Column Factor: For the column factor (lead level), we refer to the preceding Minitab display of results to find the *P*-value corresponding to the following test statistic:

$$F = \frac{\text{MS(lead level)}}{\text{MS(error)}} = \frac{24.400}{245.267} = 0.10$$

Conclusion: The corresponding *P*-value is shown in the Minitab display as 0.906. Because that *P*-value is greater than the significance level of 0.05, we fail to reject the null hypothesis of no effects from lead level. Performance IQ scores do not appear to be affected by whether the lead exposure is low, medium, or high.

Interpretation

Based on the sample data in Table 12-3, we conclude that performance IQ scores do not appear to be affected by sex or blood lead level. Example 1 in Section 12-2 showed that the different categories of blood lead level appear to have mean performance IQ scores that are different, but that example used more sample values than those included in this example.

CAUTION Two-way analysis of variance is not one-way analysis of variance done twice. When conducting a two-way analysis of variance, be sure to test for an *interaction* between the two factors.

Example 2 Performance IQ Scores

To better understand the method of two-way analysis of variance, let's repeat Example 1 after adding 30 points to each of the performance IQ scores of the females only. That is, in Table 12-3, add 30 points to each of the listed scores for females. The Minitab results will be as shown below. Based on the displayed results, we form these conclusions:

Step 1: Interaction Effect: The display shows a *P*-value of 0.655 for an interaction effect. Because that *P*-value is not less than or equal to 0.05, we fail to reject the null hypothesis of no interaction effect. There does not appear to be an interaction effect.

Step 2: Row Effect: The display shows a *P*-value of 0.000 for the row variable of sex, so we reject the null hypothesis of no effect from the factor of sex. In this case, the sex of the subject does appear to have an effect on performance IQ scores.

Column Effect: The display shows a *P*-value of 0.906 for the column variable of blood lead level, so we fail to reject the null hypothesis of no effect from the factor of blood lead level. The blood lead level does not appear to have an effect on performance IQ scores.

MINITAB

Two-way ANOVA: IQP versus SEX, LEAD

Source	DF	SS	MS	F	P
SEX	1	7457.6	7457.63	30.41	0.000
LEAD	2	48.8	24.40	0.10	0.906
Interaction	2	211.5	105.73	0.43	0.655
Error	24	5886.4	245.27		
Total	29	13604.3			