

## 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

e. Conduct the appropriate analysis. Should  $H_0$  be rejected? What should the researcher conclude?

## Solution

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

$$H_0: M_1 = M_2$$

$$H_a: M_1 < M_2$$

$$t = \frac{\bar{X}_1 - \bar{X}_2}{S_{X_1 X_2} \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}},$$

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

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

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

For this example:

$$t = 1.677051$$

The degrees of freedom:

$$k = 6 + 6 - 2 = 10$$

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

2.2281 – for  $p=0.95$

We can make a conclusion, that with probability 95% there is no difference between 2 groups.  $H_0$  is approved.