MTH 1210
Lab 4 Point Estimators and Confidence Intervals for a Population Mean μ and a Population Proportion *p*

Part A: Point Estimator and Confidence Interval for the Mean μ of a Normal Population

The ***point estimator*** for an unknown population mean **μ** is the **sample mean** $\bar{x}$.

A ***one-mean t CI*** for **μ** is

$$\bar{x} \pm t_{\alpha/2} \times \frac{s}{\sqrt{n}} .$$

This CI is valid if either the sample is from a *normal* population or the sample size *n* is large. The symbol $t_{\alpha/2}$ represents a critical value from the *t* distribution with *n* - 1 degrees of freedom, and *s* is the sample standard deviation.

Normality of the population can be checked by looking at a histogram of the sample: It should look roughly bell-shaped.

In a recent study, blood tests were performed on an individual on **six** different visits to a clinic, and phosphate levels were measured (in mg/dl) for each blood test. The data can be found in the file **phosphate.mpx**.

1. Open the data file **phosphate.mpx**.
2. Calculate the value of the sample mean phosphate level $\bar{x}$ and the estimated *standard error* of the mean, $s/\sqrt{n}$ (STAT > BASIC STATISTICS > DISPLAY DESCRIPTIVE STATISTICS).
3. **Please answer Questions 1, 2, 3 and 4 on the Answer Sheet.**
4. Make a histogram of the phosphate levels.
5. **Copy and paste the histogram into the Answer Sheet**.
6. **Please answer Question 5 on the Answer Sheet.**
7. Compute a ***95% one-mean t CI*** for the true (unknown) mean phosphate level **μ** in the person's blood:

STAT > BASIC STATISTICS > 1-SAMPLE T…

In the dialog box: One or more samples, each in a column: Leave this option selected.
Select the variable (double click).
< OPTIONS >
Enter the desired confidence level.
< OK >

< OK >

The desired calculation will appear in the Session window.

8. **Please answer Questions 6 and 7 on the Answer Sheet.**

Part B: Point Estimator and Confidence Interval for the Mean μ of a Non-Normal Population when *n* is Large

When n is large ($n \geq 30$) we *no longer* need to assume the population has a *normal* distribution to be able to use the one-mean t CI procedure.

The file **can_openers.mpx** has data on the number of can openers sold in a given time period by a sample of $n = 50$ randomly selected Midwest stores.

1. Open the data file **can_openers.mpx**.
2. Compute the value of the sample mean number of can openers sold $\bar{x}$ and estimated *standard error* of the mean, $s/\sqrt{n}$.
3. **Please answer Questions 1, 2, 3 and 4 on the Answer Sheet.**
4. Make a histogram of the can opener sales.
5. **Copy and Paste the histogram into the Answer Sheet**.
6. **Please answer Question 5 on the Answer Sheet.**
7. Compute a ***95% one-mean t CI*** for **μ**, the true unknown mean number of can openers sold in the entire population of Midwest stores using the instructions in Step 7 of Part A.
8. **Please answer Questions 6 and 7 on the Answer Sheet.**

Part C: Point Estimator and Confidence Interval for a Population Proportion *p*

The ***point estimator*** for an unknown population proportion ***p*** is the **sample proportion** $\hat{p}$.

A ***one-proportion z CI*** for p is

$$\hat{p} \pm z_{\alpha/2} \times \sqrt{\frac{\hat{p}(1-\hat{p})}{n}}.$$

This confidence interval is valid if the sample size n is large. The symbol $z_{\alpha/2}$ represents a critical value from the standard normal distribution.

A June 28, 2016 report by the polling organization Marist states: "A majority of Americans oppose legalizing the sale of human organs for transplant purposes."

The conclusion was based on a survey of n = 516 adult Americans conducted May 24th and 25th, 2016, which, according to the report, found that:

> "55% of Americans do not think the sale of human organs for transplant purposes should be legal."

The data can be found in the file **organ_sales.mpx**.

1. Open the data file **organ_sales.mpx**.
2. Make a bar plot of the **Should Organ Sales Be Legal** (Yes/No) variable (GRAPH > BAR CHART).
3. **Copy and Paste the bar plot into the Answer Sheet**.
4. Calculate the value of the sample proportion $\hat{p}$, and compute a ***95% one-proportion z CI*** for the true (unknown) population proportion ***p***:

   STAT > BASIC STATISTICS > 1 PROPORTION…
   In the dialog box: One or more samples, each in a column: Leave this option selected.
   Select the variable (double click).
   < OPTIONS >
   Enter the desired confidence level.
   < OK >
   < OK >

5. **Please answer Questions 1, 2, 3 and 4 on the Answer Sheet.**