Interpretation

By adding 30 points to each score of the female subjects, we do conclude that there is an effect due to the sex of the subject, but there is no apparent effect from an interaction or from the blood lead level.

Special Case: One Observation per Cell and No Interaction

Table 12-3 contains 5 observations per cell. If our sample data consist of only one observation per cell, there is no variation within individual cells and sample variances cannot be calculated for individual cells. This requires that we use the following procedure.

Procedure for Two-Way Analysis of Variance with One Observation per Cell

If it seems reasonable to assume (based on knowledge about the circumstances) that there is no interaction between the two factors, make that assumption and then proceed as before to test the following two hypotheses separately:

H_0: There are no effects from the row factor.

H_0: There are no effects from the column factor.

Example 3 One Observation per Cell: Performance IQ Scores

If we use only the first entry from each cell in Table 12-3, we get the Minitab results shown below. Use a 0.05 significance level to test for an effect from the row factor of sex and also test for an effect from the column factor of blood lead level. Assume that there is no effect from an interaction between sex and blood lead level.

MINITAB

Two-way ANOVA: IQP versus SEX, LEAD

Source	DF	SS	MS	F	P
SEX	1	4.167	4.167	0.02	0.901
LEAD	2	489.333	244.667	1.16	0.463
Error	2	421.333	210.667		
Total	5	914.833			

Solution

Row Factor: We first use the results from the Minitab display to test the null hypothesis of no effects from the row factor of sex (male, female).

$$F = \frac{\text{MS(sex)}}{\text{MS(error)}} = \frac{4.167}{210.667} = 0.02$$

This test statistic is not significant, because the corresponding P-value in the Minitab display is 0.901. We fail to reject the null hypothesis. It appears that performance IFQ scores are not affected by the sex of the subject.

Column Factor: We now use the Minitab display to test the null hypothesis of no effect from the column factor of blood lead level (low, medium, high). The test statistic is

$$F = \frac{\text{MS(lead level)}}{\text{MS(error)}} = \frac{244.667}{210.667} = 1.16$$

continued