Wed 12 April : Students worked on Hw06, and Dr. Burr answered their questions.

Fri 14 April: Misc. Project 2 discussion

- Comments on Hw06 summary statistics
- Fact that L_4 in Project 2 Q#6 is a contrast of cell means (as well as of row means)
- Lec2.r Either tapply() or aggregate() can be used to get row means.

  Aggregate – output is list

  tapply – " " matrix or vector

Comments on tables of summary statistics (HW06, Q#2)

From the table of cell means, we remark that mean iron content for Iron pots is consistently higher than for either Aluminum or Clay pots, for all three dishes. The standard deviations (SDs) in the nine cells have a large range (from a minimum of 0.07 to a maximum of 0.63), so the model assumption of equal variance needs to be looked at more carefully. The procedures we will use in Project 2 are robust against violations of the assumption of constant variance, because of the balance of the design, so we will proceed without examining this issue further.

This wasn't required for HW06.
You may (optionally) use these remarks in Project 2.

Discussion of the interaction plot is important in Project 2. [We had some in-class discussion of interaction plot interpretation.]

About Project 2, 4#6, The Th contrast

$$L_4 = \mu_{3.} - \frac{\mu_{1.} + \mu_{2.}}{2}$$

$$= \frac{\sum_{j=1}^{3} \mu_{3j}}{3} - \frac{1}{2}\left(\frac{1}{3}\sum_{j=1}^{3} \mu_{1j} + \frac{1}{3}\sum_{j=1}^{3} \mu_{2j}\right)$$

So, the nine coefficients of this linear combination of $\{\mu_{ij}\}_{\substack{i=1,2,3\\ j=1,2,3}}$ are :

$c_{11} = \frac{-1}{6}$, $c_{12} = \frac{-1}{6}$, $c_{13} = \frac{-1}{6}$

$c_{21} = c_{22} = c_{23} = \frac{-1}{6}$

$c_{31} = c_{32} = c_{33} = \frac{1}{3}$

And we have $\sum_{i=1}^{3}\sum_{j=1}^{3} c_{ij} = 3\left(-\frac{1}{6}\right) + 3\left(\frac{-1}{6}\right) + 3\left(\frac{1}{3}\right) = 0.$

so L_4 is a contrast of cell means.

Project 2, Q # 6

See Lecture 28 pp. 144 & 145
and, for L_4, see p. 141 for quicker way to get $\widehat{\text{var}}(\hat{L}_4)$

We have seen that L_1, L_2, L_3, L_4 are all contrasts of the cell means. Therefore, we can use the Scheffé method to find simultaneous confidence intervals for these four contrasts as a group, following the procedure described on pp. 144 & 145 of the lecture notes.

shortcut formula for $\widehat{\text{var}}(\hat{L}_4)$:

Now $L_4 = 1(\mu_{3.}) - \frac{1}{2}\mu_{1.} - \frac{1}{2}\mu_{2.}$ (w/ $c_1 = 1$, $c_2 = c_3 = -\frac{1}{2}$)
so L_4 is also a contrast of the row means, and we can get $\widehat{\text{var}}\,\hat{L}_4$ by the formula on p. 141 —

$$\widehat{\text{var}}(\hat{L}_4) = \frac{MSE}{bn}\sum_{i=1}^{a} c_i^2 .$$