## Conditions

3. A researcher is interested in whether listening to music helps or hinders test-performance. To control for differences in cognitive level, this researcher decides to use a within-participants design. He selects a random sample of participants and has them study different material of equal difficulty in both the music and no music conditions. Participants take a 20-item quiz on the material. The table below shows the scores on the quiz. The study is completely counterbalanced to control for order effects. The scores obtained are measured on an interval-ratio scale and are normally distributed.

| Music | No Music |
|---|---|
| 17 | 17 |
| 16 | 18 |
| 15 | 17 |
| 16 | 17 |
| 18 | 19 |
| 18 | 18 |

a. What statistical test should be used to analyze the data?

b. Is this a one- or two tailed test?

c. Identify H0 and Ha for this study.

d. Conduct the appropriate analysis. Should H0 be rejected? What should the researcher conclude?

e. Calculate the 95 confidence interval.

## Solution

Here must be used an independent two-sample t-test.

For this test, the null hypothesis is that the means of samples are equal:

$$H_0: M_1 = M_2$$

$$H_a: M_1 \neq M_2$$

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S_{X_1X_2}\sqrt{\frac{1}{n_1} + \frac{1}{n_2}}},$$

$$S_{X_1X_2} = \sqrt{\frac{1}{2}\left(S_{X_1}^2 + S_{X_2}^2\right)}$$

$$S_{X_1}^2 = \frac{\sum_{i=1}^{6}(X_1 - \bar{X}_1)^2}{n}$$

$$S_{X_2}^2 = \frac{\sum_{i=1}^{6}(X_2 - \bar{X}_2)^2}{n}$$

For this example:

$t = 1.520409$

The degrees of freedom:

$k = 6 + 6 - 2 = 10$

For these degrees of freedom the t-criteria value is:

1.3720 – for p=0.80

1.8125 – for p=0.9

2.2281 – for p=0.95

2.7638 – for p=0.98

We can make a conclusion, that with probability 95% there is no difference whether listening to music helps or hinders test-performance. H0 is approved