Question 11

Tire Company

Population

We are studying the lifetime of a tire from one tire company, measured in thousands of miles.

μ = true mean lifetime of a tire from one tire company.

Goal: Test to see if there is support for saying that μ has decreased from 42.

Method

$$\begin{aligned} H_0 &: \mu = 42 \\ H_a &: \mu < 42 \\ \alpha &= 0.05 \\ T - curve\ with\ df &= 9 \end{aligned} \tag{1}$$

Sample

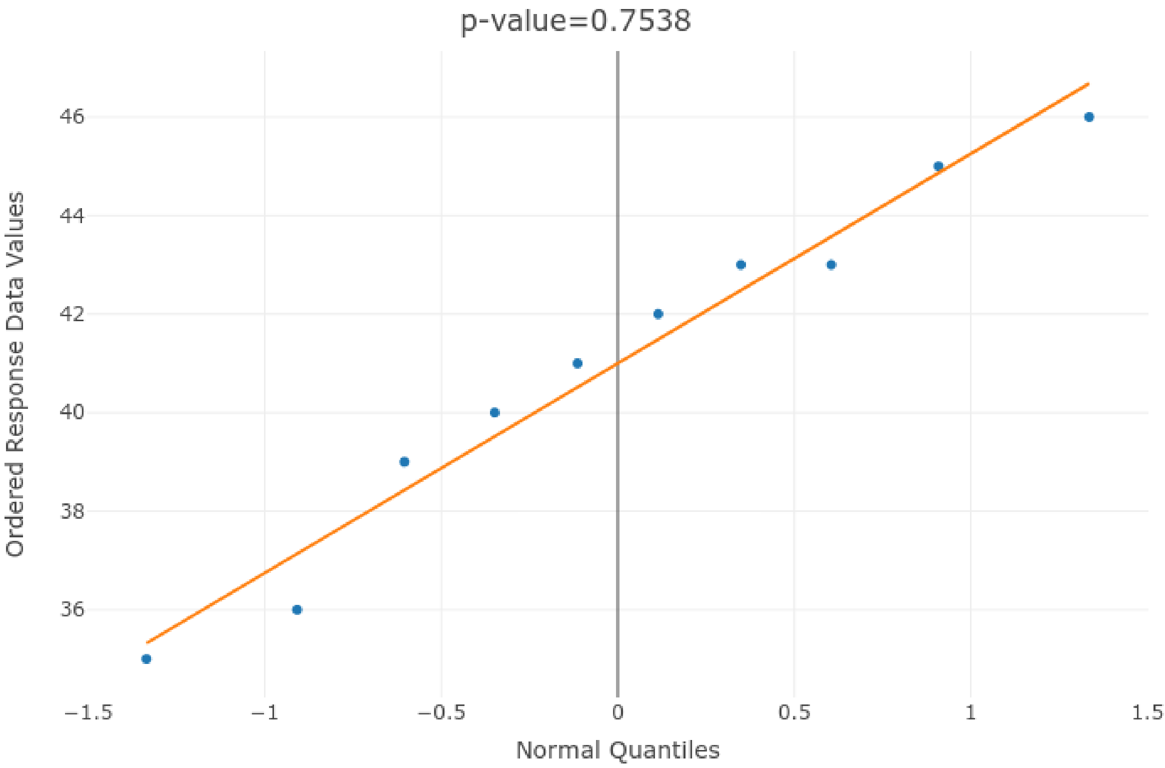
Interpretation for a 1-Sample t-Test

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 0.2007
$\alpha = 0.050$

For the p-value approach:

Since 0.2007$>$ 0.05, we fail to reject the null hypothesis.
There is not enough evidence to support the claim of the alternative hypothesis.



$$p > 0.05 \tag{2}$$
$$\therefore$$
$$The\ sample\ can\ be$$
$$considered\ normal$$

Results

$$t = \frac{\overline{x} - u_0}{s \div \sqrt{n}}\ with\ df = n - 1 \tag{3}$$
$$t = \frac{41 - 42}{\frac{3.59}{\sqrt{10}}}\ with\ df = 10 - 1$$
$$t = \frac{-1}{\frac{3.59}{\sqrt{10}}}\ with\ df = 9$$
$$t = -0.8808\ with\ df = 9$$

My sample mean is 0.8808 standard errors below 42.

My p-value is 0.2007.

Assuming that the true mean equals 80, there is 20.07% 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 42 thousand miles for the lifetime of a tire from one tire company.

Question 12

US Pennies

Population

We are studying the weight, in grams, of US pennies.

μ = true mean weight of all US pennies in grams.

Goal: Test to see if there is support for saying that μ has changed from 2.5.

Method

$$\begin{aligned} H_0 &: \mu = 2.5 \\ H_a &: \mu \neq 2.5 \\ \alpha &= 0.05 \\ T - curve\ with\ df &= 36 \end{aligned} \tag{4}$$

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 0.7417
$\alpha = 0.050$

For the p-value approach:

Since 0.7417$>$ 0.05, we fail to reject the null hypothesis.
There is not enough evidence to support the claim of the alternative hypothesis.

$$\begin{aligned} &n > 30 \\ &\therefore \\ &The\ sample\ can\ be \\ &considered\ normal \end{aligned} \tag{5}$$

Results

$$\begin{aligned} t &= \frac{\overline{x} - u_0}{s \div \sqrt{n}}\ with\ df = n - 1 \\ t &= \frac{2.499 - 2.5}{\frac{0.0165}{\sqrt{37}}}\ with\ df = 37 - 1 \\ t &= \frac{0.0009}{\frac{0.0165}{\sqrt{37}}}\ with\ df = 36 \\ t &= -0.3322\ with\ df = 36 \end{aligned} \tag{6}$$

My sample mean is 0.3322 standard errors below 2.5.

My p-value is 0.7417.

Assuming that the true mean equals 2.5, there is a 74.17% 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 changed from 2.5 grams for the weight of a US penny.