

# HOMEWORK №12

Math 107, Spring 2016

Due: May 24 by 4:00 pm

## Problem 1

In April 2012, Gallup reported that in a random sample of 1016 US adults, only 17% approve of the way Congress is handling its job.

- (a) What is the population?
- (b) What is the sample?
- (c) Use the poll results to estimate the proportion of all US adults who approve of the way Congress is doing its job.
- (d) What is the margin of error, with 95% confidence, for this estimate?
- (e) If Gallup wants a margin of error of 0.01 ( $\pm 1\%$ ), with 95% confidence, how large of a sample must they use?

## Problem 2

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.

- (a)  $n = 6, CL = 90\%$
- (b)  $n = 21, CL = 98\%$
- (c)  $n = 29, CL = 95\%$
- (d)  $n = 12, CL = 99\%$

## Problem 3

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  $\alpha = 0.05$ .

- (a)  $H_A : \mu > \mu_0, n = 11, T = 1.91$
- (b)  $H_A : \mu < \mu_0, n = 17, T = -3.45$
- (c)  $H_A : \mu \neq \mu_0, n = 7, T = 0.83$
- (d)  $H_A : \mu > \mu_0, n = 28, T = 2.13$

## Problem 4

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 124.32

$\mu\text{g/l}$  and a SD of  $37.74 \mu\text{g/l}$ ; 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>

- (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.
- (b) Explicitly state and check the conditions/assumptions necessary for inference on these data.
- (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.
- (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  $35 \mu\text{g/l}$ ?
- (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.

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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.