Hypothesis of Interest: Example Two

Let's consider another example. Here you want to test whether the **Reading3** score for Cottonwood school is the same as the **Reading3** score averaged across Dogwood, Maple, and Pine. Please note that, in this hypothesis, you are not referring to the **Gender*School** combination. You are interested in only testing for main effects. In the presence of significant interactions, the tests for main effects might be misleading, so this example illustrates writing the LSMESTIMATE statement for main effects.

The hypothesis of interest, that is, is the **Reading3** score for Cottonwood school the same as the **Reading3** score averaged across Dogwood, Maple, and Pine schools, can be written in terms of cell means as $\mu_{1.} = 1/3\ (\mu_{2.} + \mu_{3.} + \mu_{4.})$ where

- $\mu_{1.}$ = **Reading3** score for Cottonwood school
- $\mu_{2.}$ = **Reading3** score for Dogwood school
- $\mu_{3.}$ = **Reading3** score for Maple school, and
- $\mu_{4.}$ = **Reading3** score for Pine school.

Rewriting this equation with zero on one side takes the following form: $\mu_{1.} - 1/3\ (\mu_{2.} + \mu_{3.} + \mu_{4.}) = 0$. Because this hypothesis involves only main effects, you don't need to provide the coefficients for the interaction terms. Only the coefficients associated with main effects need to be specified in the LSMESTIMATE statement.

But behind the scenes, coefficients of the specified effect (school) are equally distributed to the levels of the **School*Gender** interaction. For fractional coefficients that have repeating decimals, such as 1/3, accuracy and precision are lost when you write 1/3 as 0.33. In such situations, you must carry the decimal places to at least six digits or more, or multiply all coefficients by the common denominator to clear the fractions. If you multiply all coefficients by the common denominator in an LSMESTIMATE statement, you must use the DIVISOR= option to eliminate the need for fractions, but maintain the same magnitude of the difference that you are estimating.

Using a second approach, you need to provide only the coefficients for the main effect of school. The LSMESTIMATE statement does not need coefficients for the interaction terms for a hypothesis involving only main effects. From the equation $\mu_{1.} - 1/3\ (\mu_{2.} + \mu_{3.} + \mu_{4.}) = 0$, you can fill in the last column on the right, which corresponds to the main effect of school. As discussed earlier, in the case of fractional coefficients with repeating decimals, you can use the DIVISOR= option in the LSMESTIMATE statement to eliminate the need for fractions.
