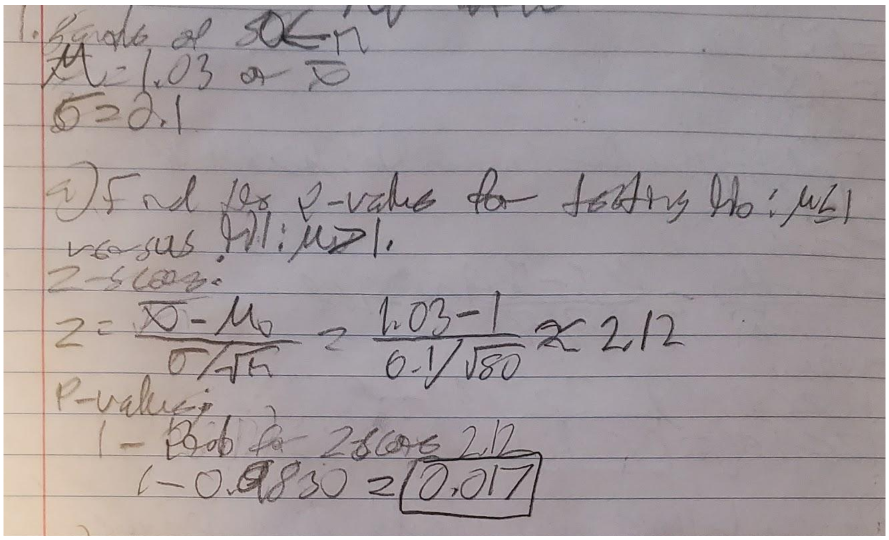
STAT 50 HW #16 Sections 6.1 and 6.2

Section 6.1 #'s 1, 3, 5, 7

1.

A sample of 50 copper wires had a mean resistance of 1.03 mΩ with a standard deviation of 0.1 mΩ. Let μ represent the mean resistance of copper wires of this type.

a. **Find the P-value for testing H0 : μ ≤ 1 versus H1 : μ > 1.**



1. Sample of 50 Ω
$\mu = 1.03$ or $\bar{x}$
$\sigma = 0.1$

a) Find the p-value for testing $H_0: \mu \le 1$ versus $H_1: \mu > 1$.

Z-score:

$$z = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}} = \frac{1.03-1}{0.1/\sqrt{80}} \approx 2.12$$

P-value:

1 − Prob for Zscore 2.12

$1 - 0.9830 = \boxed{0.017}$

b. **Either the mean resistance is greater than 1 mΩ, or the sample is in the most extreme _____% of its distribution.**

Answer: 1.7%

3.

The article "Supply Voltage Quality in Low-Voltage Industrial Networks of Estonia" (T. Vinnal, K. Janson, et al., Estonian Journal of Engineering, 2012:102–126) presents voltage measurements for a sample of 66 industrial networks in Estonia. Assume the rated voltage for these networks is 232 V. The sample mean voltage was 231.7 V with a standard deviation of 2.19 V. Let μ represent the population mean voltage for these networks.

a. **Find the P-value for testing H0 : μ = 232 versus H1 : μ ≠ 232.**

3. $n = 66$ rated voltage $= 232V$

$\bar{x} = 231.7 \rightarrow \mu?$

$\sigma = 2.19 \approx s$ because sample size is large

a) Find p-value for testing $H_0: \mu = 232$ versus $H_1: \mu \neq 232$

z-score:

$$z = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}} = \frac{231.7 - 232}{2.19/\sqrt{66}} \approx -1.11$$

we are comparing $=$ and $\neq$, so we do this!

P-value:

$P = P(Z < -1.11$ or $Z > 1.11) = 2P(Z < -1.11)$

$P(Z < -1.11) = 0.1335$ $2(0.1335) = \boxed{0.267}$

b. **Either the mean voltage is not equal to 232, or the sample is in the most extreme _____% of its distribution.**

Answer: 26.70%

5.

Recently many companies have been experimenting with telecommuting, allowing employees to work at home on their computers. Among other things, telecommuting is supposed to reduce the number of sick days taken. Suppose that at one firm, it is known that over the past few years employees have taken a mean of 5.4 sick days. This year, the firm introduces telecommuting. Management chooses a simple random sample of 80 employees to follow in detail, and, at the end of the year, these employees average 4.5 sick days with a standard deviation of 2.7 days. Let μ represent the mean number of sick days for all employees of the firm.

a. **Find the P-value for testing H0 : μ ≥ 5.4 versus H1 : μ < 5.4.**

5. $n = 80$

$\bar{x} = 4.5$

$\sigma = 2.7$

a) Find P-value for testing $H_0: \mu \geq 5.4$ versus $H_1: \mu < 5.4$.

z-score:

$$z = \frac{\bar{x} - \mu_0}{\sigma/\sqrt{n}} = \frac{4.5 - 5.4}{2.7/\sqrt{80}} \approx -2.98$$

P-value:

$P = P(Z < -2.98)$

$P(Z < -2.98) = \boxed{0.0014}$

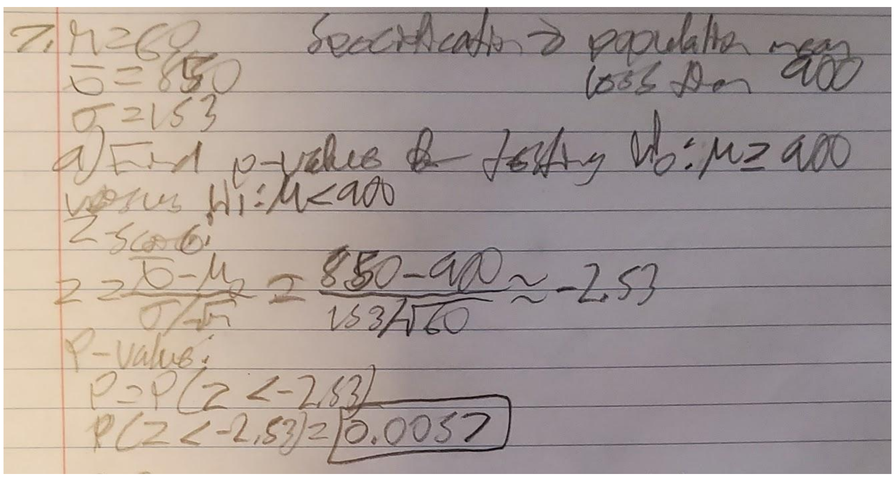
b. **Do you believe it is plausible that the mean number of sick days is at least 5.4, or are you convinced that it is less than 5.4? Explain your reasoning.**

I am convinced that the mean number of sick days is less than 5.4, as we have a p-value of 0.0014, which is less than 0.05. We reject the null hypothesis and assume there's a 0.14% likelihood that the change only happened by chance.

7.

In a test of corrosion resistance, a sample of 60 Incoloy steel specimens were immersed in acidified brine for four hours, after which each specimen had developed a number of corrosive pits. The maximum pit depth was measured for each specimen. The mean depth was 850 μm with a standard deviation of 153 μm. The specification is that the population mean depth μ is less than 900 μm.

a. **Find the P-value for testing H0 : μ ≥ 900 versus H1 : μ < 900.**


7. $n=60$ Specification → population mean less than 900
$\bar{x}=850$
$\sigma=153$
a) Find p-value for testing $H_0: \mu \geq 900$ versus $H_1: \mu < 900$
Z-score:
$z = \frac{\bar{x}-\mu_0}{\sigma/\sqrt{n}} = \frac{850-900}{153/\sqrt{60}} \approx -2.53$
P-value:
$P = P(Z < -2.53)$
$P(Z<-2.53) = \boxed{0.0057}$

b. **Do you believe it is plausible that the mean depth is at least 900μm, or are you convinced that it is less than 900μm? Explain.**

I am convinced that the mean depth is less than 900μm, as we have a p-value of 0.0057, which is less than 0.05. We reject the null hypothesis and assume there's a 0.0057 likelihood that the change only happened by chance.

Section 6.2 #'s 1, 3, 5, 11, 15, 21

1.

For which P-value is the null hypothesis more plausible: P = 0.5 or P = 0.05?

Answer: P = 0.5

3.

If P = 0.01, which is the best conclusion?

I. **H0 is definitely false.**
II. **H0 is definitely true.**
III. **There is a 1% probability that H0 is true.**
IV. **H0 might be true, but it's unlikely.**
V. **H0 might be false, but it's unlikely.**
VI. **H0 is plausible.**

Answer: IV

5.

True or false: If P = 0.02, then

a. **The result is statistically significant at the 5% level.**
b. **The result is statistically significant at the 1% level.**
c. **The null hypothesis is rejected at the 5% level.**
d. **The null hypothesis is rejected at the 1% level.**

a. True

b. False

c. True

d. False

11.

In each of the following situations, state the most appropriate null hypothesis regarding the population mean μ.

a. **A new type of battery will be installed in heart pacemakers if it can be shown to have a mean lifetime greater than eight years.**

Answer: H0: $\mu \leq 8$

b. **A new material for manufacturing tires will be used if it can be shown that the mean lifetime of tires will be more than 60,000 miles.**

Answer: H0: $\mu \leq 60{,}000$

c. **A quality control inspector will recalibrate a flowmeter if the mean flow rate differs from 10 mL/s.**

Answer: H0: $\mu = 10$

*For these answers, I think the null hypothesis is usually what we try to reject.

15.

A method of applying zinc plating to steel is supposed to produce a coating whose mean thickness is no greater than 7 microns. A quality inspector measures the thickness of 36 coated specimens and tests H0 : $\mu \leq 7$ versus H1 : $\mu > 7$. She obtains a P-value of 0.40. Since $P > 0.05$, she concludes that the mean thickness is within the specification. Is this conclusion correct? Explain.

No. Because our P-value is 0.40, which is greater than 0.05, we fail to reject the null hypothesis. This does not mean the mean thickness will be within the specification. The issue could be with how the hypotheses are set up.

21.

The strength of a certain type of rubber is tested by subjecting pieces of the rubber to an abrasion test. For the rubber to be acceptable, the mean weight loss μ must be less than 3.5 mg. A large number of pieces of rubber that were cured in a certain way were subject to the abrasion test. A 95% upper confidence bound for the mean weight loss was computed from these data to be 3.45 mg. Someone suggests using these data to test H0 : $\mu \geq 3.5$ versus H1 : $\mu < 3.5$.

a. **Is it possible to determine from the confidence bound whether $P < 0.05$? Explain.**

Yes. Because we know that the 95% UCB is 3.45mg, we know that 95% of the sample means are expected to be at most 3.45mg and as such, only 5% would be expected to exceed that amount. We could conclude that $P < 0.05$ when the sample mean exceeds 3.45 mg.

b. **Is it possible to determine from the confidence bound whether $P < 0.01$? Explain.**

No. We know the 95% UCB, but would not be able to determine whether $P < 0.01$ from that UCB.