

Homework 1

ECON 5453

August 24, 2020

1.

Consider the parameter β which is normally distributed from a population which has variance equal to σ^2 . Next, consider two estimators, $\hat{\beta}$ and $\tilde{\beta}$, of this parameter β . The two estimators have the following characteristics:

$$\hat{\beta} \sim N(\beta, \sigma^2) \text{ and } \tilde{\beta} \sim N(2\beta, 4\sigma^2)$$

- (a) According to this notation, what is the expected value of $\hat{\beta}$? According to this notation, what is the expected value of $\tilde{\beta}$?
- (b) Is $\hat{\beta}$ an unbiased estimator of β ? Explain and give proper evidence to support your answer (convince me that you are not just guessing).
- (c) Is $\tilde{\beta}$ an unbiased estimator of β ? Explain and give proper evidence to support your answer (convince me that you are not just guessing).
- (d) According to this notation, what is the variance of $\hat{\beta}$? According to this notation, what is the variance of $\tilde{\beta}$?
- (e) Which of these two estimators is relatively more efficient? Explain.

2.

You are the owner of a production plant that produces iPhones. In a typical week, the number of iPhones produced is a normally distributed random variable with an average production level of 174 and a standard deviation of 9.

- (a) What is the probability that the plant will produce between 160 and 180 iPhones in any given week?
- (b) Due to increased advertising in recent weeks, you expect the demand for iPhones next week to exceed 190. What is the probability that the plant will produce 190 iPhones or more?
- (c) The manager of your iPhone plant wants to tell you with a 95% probability that production levels will fall within some range, say from X_{lower} to X_{upper} . What should these values be?

3.

You have been hired by the East Coast Tourists' Association to analyze the incidence of shark attacks on humans at US beaches. Your research shows that, in any given year, shark attacks is a normally distributed variable with an average of 45 attacks per year and a variance of 64. Use this information to answer each of the following questions.

- (a) What is the probability that, in any given year, there will be less than 27 shark attacks?
- (b) What is the probability that, in any given year, there will be between 33 and 55 shark attacks?
- (c) The President of the East Coast Tourists' Association wants to know how many shark attacks to expect in any given year within a range from X_{lower} to X_{upper} , with a 78.5% probability. That is, she wants to say with a 78.5% probability that there will be between X_{lower} and X_{upper} shark attacks. What should the values of X_{lower} and X_{upper} be?

4.

Use the "Earthquakes in Oklahoma" data file from the course website.

- (a) Calculate summary statistics for the entire time sample.
- (b) Calculate summary statistics for sub-samples of the data: Before 1/1/2008, and after 1/1/2008. How do these two cuts of the data differ in terms of 'central tendency' and 'dispersion'? How does this compare to the summary statistics reported in question 4.a?
- (c) Assume for the moment that earthquakes are normally distributed. In what percentile would the mean amount of earthquakes from the 2000-2008 period be in 2008-2016? What about the mean amount of earthquakes in 2008-2016 if instead it were in the 2000-2008 sample?