

## STA402L: HOMEWORK 1

DUE: 11:59 PM ON WEDNESDAY, JANUARY 21, 2026

**Instructions.** Solutions must be submitted to Gradescope as a single PDF. Programming exercises must be completed in R, should be clearly presented, and include all R code. Lab questions are restated here for convenience, but you should refer to the lab itself for details.

**Total points.** Book exercises: 15; Lab exercises 7; Overall: 22.

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### BOOK EXERCISES

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B1. There are three coins in a bag; two fair coins (probability of heads = probability of tails) and one fake coin (probability of heads = 1).

- (a) (1 point) You reach in and select one coin at random and throw it in the air. What is the probability that it lands on heads?
- (b) (1 point) You reach in and select one coin at random and throw it in the air and get heads. What is the probability that it is the fake coin?

B2. (Slight variation of Hoff 2.1) The social mobility data from Section 2.5 in Hoff gives a joint probability distribution on  $(Y_1, Y_2) = (\text{father's occupation}, \text{son's occupation})$ . Using this joint distribution, calculate the following distributions:

- (a) (1 point) The marginal probability that the father is in sales.
- (b) (1 point) The probability that the son is a farmer, given that the father is in sales.
- (c) (1 point) The probability that the father is a farmer, given that the son is in sales.

B3. Hoff 2.3

- (a) (2 points)
- (b) (2 points)
- (c) (1 point)

B4. (5 points) Hoff 2.6

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- L1. (1 point) Create a code chunk and set the header parameter to TRUE and print out the top rows of the table with `head()` as above.
- L2. (1 point) Generate a sequence of 100 equispaced real numbers from 0 to 1 and store it in a variable called `seq2`.
- L3. (1 point) Sort the entries in `seq3` from greatest to least.
- L4. (1 point) Find the variance of each row of `mat5`.
- L5. (1 point) Generate 500 samples from a Beta distribution with shape parameter  $[a, b] = [0.5, 0.5]$  and store the samples in a variable called `W`.
- L6. (2 points) Use code from above to make a few plots of your own.