

### 1. Problem

A survey with 51 persons was conducted to analyze the design of an advertising campaign. Each respondent was asked to evaluate the overall impression of the advertisement on an eleven-point scale from 0 (bad) to 10 (good). The evaluations are summarized separately with respect to type of occupation of the respondents in the following figure.



To analyze the influence of occupation on the evaluation of the advertisement an analysis of variance was performed:

	Res. Df	RSS	Df	Sum of Sq	F	Pr(>F)
1	50	53.549				
2	47	34.018	3	19.531	8.995	8.1265e-05

Which of the following statements are correct?

- (a) It can be shown that the evaluation of the respondents depends on their occupation. (Significance level 5%)
- (b) The fraction of explained variance is larger than 60%.
- (c) A one-sided alternative was tested for the mean values.
- (d) The fraction of explained variance is smaller than 45%.
- (e) The test statistic is larger than 7.5.

### Solution

In order to be able to answer the questions the fraction of explained variance has to be determined. The residual sum of squares when using only a single overall mean value ( $RSS_0$ ) as well as the residual sum of squares when allowing different mean values given occupation ( $RSS_1$ ) are required. Both are given in the RSS column of the ANOVA table. The fraction of explained variance is given by  $1 - RSS_1/RSS_0 = 1 - 34.018/53.549 = 0.365$ .

The statements above can now be evaluated as right or wrong.

- (a) True. The  $p$  value is  $8.13e - 05$  and hence significant. It can be shown that the evaluations differ with respect to the occupation of the respondents.
- (b) False. The fraction of explained variance is 0.365 and hence *not* larger than 0.6.
- (c) False. An ANOVA always tests the null hypothesis, that all mean values are equal against the alternative hypothesis that they are different.
- (d) True. The fraction of explained variance is 0.365 and hence smaller than 0.45.
- (e) True. The test statistic is  $F = 8.995$  and hence larger than 7.5.