

# Homework 9

*Fall 2016, Math 107, Prof. Adam Loy*

*Due Wednesday, November 16 at the beginning of class*

## Instructions

Please complete your homework in this R markdown file. When you are done, please knit the document to Word and print a hard copy for submission. Make sure to change the **author:** so that you get credit for your work!

The below code chunk loads all of the necessary R packages.

```
library(ggplot2)
library(mosaic)
```

## Problem 1

An independent random sample is selected from an approximately normal population with unknown standard deviation. Find the degrees of freedom and use R to find the critical t-value ( $t^*$ ) for the given sample size and confidence level.

### Part a.

$n = 6, CL = 90\%$

```
# INSERT YOUR CODE HERE
```

### Part b.

$n = 21, CL = 98\%$

```
# INSERT YOUR CODE HERE
```

### Part c.

$n = 29, CL = 95\%$

```
# INSERT YOUR CODE HERE
```

### Part d.

$n = 12, CL = 99\%$

```
# INSERT YOUR CODE HERE
```

## Problem 2

An independent random sample is selected from an approximately normal population with an unknown standard deviation. Find the p-value for the given set of hypotheses and  $T$  test statistic. Also determine if the null hypothesis would be rejected at  $\alpha = 0.05$ .

**Part a.**

$$H_A : \mu > \mu_0, n = 11, T = 1.91$$

```
# INSERT YOUR CODE HERE
```

*Write your answer here, replacing this text.*

**Part b.**

$$H_A : \mu < \mu_0, n = 17, T = -3.45$$

```
# INSERT YOUR CODE HERE
```

*Write your answer here, replacing this text.*

**Part c.**

$$H_A : \mu \neq \mu_0, n = 7, T = 0.83$$

```
# INSERT YOUR CODE HERE
```

*Write your answer here, replacing this text.*

**Part d.**

$$H_A : \mu > \mu_0, n = 28, T = 2.13$$

```
# INSERT YOUR CODE HERE
```

*Write your answer here, replacing this text.*

### Problem 3

Researchers interested in lead exposure due to car exhaust sampled the blood of 52 police officers subjected to constant inhalation of automobile exhaust fumes while working traffic enforcement in a primarily urban environment. The blood samples of these officers had an average lead concentration of 109.4  $\mu\text{g/l}$  and a SD of 36.4  $\mu\text{g/l}$ ; a previous study of individuals from a nearby suburb, with no history of exposure, found an average blood level concentration of 35  $\mu\text{g/l}$ .<sup>1</sup>

The data set `leadexposure.csv` contains the measured lead concentration found in the blood samples.

First, run the below code chunk to load the `leadexposure.csv` data set.

```
lead <- read.csv("data/leadexposure.csv")
```

**Part a.**

Write down the hypotheses that would be appropriate for testing if the police officers appear to have been exposed to a higher concentration of lead.

*Write your answer here, replacing this text.*

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<sup>1</sup>WI Mortada et al. "Study of lead exposure from automobile exhaust as a risk for nephrotoxicity among traffic policemen." In: *American journal of nephrology* 21.4 (2000), pp. 274–279.

**Part b.**

Explicitly state and check the conditions/assumptions necessary for inference on these data.

# INSERT YOUR CODE HERE

*Write your answer here, replacing this text.*

**Part c.**

Test the hypothesis that the downtown police officers have a higher lead exposure than the group in the previous study. Interpret your results in context.

# INSERT YOUR CODE HERE

*Write your answer here, replacing this text.*

**Part d.**

Based on your preceding result, without performing a calculation, would a 99% confidence interval for the average blood concentration level of police officers contain  $35 \mu\text{g/l}$ ?

*Write your answer here, replacing this text.*

**Part e.**

Verify your answer to part (d) by constructing a 99% confidence interval for the average blood concentration level of police officers. Provide an interpretation of this interval in the context of the problem.

# INSERT YOUR CODE HERE

*Write your answer here, replacing this text.*