

HOMEWORK ONE-WAY ANOVA

In StatTool open: HW_anova_1.dat

A researcher thinks that music affects concentration. He hypothesizes that soft music will increase concentration, moderately loud music will have no effect on concentration, and loud music will detract from concentration. He randomly breaks 24 college students into four groups. All groups are given a reading comprehension task while listening to a tape of their favorite music (which each subject was asked to bring to the experiment). The Soft Group hears the music at a low background level, similar to that played in a grocery store: It is there, but you can hardly hear it. The Moderate Group hears the music at listening level: The music is clearly present and can be easily heard. The Loud Group hears the music at a very high level. The Control Group hears only the soft sounds of an air conditioning system.

Reading Comprehension Scores			
Soft	Moderate	Loud	Control
20	36	25	22
12	30	28	15
12	32	25	27
13	36	20	19
17	30	25	20
17	33	24	21

The data in the table are reading comprehension scores; the higher the score the greater the comprehension.

1. What are the independent and dependent variables both abstractly and operationally.
2. What is (are) the scientific hypothesis(es)?
3. Find the means of the four groups and graph them.
4. Does the data pattern support the hypotheses? Why or why not?
5. Despite that, go ahead and check the statistical conclusion validity.

ANOVA 1

1. IV = Music level; (soft, moderate loud & control)
DV = Concentration (Reading comprehension score)

2 Music affects concentration (soft music will increase concentration, moderately loud music will have no effect & loud music will detract from concentration)

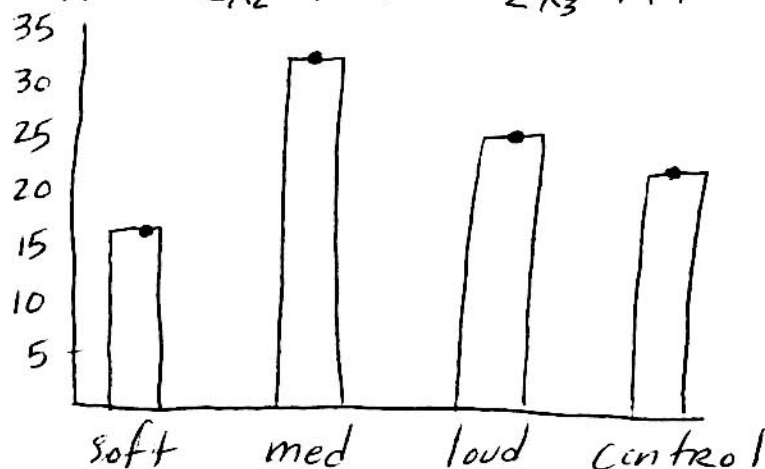
<u>Soft</u>	<u>Moderate</u>	<u>Loud</u>	<u>Control</u>
20	36	25	22
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13	36	20	19
17	30	25	20
<u>17</u>	<u>33</u>	<u>24</u>	<u>21</u>

$$M_1 = 15.167$$
$$\sum X_1 = 91$$

$$M_2 = 32.833$$
$$\sum X_2 = 197$$

$$M_3 = 24.5$$
$$\sum X_3 = 147$$

$$M_4 = 20.667$$
$$\sum X_4 = 124$$



4. No, data pattern does not support hypothesis
Soft music has the lowest mean.

$$\begin{aligned}
 5. \text{SSB} &= \sum \left[\frac{(\sum X_{ij})^2}{n_j} \right] - \frac{(\sum \sum X_{ij})^2}{N} \\
 &= \frac{912^2}{6} + \frac{197^2}{6} + \frac{147^2}{6} + \frac{124^2}{6} - \frac{559^2}{24} \\
 &= 992.46
 \end{aligned}$$

$$\begin{aligned}
 \text{SSW} &= \sum \sum X_{ij}^2 - \sum \left[\frac{(\sum X_{ij})^2}{n_j} \right] \\
 &= 14215 - 14012.5 \\
 &= 202.499
 \end{aligned}$$

$$\begin{aligned}
 \text{MSB} &= \text{SSB} / \text{dfB} \\
 &= 992.46 / 3 \\
 &= 330.82
 \end{aligned}$$

$$\text{dfB} = J - 1 = 4 - 1 = 3$$

$$\begin{aligned}
 \text{MSW} &= \text{SSW} / \text{dfw} \\
 &= 202.499 / 20 \\
 &= 10.125
 \end{aligned}$$

$$\text{dfw} = N - J = 24 - 4 = 20$$

$$\begin{aligned}
 F &= 330.82 / 10.125 \\
 &= 32.674
 \end{aligned}$$

$$\text{crit } F(3, 20)^{0.05} = 3.1$$

