

Name:

# MATH 321: Homework 6

**Due** \_\_\_\_\_ : Turn in a hard copy, neat and stapled.

Find the .xlsx file to work in and/or the .csv file to load into R on Canvas.

For all the questions below, do the following:

- Choose the correct form of the interval, must provide justification for this choice (i.e. reference the variables that affect the scenarios we have discussed).
- Calculate the point estimate, critical value and standard error using technology (Excel / R).
- Give the final lower and upper bounds.

1. Assume that the yield per acre for a particular variety of soybeans is  $N(\mu, \sigma^2)$  with unknown variance. Using the ‘Soybean’ data, find an 80% confidence interval for  $\mu$ .

2. Let  $X_1$  and  $X_2$  equal be the earnings of two different stores owned by a toy company during the Christmas season. Assume that  $X_1 \sim N(\mu_1, \sigma^2)$  and  $X_2 \sim N(\mu_2, \sigma^2)$ . Data is given in the excel file. Using the ‘Earnings’ data, find a 95% confidence interval for  $\mu_1 - \mu_2$ .

3. As a clue to the amount of organic waste in Lake Macatawa, several samples of water were taken from the east basin and the count of the number of bacteria colonies in 100 milliliters of water was recorded. Using the ‘Bacteria’ data, find a 90% confidence interval for the mean number  $\mu$  of colonies in 100 milliliters of water in the east basin.

4. SAT scores for 2010 are shown below. Separate random samples size 45 (so not the same test-taker’s Verbal and Math) and produced the means and standard deviations listed in the accompanying table:

	Verbal	Mathematics
Sample mean	505	495
Sample standard deviation	57	69

- Construct a 92% confidence interval for the mean Verbal score.
- Construct a 92% confidence interval for the mean Math score.
- Construct a 92% confidence interval for the mean difference in Verbal and Math scores.

State a conclusion about how the mean Verbal and Math scores compare.

- Suppose the average scores in 2005 for Verbal and Math were 508 and 520, respectively. State a conclusion about how each score compares to the respective 2005 average.

5. Researchers investigated a muscle condition between two types of exercise enthusiasts, runners and cyclists. Compartment pressure measurements were taken at for both groups at rest and during exercise (80% max  $O_2$  consumption). The data from random samples of 10 runners and 10 cyclists for compartment pressure (in millimeters of mercury) are summarized in the following table:

Condition	Runners		Cyclists	
	Mean	$s$	Mean	$s$
Rest	14.5	3.92	11.1	3.98
80% maximal $O_2$ consumption	12.2	3.49	11.5	4.95

- Construct a 95% confidence interval for the difference in mean compartment pressures between runners and cyclists under the resting condition.
  - Construct a 90% confidence interval for the difference in mean compartment pressures between runners and cyclists who exercise at 80% of maximal oxygen ( $O_2$ ) consumption.
6. Twenty-four 9<sup>th</sup> and 10<sup>th</sup> grade high school girls were put on an ultraheavy rope-jumping program where their 40-yard dash times were measured before and after the program. Use the '40 yard dash time' data to:
- Construct a 85% confidence interval for the mean difference in before and after times for the 40-yard dash. State a conclusion about whether or not the jump rope program was effective.
  - Construct a 98% lower-bound confidence interval AND a 98% upper-bound confidence interval for mean difference in before and after times for the 40-yard dash.
  - Combine the intervals from (b) to form a two-sided confidence interval. State the new confidence and the conclusion about whether or not the jump rope program was effective. Is this a different conclusion than in (a)?

Select answers

- $\approx [43.24, 53.16]$
- $\approx [218.76, 546.42]$
- $\approx [50.00, 75.47]$
- $\approx [490.12, 519.88]$
  - $\approx [476.99, 513.01]$
  - $\approx [-13.36, 33.36]$
  -
- $\approx [-0.31, 7.11]$
  - $\approx [-2.62, 4.02]$
- $\approx [0.00, 0.16]$
  - 
  - $\approx [-0.03, 0.19]$