

Problem Set #9

Econ 103

For all of the questions on this assignment, assume the data are a random sample from a normal population, that is $X_1, \dots, X_n \sim \text{iid } N(\mu, \sigma^2)$. Depending on the specifics of the question, σ may be known or unknown. I'd recommend that you use R for any problems in which you need to calculate sample means or variances from a dataset: in an exam, I wouldn't make you do this by hand.

Part I – Problems from the Textbook

Chapter 8: 1, 3, 5, 7, 9

To avoid typing, you can download the data for question 8-9 from my website and import it directly into R with the following commands:

```
data.url <- "http://www.ditraglia.com/econ103/speed.csv"
speed <- read.csv(data.url, header = FALSE)
speed <- speed[,1]
```

The second command is simply a quick way to tell R to store `speed` as a vector rather than a dataframe since it only contains one column.

Part II – Additional Problems

1. Oranges sold at Iovine Brothers Produce in Reading Terminal Market have weights that follow a normal distribution with a mean of 12 ounces and standard deviation of 2 ounces.
 - (a) If we choose an orange at random, what is the probability that it will weigh less than 10 ounces?
 - (b) If we choose 25 oranges at random, what is the probability that they will have a total weight of less than 250 ounces?
2. All other things equal, how would the following change the width of a confidence interval for the mean of a normal population? Explain.

- (a) The sample mean is smaller.
 - (b) The population mean is smaller.
 - (c) The sample standard deviation is smaller.
 - (d) The sample size is smaller.
3. Do you agree or disagree with the following statement: “the household unemployment survey is hardly flawless; its 60,000 families constitute less than 0.1% of the workforce.” Explain your answer.
 4. Suppose you want to construct a 99% confidence interval for the average height of US males above the age of 20. Based on past studies you think the standard deviation of heights for this population is around 6 inches. How large a sample should you gather to ensure that your confidence interval has a width no greater than 1 inch?
 5. A well-known weekly news magazine once wrote that the width of a confidence interval is inversely related to sample size: for example, if a sample size of 500 gives a confidence interval of plus or minus 5, then a sample of 2500 would give a confidence interval of plus or minus 1. Explain the error in this argument.
 6. This question uses the same data as question 8-9 from the textbook. (See above for instructions on how to download the data.) You may assume that the data constitute a random sample from a normal population.
 - (a) Construct a 90% confidence interval for population variance.
 - (b) The data for this problem are given in kilometers per hour. How would the confidence interval change if the data were expressed in miles per hour? Note that 1 km \approx 0.62 miles.
 - (c) Construct a 90% confidence interval for the population *standard deviation* in kilometers per hour.
 7. Researchers asked a random sample of college students how many hours they sleep every night. The data are stored on my website and can be imported directly into R as follows:

```
data.url <- "http://www.ditraglia.com/econ103/sleep.csv"
sleep <- read.csv(data.url, header = FALSE)
sleep <- sleep[,1]
```

The second command is simply a quick way to tell R to store `sleep` as a vector rather than a dataframe since it only contains one column. You may assume that the data represent a random sample from a normal population.

- (a) Construct a 95% confidence interval for the population mean.
- (b) Construct a 95% confidence interval for the population variance.