STA 032 Homework 8

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§ 6.1

5 We have $n = 80, \overline{X} = 4.5$ and $s = 2.7$.

i. We have our hypotheses:

$$H_0 : \mu \geq 5.4$$
$$H_A : \mu < 5.4$$

ii. The test statistic is:

$$Z_s = \frac{\overline{X} - \mu_0}{\frac{s}{\sqrt{n}}} = \frac{4.5 - 5.4}{\frac{2.7}{\sqrt{80}}} = -2.98$$

iii. The corresponding p-value is: 0.001 40

iv. Since the p-value is so small, we reject the null hypothesis.

(1) See part iii above.

(2) I am convinced the mean number of sick days is less than 5.4 after allowing telecommuting. The probability that the sample was from a population where the mean number of sick days was greater than 5.4 is exceedingly small. It is much more likely that the sample was taken from a population with a mean number of sick days less than 5.4.

8 We have $n = 100, \overline{X} = 25$ and $s = 60$.

i. We have our hypotheses:

$$H_0 : \mu = 0$$
$$H_A : \mu \neq 0$$

ii. The test statistic is:

$$Z_s = \frac{\overline{X} - \mu_0}{\frac{s}{\sqrt{n}}} = \frac{25 - 0}{\frac{60}{\sqrt{100}}} = 4.17$$

iii. The corresponding p-value is: 1

iv. Since the p-value is large, we assume the null hypothesis is true.

(1) See part iii above.

(2) I am convinced that the laser is properly calibrated. Since the probability that the sample was from a population with 0 mean error is effectively 1, it makes sense that the laser is properly calibrated.

§ 6.2 9 (1) The null hypothesis should be:

$$H_0 : \mu \leq 8 \text{ years}$$

If H_0 is rejected, then it is known that the batteries will have a mean lifetime of more than 8 years and so can be installed in pacemakers.
If H_0 is not rejected, then the batteries might have a mean lifetime less than 8 years and so cannot be installed in pacemakers.

(2) The null hypothesis should be:

$$H_0 : \mu \leq 60\,000 \text{ miles}$$

If H_0 is rejected, then it is known that the tires will have a mean lifetime more than 60 000 miles and so the new material can be used to make tires.
If H_0 is not rejected, then the tires might have a mean lifetime less than 60 000 miles and so the new material cannot be used to make tires.

(3) The null hypothesis should be:

$$H_0 : \mu = 10 \text{ mL}\,\text{s}^{-1}$$

If H_0 is rejected, then it is known that the flow rate will be 10 $\text{mL}\,\text{s}^{-1}$ and so the flowmeter should be recalibrated.
If H_0 is not rejected, then the flow rate might not be 10 $\text{mL}\,\text{s}^{-1}$ and so the flowmeter should not be recalibrated.

14 i. Greater than 0.05.

We can compute the necessary values from the information given.
With the interval from 1.2 to 2.0, we can compute $\overline{X} = \frac{1.2+2.0}{2} = 1.6$.
We also know that

$$\begin{aligned} 1.2 &= 1.6 - 1.96\frac{s}{\sqrt{n}} \\ 1.96\frac{s}{\sqrt{n}} &= 0.4 \\ \frac{s}{\sqrt{n}} &= \frac{0.4}{1.96} \\ \frac{s}{\sqrt{n}} &= 0.204 \end{aligned}$$

So, we can compute a z-score

$$Z = \frac{\overline{X} - \mu_0}{\frac{s}{\sqrt{n}}} = \frac{1.6 - 1.4}{0.204} = 0.98$$

The corresponding p-value is 0.8365, which much greater than 0.05.

§ 6.3 7 We want the hypotheses:

$$H_0 : \mu \leq 0.7$$
$$H_A : \mu > 0.7$$

So $n = 150$ and $p = 0.7$.
Thus, $\hat{p} \sim N(150, \frac{0.7(1-0.7)}{150}) = N(150, 0.001\,40)$.
This lets us compute $\sigma_{\hat{p}} = \sqrt{0.001\,40} = 0.0374$, and an observed $\hat{p} = \frac{110}{150} = 0.733$.
So we have a z-score of $Z = \frac{0.733-0.7}{0.0374} = 0.8913$.
The corresponding p-value is $1 - 0.8133 = 0.1867$.
Since this value is much higher than 0.05, we do not reject the null hypothesis. We cannot conclude that more than 70% of the households in the city have high-speed internet access.

8 We want the hypotheses:

$$H_0 : \mu \geq 0.08$$
$$H_A : \mu < 0.08$$

So $n = 300$ and $p = 0.08$.
Thus, $\hat{p} \sim N(300, \frac{0.08(1-0.08)}{300}) = N(300, 0.000\,245)$.
This lets us compute $\sigma_{\hat{p}} = \sqrt{0.000\,245} = 0.0157$, and an observed $\hat{p} = \frac{12}{300} = 0.0400$.
So we have a z-score of $Z = \frac{0.0400-0.08}{0.0157} = -2.55$.
The corresponding p-value is 0.0054.
Since this value is very small, we reject the null hypothesis. We can conclude that less than 8% of the produced parts are defective.

§ 6.4 3 (1)
(2)
(3)

4 (1)
(2)
(3)

§ 6.5 7 (1)
(2)

§ 6.6 12

§ 6.7	13	
§ 6.12	4	(1)
		(2)
		(3)
		(4)
	5	(1)
		(2)
		(3)
		(4)