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Homework 9: Due Friday 7/17/2020

STAT-145-02

65. Previously, an organization reported that teenagers spent 4.5 hours per week, on average, on the phone. The organization thinks that, currently, the mean is higher. Fifteen randomly chosen teenagers were asked how many hours per week they spend on the phone. The sample mean was 4.75 hours with a sample standard deviation of 2.0. Conduct a hypothesis test. The null and alternative hypotheses are:
    1. $\cancel{H_o : \overline{x} = 4.5, H_a : \overline{x} > 4.5}$
    2. $\cancel{H_o : \mu \geq 4.5, H_a : \mu < 4.5}$
    3. $\cancel{H_o : \mu = 4.75, H_a : \mu > 4.75}$
    4. $\boxed{H_o : \mu = 4.5, H_a : \mu > 4.5}$

79. In 1955, *Life Magazine* reported that the 25 year-old mother of three worked, on average, an 80 hour week. Recently, many groups have been studying whether or not the women's movement has, in fact, resulted in an increase in the average work week for women (combining employment and at-home work). Suppose a study was done to determine if the mean work week has increased. 81 women were surveyed with the following results. The sample mean was 83; the sample standard deviation was ten. Does it appear that the mean work week has increased for women at the 5% level? (**Show complete testing process as shown in notes.**)

Population

We are studying the amount of time, in hours per week, that a 25-year-old mother of three works, on average.

μ = true mean working hours per week of all 25-year-old mothers of three.

Goal: Test to see if there is support for saying that μ has increased from 80.

Method

$$\begin{aligned} H_0 &: \mu = 80 \\ H_a &: \mu > 80 \\ \alpha &= 0.05 \\ T - curve\ &with\ df = 80 \end{aligned} \tag{1}$$

Sample

Interpretation for a 1-Sample t-Test

Decision Rule Based on p-value
Reject H_0 : p-value $\leq \alpha$
Fail to Reject H_0 : p-value $> \alpha$

The p-value for this test is 0.0042
$\alpha = 0.050$

For the p-value approach:

Since 0.0042$<$ 0.05, we reject the null hypothesis in favor of the alternative hypothesis. There is enough evidence to support the claim of the alternative hypothesis.

$$\begin{aligned} & n > 30 \\ & \therefore \\ & \textit{The sample can be} \\ & \textit{considered normal} \end{aligned} \tag{2}$$

Results

$$\begin{aligned} t &= \frac{\overline{x} - u_0}{s \div \sqrt{n}} \; with\; df = n - 1 \\ t &= \frac{83 - 80}{\frac{10}{\sqrt{81}}} \; with\; df = 81 - 1 \\ t &= \frac{3}{\frac{10}{\sqrt{81}}} \; with\; df = 80 \\ t &= 2.7 \; with\; df = 80 \end{aligned} \tag{3}$$

My sample mean is 2.7 standard errors above 80.

My p-value is 0.0042.

Assuming that the true mean equals 80, there is a 0.42% probability of getting a sample mean ($\overline{x}$) at least as extreme as the one we got from sampling.

Conclusion

At the 5% level of significance, the sample data does provide sufficient evidence to say that the true mean has increased from 80 work hours per week for 25-year-old mothers of three.

85. The mean work week for engineers in a start-up company is believed to be about 60 hours. A newly hired engineer hopes that it's shorter. She asks ten engineering friends in start-ups for the lengths of their mean work weeks. Based on the results that follow, should she count on the mean work week to be shorter than 60 hours? (**Show the complete testing process as shown in notes. Data in the "Work Hours (#85)" sheet in the data file.**)

Population

We are studying the amount of time, in hours per week, that engineers work in a start-up company.

μ = true mean working hours per week of all engineers in the start-up company.

Goal: Test to see if there is support for saying that μ has decreased from 60.

Method

$$\begin{aligned} H_0 &: \mu = 60 \\ H_a &: \mu < 60 \\ \alpha &= 0.05 \\ T - curve\ with\ df &= 9 \end{aligned} \tag{4}$$

Sample

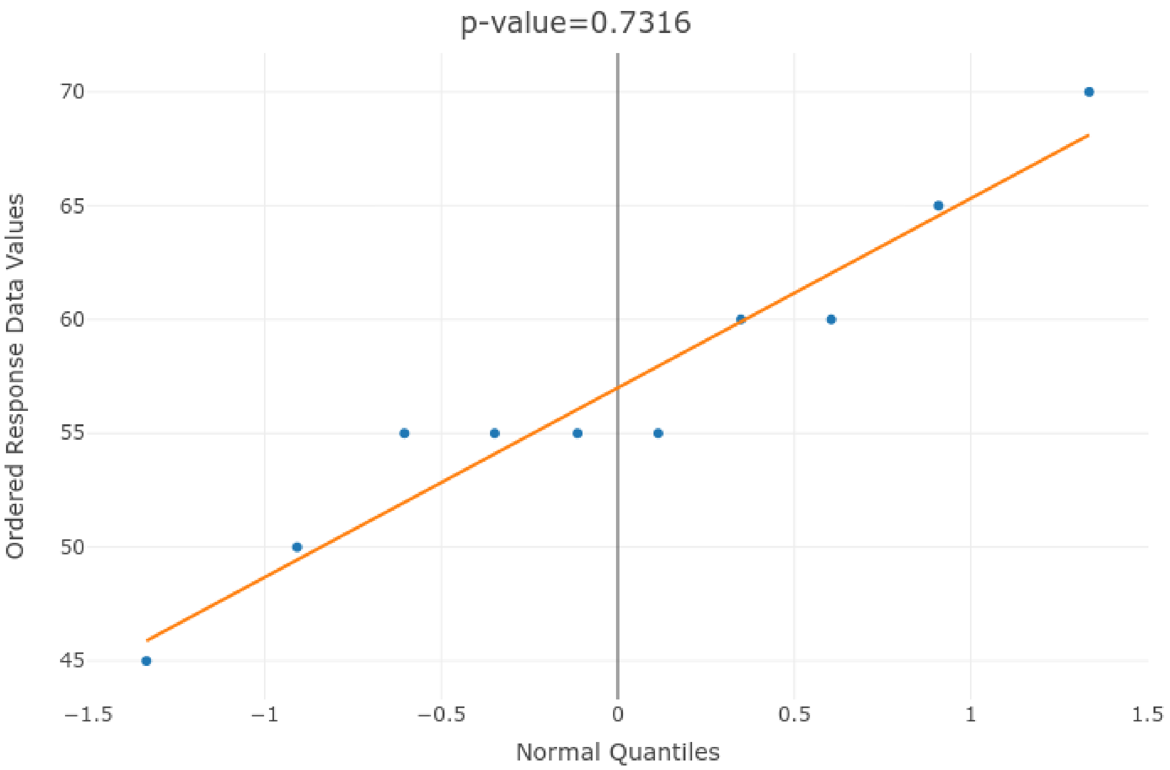
Interpretation for a 1-Sample t-Test

Decision Rule Based on p-value
Reject H_0 : p-value $\leq \alpha$
Fail to Reject H_0 : p-value $> \alpha$

The p-value for this test is 0.1086
$\alpha = 0.050$

For the p-value approach:

Since 0.1086$>$ 0.05, we fail to reject the null hypothesis.
There is not enough evidence to support the claim of the alternative hypothesis.



$$\begin{aligned} p &> 0.05 \\ &\therefore \\ &The\ sample\ can\ be \\ &considered\ normal \end{aligned} \tag{5}$$

Results

$$
\begin{aligned}
t &= \frac{\overline{x} - u_0}{s \div \sqrt{n}} \; with \; df = n - 1 \\
t &= \frac{57 - 60}{\frac{7.149}{\sqrt{10}}} \; with \; df = 10 - 1 \\
t &= \frac{-3}{\frac{7.149}{\sqrt{10}}} \; with \; df = 9 \\
t &= -1.327 \; with \; df = 9
\end{aligned} \tag{6}
$$

My sample mean is 1.327 standard errors below 60.

My p-value is 0.1086.

Assuming that the true mean equals 60, there is a 10.86% probability of getting a sample mean ($\overline{x}$) at least as extreme as the one we got from sampling.

Conclusion

At the 5% level of significance, the sample data does not provide sufficient evidence to say that the true mean has decreased from 60 work hours per week for engineers at a start-up company.