Name: Solutions

Date: 4/17/2025

Math 130
Quiz 13

Some formulas you may need:

$$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} \qquad df = n - 1 \qquad s = \sqrt{\frac{\sum (x - \bar{x})^2}{n-1}} = \sqrt{\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1}}$$

1. (10 points) **Agriculture: Groundwater** Unfortunately, arsenic occurs naturally in some groundwater. A mean arsenic level less than 8.0 parts per billion (ppb) is considered safe for agricultural use. A well in Texas is used to water crops. This well is tested on a regular basis for arsenic. A sample of 8 tests of this well lead to the arsenic levels in the table below.

Arsenic Level (ppb)			
7.7	8.1	7.9	8.2
8.1	7.8	7.9	7.6

Does the data indicate that the level of arsenic in this well is safe for agricultural use at the 0.01 significance level?

Hyp. Test

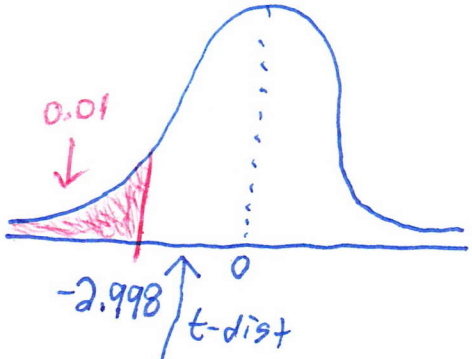
H_0: $\mu = 8.0$ ppb

H_1: $\mu < 8.0$ ppb

μ = The average arsenic level of the well

Rejection Region

$\alpha = 0.01$ $\quad df = n - 1 = 8 - 1 = 7$



Test stat

$n = 8$

$\bar{x} = \frac{7.7 + 8.1 + \cdots + 7.6}{8} = 7.9125$

$\Sigma x^2 = 7.7^2 + 8.1^2 + \cdots + 7.6^2 = 501.17$

$\Sigma x = 7.7 + 8.1 + \cdots + 7.6 = 63.3$

$$s = \sqrt{\frac{\Sigma x^2 - \frac{(\Sigma x)^2}{n}}{n-1}} = \sqrt{\frac{501.17 - \frac{(63.3)^2}{8}}{8-1}}$$

$= 0.2100170061$

$$t = \frac{\bar{x} - \mu}{\frac{s}{\sqrt{n}}} = \frac{7.9125 - 8}{\frac{0.2100170061}{\sqrt{8}}}$$

$= -1.178415872$

Conclusion Do not reject H_0!

Not enough evidence to say that the average arsenic level for this well makes it safe for agricultural use.

Extra Credit

1. (3 points) What does the 0.01 mean when a hypothesis test is performed at the 0.01 significance level?

If you perform the same hypothesis test many times, each time with a new sample, you will reject Ho when Ho is true about 1% of the time.

2. (1 point) What is a type I error?

when you reject Ho when Ho is true.

3. (1 point) What is a type II error?

when you do not reject Ho when Ho is false.