Solutions Exercise 2

TMA4255

Problem 1

We want to test if a N tyre has better quality in the long run than a G tyre which means that that we want to see if the N tyres have smaller decrease in the depth of the grooves than the G tyres. Considering testing H_0 : *There is no difference between the tyres against* H_1 : N *tyres are better* the average $\bar{D} = \sum_{i=1}^{9}\left(\frac{G_i - N_i}{9}\right)$ is a natural test statistics.

Under H_0 $\bar{D}$ should be small, and under H_1 it is expected that $\sum_{i=1}^{9} G_i > \sum_{i=1}^{9} N_i$ which means that $\bar{D}$ should be large which means that the decrease in the depth of the grooves is smaller for the N tyre, and thus N tyres are better.

b)

Use the following command:

Commands: *Stat* $->$ *Basic Statistics* $->$ *1-sample Z*

Minitab Express: *Statistics* $->$ *1-sample statistics* $->$ *Z...*

In "samples in column" choose the C3 column named D, in standard deviation write 6 and check the "perform hypothesis test" box, then fill in the value for δ, which is 0. In Option as Alternative Hypothesis choose mean $>$ hypothesized value.

The result gives us a p-value of 0.0228 which is smaller than 0.05 and therefore we reject the null hypothesis and we conclude with that the N tyres are better than the G tyres.

c)

If the variance is unknown we can use an one sided t-test. Use the following command:

Commands: *Stat* $->$ *Basic Statistics* $->$ *1-sample t*

Minitab Express: *Statistics* $->$ *1-sample statistics* $->$ *t...*

In "samples in column" choose the C3 column named D, then check the "perform hypothesis test" box, then fill in the value for δ, which is 0. In Option as Alternative Hypothesis choose mean $>$ hypothesized value.

Here we get that the p-value is 0.0368 which is smaller than 0.05 and therefore we reject the null hypothesis.

d)

In that case we use a 2-sample t test. Use the following command:

Commands: *Stat* $->$ *Basic Statistics* $->$ *2-sample t*

Minitab Express: *Statistics* $->$ *2-sample statistics* $->$ *t...*

In "samples in different columns" choose the C1 column for first and C2 for second, then check the "assume equal variances" box. The resulting p-value is 0.376 ~~too low~~, and so we ~~reject the null~~. do not reject the null hypothesis.

2 Problem 2

a)

Use the following command:

Commands: *Stat* $->$ *Basic Statistics* $->$ *2 variances*

Then choose "samples in different columns", and then choose columns A and B in the right boxes. By clicking the options box you can choose the confidence level, else choose "variance1/variance2" in the "Hypothesized ratio". As the p-value is greater than 0.05, we cannot reject the null.

Minitab Express: *Statistics* $->$ *2-sample statistics* $->$ *Variances...*

Then choose "each sample in its own column", and then choose columns A and B in the right boxes. By clicking the options box you can choose the confidence level. As the p- value is greater than 0.05, we cannot reject the null.

b)

Do the same as in a), but this time choose the new confidence level. Then on the panel you can find the confidence intervals CI ("CI for Variance Ratio").

The t-distribution from Problem 1 and the F-distribution from Problem 2 can be plotted and critical values marked. This to better understand the CI and hypothesis test. The T distribution with 8 df from Problem 1.

Commands: *Graphs* $->$ *Probability Distribution Plot*

Choose t and 8 df. You may do the same for the F distribution (df=9 and 7).