UNIVERSITY OF TEXAS AT AUSTIN, DEPARTMENT OF MATHEMATICS
M358K - Applied Statistics

HOMEWORK #8

8.1. **Textbook problems.**

Problem 8.1. (2 points) Solve **Exercise 7.2** from the textbook.

Problem 8.2. ($2 + 2 = 4$ points) Solve **Exercise 7.4** from the textbook **assuming a two-sided alternative.**

Problem 8.3. ($1 + 1 + 2 = 4$ points) Solve **Exercise 7.6** from the textbook.

Problem 8.4. (2 points) Solve **Exercise 7.10** from the textbook.

Problem 8.5. ($2 + 4 + 4 = 10$ points) Solve **Exercise 7.12** from the textbook.

Problem 8.6. (4 points) Solve **Exercise 7.16** from the textbook.

Problem 8.7. (3 points) Solve **Exercise 7.18** from the textbook.

Problem 8.8. ($4 + 2 + 1 = 7$ points) Solve **Exercise 7.22** from the textbook.

8.2. **Additional problems.**

Problem 8.9. (7 points) *Source: "Probability and Statistics for Engineers and Scientists" by Walpole, Myers, Myers, and Ye.*
The contents of seven similar containers of sulfuric acid are

$$9.8, \quad 10.2, \quad 10.4, \quad 9.8, \quad 10.0, \quad 10.2, \quad 9.6$$

liters. Find a 95%-confidence interval for the mean contents of all such containers, assuming a normal distribution of the contents of all such containers.

Solution: First we calculate the sample average and the sample standard deviation. We get

$$\bar{x} = 10.0 \quad \text{and} \quad s_x = 0.283.$$

The critical value of the $t-$distribution with $n - 1 = 6$ degrees of freedom is $t^*_{0.025}(df = 6) = 2.447$. So, the margin of error is

$$2.447 \left(\frac{0.283}{\sqrt{7}} \right) = 0.26.$$

Finally, our confidence interval is

$$\mu = 10 \pm 0.26 = (9.74, 10.26).$$

Problem 8.10. (7 points) *Source: "Probability and Statistics for Engineers and Scientists" by Walpole, Myers, Myers, and Ye.*
The Edison Electric Institute has published figures on the number of kilowatt hours used annually by various home appliances. It is claimed that a vacuum cleaner uses an average of 46 kilowatt hours per year. If a random sample of 12 homes included in a planned study indicates that vacuum cleaners use an average of 42 kilowatt hours per year with a standard deviation of 11.9 kilowatt hours, do these data suggest that at the 0.05 significance level the mean annual usage of vacuum cleaners is less than 46 kilowatt hours? Assume the population distribution of usage in kilowatt hours to be normal.

Solution: The parameter of interest is μ – the mean energy usage in the population of vacuum cleaners. Our hyopthesis test is, then,

$$H_0 : \mu = \mu_0 = 46 \quad \text{vs.} \quad H_a : \mu < 46.$$

The test statistic, under the null hypothesis, is the $t-$statistic

$$T = \frac{\bar{X} - \mu_0}{S_x/\sqrt{n}}$$

which has the $t-$distribution with $n - 1 = 11$ degrees of freedom. With the given significance level of 0.05, the critical value of the $t-$distribution for the left-sided alternative is $-t^*_{0.05}(df = 11) = -1.796$.

The observed value of the test statistic is

$$\frac{42 - 46}{11.9/\sqrt{12}} = -1.16 > -1.796.$$

We **fail to reject** the null hypothesis.