

Homework 3

Statistics and Probability review (15 points)

Instruction:

- This HW must be done in Rmarkdown!
- Please submit both the .rmd and the Microsoft word files. (Do not submit a PDF or any other image files as the TAs are going to give you feedback in your word document)
- Name your files as: HW3-groupnumber-name
- All the HW assignments are individual work. However, I highly encourage you to discuss it with your group members.
- Late homework assignments will not be accepted under any circumstances.

Appendix A

Note: Appendix A is basic mathematical tools. We didn't talk about it in the class but I am confident that you already know the material. If not, first read the Appendix-A from Wooldridge textbook and then answer the following questions.

Question 1 The following table contains monthly housing expenditures for 10 families.

Family	Monthly Housing Expenditures (Dollars)
1	300
2	440
3	350
4	1,100
5	640
6	480
7	450
8	700
9	670
10	530

- (i) Find the average monthly housing expenditure.
- (ii) Find the median monthly housing expenditure.
- (iii) If monthly housing expenditures were measured in hundreds of dollars, rather than in dollars, what would be the average and median expenditures?
- (iv) Suppose that family number 8 increases its monthly housing expenditure to \$1000, but the expenditures of all other families remain the same. Compute the average and median housing expenditures.

Question 2 Suppose that the return from holding a particular firm's stock goes from 12% in one year to 16% in the following year. The majority shareholder claims that "the stock return only increased by 4%," while the chief executive officer claims that "the return on the firm's stock increased by 33%." Reconcile their disagreement.

Question 3 Suppose the following model describes the relationship between annual salary (salary) and the number of previous years of education (educ):

$$\log(\text{salary}) = 10.3 + 0.06\text{educ}$$

- (i) What is salary when $\text{educ} = 0$? When $\text{educ} = 13$? (Hint: You will need to exponentiate.)
- (ii) Use this equation: $\% \Delta y \approx (100 * \beta_1) \Delta x$ to approximate the percentage increase in salary when education increases by 13 years.
- (iii) Use the results of part (i) to compute the exact percentage difference in salary when $\text{educ} = 0$ and when $\text{educ} = 13$. Comment on how this compares with the approximation in part (ii).

Appendix B

Question 4 Let X be a random variable distributed as $X \sim \text{Norm}(3, 2)$. Find the probabilities of the following events. Hint: $E(X) = 3$ and $\text{Var}(X) = 2$

- (i) $P(X \leq 5)$
- (ii) $P(X > 2)$
- (iii) $P(|X - 4| > 1)$

Question 5 For a randomly selected county in the United States, let X represent the proportion of adults over age 65 who are employed, or the elderly employment rate. Then, X is restricted to a value between zero and one. Suppose that the cumulative distribution function for X is given by

$$F(x) = 3x^2 - 2x^3, 0 \leq x \leq 1$$

Find the probability that the elderly employment rate is at least 0.57 (i.e. 57%).

Question 6 Let X denote the annual salary of nurses in the United States, measured in dollars. Suppose that the average salary is 51,300, with a standard deviation of 14,200. Find the mean and standard deviation when salary is measured in thousands of dollars.