

# Exercise 2-Solutions

## TMA4255

### Applied Statistics

January 18, 2016

#### Intro

- Start MINITAB as we did on exercise 1.
- Make new project and name it Ex2.PRJ, as we did on exercise 1.
- Read data2.MTW as we did on exercise 1.

#### 1 Problem 1

a)

We want to test if if a N tyre on the average has better quality than a G tyre. Which means that we want to see if the N tyres have smaller decrease in the depth of the grooves than the G tyres. If the average of D can be written as

$\delta = \sum_{j=1}^9 \frac{G_j - N_j}{9}$  then testing  $H_0$  : *there is no difference between the tyres* against  $H_1$  : *N tyres are better*, has a meaning because:

- Under  $H_0$ :

$$\delta = 0 \Rightarrow \sum_{j=1}^9 \frac{G_j - N_j}{9} = 0 \Rightarrow \sum_{j=1}^9 G_j = \sum_{j=1}^9 N_j$$

which means that the decrease in the depth of the grooves is the same for both tyre types.

- Under  $H_1$ :

$$\delta > 0 \Rightarrow \sum_{j=1}^9 \frac{G_j - N_j}{9} > 0 \Rightarrow \sum_{j=1}^9 G_j > \sum_{j=1}^9 N_j$$

which means that the decrease in the depth of the grooves is smaller for the N tyres, and thus, N tyres are better.

b)

Use the following command:

**Commands:** *Stat - > Basic Statistics - > 1-sample 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  $\delta$ , which is 0.

The result gives us a p-value of 0.046 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*

In "samples in column" choose the C3 column named D, then check the "perform hypothesis test" box, then fill in the value for  $\delta$ , which is 0.

Here we get that the p-value is 0.074 which is greater than 0.05 and thus, we don't have enough evidence to 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*

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 too high for rejecting the null.

## 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.

**b)**

Do the same as in a), but this time choose the new confidence level. Then on the panel you can 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).