

2028: Basic Statistical Methods Homework 5

This homework is due Monday, Oct 21th in class **BEFORE class starts**. Late papers will not be accepted. Please do not turn in any papers to any mailbox.

- Please remember to staple if you turn in more than one page.
- Please make sure to **SHOW ALL WORK** in order to receive full credit.

I Hypothesis Testing for the Population Mean

- 1 Textbook 9-62 page 318: baseball coefficient of detection. Please skip part (b), and assume the data is normally distributed. Also, since the true variance is unknown, you may use sample variance.
- 2 The drying time for a certain type of paint under specified test conditions is known to be normally distributed with mean value 75 min and standard deviation 9 min. Chemists have proposed a new additive designed to *decrease* average drying time. It is believed that the drying times with this additive will remain normally distributed with $\sigma = 9$. Because of the expense associated with the additive, evidence should strongly suggest an improvement in average drying time before such a conclusion is adopted. Experimental data consist of drying times from $n = 25$ test specimens.
 - (a) State the hypotheses to be tested. Comment on your choice of test hypotheses?
 - (b) Find the type I error for the rejection region $\bar{X} \leq 70.8$.
 - (c) Compute the type II error of the test based on the rejection region $\bar{X} \leq 70.8$ when the alternative H_A is true and $\mu = 72$.

II Hypothesis Testing for the Proportion Parameter

- 1 Textbook Problem 9.125 page 346: p -value for the proportion parameter.
- 2 Textbook Problem 9.142 page 348: p -value and confidence interval for proportion parameter.

III Computer Problem

Cloud seeding has been studied for many decades as a weather modification procedure (for an interesting study of this subject, see the article in *Technometrics*, "A Bayesian Analysis of a Multiplicative Treatment Effect in Weather Modification," Vol. 17, pp. 161 - 166). The rainfall in acre-feet from 20 clouds that were selected at random and seeded with silver nitrate is given the the quiz data file.

Instructions for reading the data. The data is in the file 'rain.txt'. In these data, there is only one column that specifies the rainfall data.

To read the data in R, save the file in your working directory (make sure you have changed the directory if different from the R working directory) and read the data using the R function `read.table` as follows:

```
data = read.table("rain.txt")
```

Then, convert the data to numeric, using:

```
Rain= as.numeric(data[,1])
```

Now, answer the following questions:

Question 1. Does the rain fall seem to follow an approximate normal distribution? Use a histogram.

Question 2. What is the two-sided 95% confidence interval for the mean rain fall? Does that support the claim that the mean rain fall is not equal to 35?

Question 3. Now, we want to test the claim that the mean rain fall is above 30. What is the null and alternative hypotheses that we should use to test this claim?

Question 4. Perform a t -test to test the claim in question 3. Use a confidence interval of 95% What are your conclusions?

You may use:

```
t.test(data,alternative,mu,conf.level)
```

Where,

data should be Rain,

alternative is either `alternative=c("greater")`, or `alternative=c("less")`
or `alternative=c("two.sided")` depending on your alternative hypothesis,

mu should be `mu=30`,

`conf.level` should be `conf.level=0.95`

Question 5. What was the p -value for the hypothesis test in Question 4? Based on this p -value, would you reject the null hypothesis at 99% confidence level? How about at 90% confidence level?