(2) The variances of the cells are 95.3, 146.7, 130.8, 812.7, 142.3, and 143.8. One of those values is considerably different from the others. The test is robust against departures from equal variances, but we might have some reservations about satisfying this requirement. For the purposes of illustrating the method of two-way analysis of variance, we will assume that this requirement is satisfied. (3) The samples are simple random samples of subjects. (4) The samples are independent of each other; the subjects are not matched in any way. (5) The sample values are categorized in two ways (sex and blood lead level). (6) All of the cells have the same number (five) of sample values.

The calculations are quite involved, so we use technology. The Minitab two-way analysis of variance display for the data in Table 12-3 is shown here.

MINITAB

Two-way ANOVA: IQP versus SEX, LEAD

Source	DF	SS	MS	F	P
SEX	1	17.63	17.633	0.07	0.791
LEAD	2	48.80	24.400	0.10	0.906
Interaction	2	211.47	105.733	0.43	0.655
Error	24	5886.40	245.267		
Total	29	6164.30			

Step 1: Interaction Effect: We begin by testing the null hypothesis that there is no interaction between the two factors. Using Minitab for the data in Table 12-3, we get the results shown in the preceding Minitab display and we find the following test statistic:

$$F = \frac{\text{MS(interaction)}}{\text{MS(error)}} = \frac{105.733}{245.267} = 0.43$$

Interpretation: The corresponding *P*-value is shown in the Minitab display as 0.655, so we fail to reject the null hypothesis of no interaction between the two factors. It does not appear that the performance IQ scores are affected by an interaction between sex (male, female) and blood lead level (low, medium, high). There does not appear to be an interaction effect.

Step 2: Row/Column Effects: Because there does not appear to be an interaction effect, we proceed to test for effects from the row and column factors. The two hypothesis tests use these null hypotheses:

H_0: There are no effects from the row factor (that is, the row values are from populations with equal means).

H_0: There are no effects from the column factor (that is, the column values are from populations with equal means).

Row Factor: For the row factor (sex), we refer to the preceding Minitab display of results to find the *P*-value corresponding to the following test statistic:

$$F = \frac{\text{MS(sex)}}{\text{MS(error)}} = \frac{17.633}{245.267} = 0.07$$

Conclusion: The corresponding *P*-value is shown in the Minitab display as 0.791. Because that *P*-value is greater than the significance level of 0.05, we fail to reject the null hypothesis of no effects from sex. That is, performance IQ scores do not appear to be affected by the sex of the subject.