes in the four treatment groups.

(ii) Construct the appropriate ANOVA table and compute the F statistic.

(iii) Perform a randomization test assuming a completely randomized treatment assignment mechanism. Report the p-value and state your conclusion.

(iv) Perform randomization tests for each of the three factorial effects using the T_{scaled} statistic and interpret your results.

(v) Obtain 95% large-sample confidence intervals individually for each of the average factorial effects.

(vi) Perform tasks (i)-(iv) separately for female and male students, assuming a randomized block design in which females and males were separately allocated to the treatment combinations through a completely randomized assignment mechanism.