Errata Sheet, 12/1/11

Design of Experiments: An Introduction Based on Linear Models

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Here are errors of which I am aware as of the date given above. As more are found, I will periodically update this document. I am grateful for email pointing out errors I've not listed. – MDM

- page 15, line 8: " rank($\mathbf{X}'\mathbf{X}$) $\leq k$" should be " rank($\mathbf{X}'\mathbf{X}$) $< k$".
- page 22, line 4: "$\mathbf{X}_1(\mathbf{X}_1'\mathbf{X}_1)^{-1}\mathbf{X}_1$" should be "$\mathbf{X}_1(\mathbf{X}_1'\mathbf{X}_1)^{-1}\mathbf{X}_1'$".
- page 37, 3 lines from the bottom: " group;- rats" should be "group; rats".
- page 44, in equation (3.8): "$\bar{y}_i$" should be "$\bar{y}_{i.}$".
- page 51, line 22: "problem 2" should be "exercise 2".
- page 52, line 11: " length of confidence intervals" should be "length of 95% confidence intervals".
- page 53, line 17: " expected width $(5\%)^2$" should be "expected squared width $(5\%)^2$".
- page 61, equation (4.9): "$Var(\widehat{\mathbf{C}'\boldsymbol{\tau}})$" should be "$Var(\widehat{\mathbf{C}\boldsymbol{\tau}})$".
- page 68, Exercise 3 (b), second sentence: "Is is" should be "Is it".
- page 69, Exercise 6, second sentence: "blocks 7 and 8" should be "blocks 6 and 7".
- page 83, 5 lines from the bottom: "$\sum_l(\bar{y}_{ijkl} - \bar{y}_{....})^2$" should be "$\sum_{ijkl}(\bar{y}_{ijkl} - \bar{y}_{....})^2$".
- page 83, 3 lines from the bottom: "$\sum_l r(\bar{y}_{...l} - \bar{y}_{....})^2$" should be "$\sum_l t^2(\bar{y}_{...l} - \bar{y}_{....})^2$".
- page 84, line 7: "$\sum_l t^2(\bar{y}_{..k.} - \bar{y}_{....})^2$" should be "$\sum_l rt(\bar{y}_{..k.} - \bar{y}_{....})^2$".
- page 88, 11 lines from the bottom: "(e.g. total of 8 automobiles)" should be "(i.e. total of 8 automobiles)".
- page 107, line 1: "subection 5.1.1" should be "subsection 5.1.1".
- page 114, 4 lines from the bottom: "any two columns of $\mathbf{X}_2$ is zero" should be "any two columns of $\mathbf{X}_2$ is λ".
- page 115, 9 lines from the bottom: "just the rows of $\mathbf{H}_1\mathbf{X}_2$ corresponding" should be "just the rows of $(\mathbf{I} - \mathbf{H}_1)\mathbf{X}_2$ corresponding".
- page 132, line 20: "$\frac{1}{k}(k^2\sigma_\beta^2 + \sigma^2)$" should be "$\frac{1}{k}(k^2\sigma_\beta^2 + k\sigma^2)$".
- page 136, line 5: "$k\sigma_\delta^2 + \sigma^2$ can be estimated by" should be "$k\sigma_\beta^2 + \sigma^2$ can be estimated by".
- page 137, line 10 after the table: "MSE_{inter} is 0.9876" should be "MSE_{inter} is 2.9630".
- page 166: 4 lines from the bottom: "a confidence interval" should be "a 95% confidence interval".

- page 166: 2 lines from the bottom: "power of the test" should be "power of the level 0.05 test".
- page 170: 3 lines from the bottom: "$\delta_{it(i)}$ and $\epsilon_{it(i)j}$" should be "$\zeta_{it(i)}$ and $\epsilon_{it(i)j}$".
- page 176: line 12: "$y_{tij} = \rho_t + \dot{\alpha}_i + \delta_{ti} + \dot{\beta}_j + (\dot{\alpha\beta})_{ij} + \epsilon_{tij}$" should be "$y_{tij} = \rho_t + \dot{\alpha}_i + \zeta_{ti} + \dot{\beta}_j + (\dot{\alpha\beta})_{ij} + \epsilon_{tij}$".
- page 176: line 15: "$\zeta_{ti} \sim$ i.i.d., $E(\zeta_{ti}) = \mu_\zeta,\ Var(\delta_{ti}) = \sigma^2_\zeta$" should be "$\zeta_{ti} \sim$ i.i.d., $E(\zeta_{ti}) = \mu_\zeta,\ Var(\zeta_{ti}) = \sigma^2_\zeta$".
- page 243, 18 lines from the bottom: "in which only the sign of one factor" should be "in which the sign of only one factor".
- page 296, 13 lines from the bottom: "A BIBD based on" should be "A BIBD in 6 blocks based on".
- page 297, Exercise 5: Before the sentence that begins "For $d > 3$, the design contains ...", the following text should be inserted:

  For $d = 3$, the design matrix is:

$$\begin{pmatrix} -1 & -1 & -1 \\ -1 & +1 & +1 \\ +1 & -1 & +1 \\ +1 & +1 & -1 \\ +1 & 0 & 0 \\ 0 & +1 & 0 \\ 0 & 0 & +1 \\ -1 & -1 & +1 \\ -1 & +1 & -1 \\ +1 & -1 & -1 \end{pmatrix}.$$

- page 297, 2 lines from the bottom: "$y(x) = y(-x)$" should be "$E(y(x)) = E(y(-x))$".
- page 311, 9 lines from the bottom: "half of the runs as $x = -1$" should be "half of the runs at $x = -1$".
- page 323, line 5: "$\boldsymbol{\theta}' = (\alpha, \tau_1, \tau_2, \tau_3, \tau_4, \tau_5)$" should be "$\boldsymbol{\theta}' = (\alpha, \tau_1, \tau_2, \tau_3, \tau_4)$".
- page 325, line 6: "$r^2\mathbf{I} + (2r + t)\mathbf{J}$" should be "$\frac{1}{t+r}(r^2\mathbf{I} + (2r + t)\mathbf{J})$".
- page 325, line 8: "$\mathbf{X}_2'\mathbf{X}_2 - \mathbf{X}_2'(\mathbf{I} - \mathbf{H}_1)\mathbf{X}_2$" should be "$\mathbf{X}_2'\mathbf{X}_2 - \mathbf{X}_2'\mathbf{H}_1\mathbf{X}_2$".
- page 326, table for exercise 6(a): "corrected total 2" should be "corrected total 8".
- page 327, line 6: "suggesting no evidence" should be "suggests no evidence".
- page 327, 16 lines from the bottom: "`amod <- aov(y~Treatment)`" should be "`amod <- aov(y~Dose)`".
- page 327, 5 lines from the bottom: "studentized residuals each a" should be "studentized residuals are each a".
- page 328, last line of 2(d): $\sqrt{(4 \times 0.01368 \times 3)/(2 \times 4)} = 0.1013$ should be $\sqrt{(2 \times 0.01368 \times 3)/(2 \times 4)} = 0.1013$

- page 329, exercise 4(b): "critical value is $F_{0.95}(4, 360) = 2.3967$ ... based on the $F'(4, 360, 43.43)$ distribution" should be "critical value is $F_{0.95}(4, 236) = 2.4099$ ... based on the $F'(4, 236, 43.43)$ distribution".

- page 331, exercise 5(b): "*MSE* is 14.669 ... margin of error of 37.69" should be "*MSE* is 11.5920 ... margin of error of 29.80".

- page 332, exercise 1, first line in the body of the table: "T" should be "Temp".

- page 332, exercise 7(a), two lines are missing from the table:

Latin Square rows	$r(l_2 - 1)$
Latin Square columns	$r(l_2 - 1)$

  and S.P. Residual degrees of freedom should be $r(l_2 - 1)^2 - l_1(l_2 - 1)$.

- page 332, exercise 7(b): solution should be:

  If all variation due to Latin Square reps, row-blocks, and column-blocks is ignored in the ANOVA decomposition, the (single) "residual" mean square is likely to be inflated; at least the tests for the B main effect and the A×B interaction would likely be conservative.

- page 334, exercise 4: solution should be:

  (a) $\frac{1}{N}\sigma^2 = \frac{1}{128}\sigma^2$.

  (b) $\widehat{E(y_{111222})} = \hat{\mu} - \hat{\alpha} - \hat{\beta} - \hat{\gamma} + \hat{\delta} + \hat{\zeta} + \hat{\eta} + \hat{(\alpha\beta)} + \hat{(\alpha\gamma)} - \hat{(\alpha\delta)} - \hat{(\alpha\zeta)} - \hat{(\alpha\eta)}$. $Var(\widehat{E(y_{111222})}) = \frac{12}{128}\sigma^2 = 0.09375\sigma^2$. The quantity being estimated is not a a contrast in treatment means.

  (c) $\widehat{E(y_{111222} - y_{111111})} = 2\hat{\delta}+2\hat{\zeta}+2\hat{\eta}-2\widehat{(\alpha\delta)}-2\widehat{(\alpha\zeta)}-2\widehat{(\alpha\eta)}$. $Var(\widehat{E(y_{111222} - y_{111111})}) = \frac{6}{128}4\sigma^2 = 0.1875\sigma^2$.

- page 337, exercise 2: table should be:

	residuals	
run	standardized	studentized
1	-0.322	-0.806
2	-0.322	-0.806
3	-0.395	-0.990
4	-0.395	-0.990
5	-0.322	-0.806
6	-0.395	-0.990
7	-0.395	-0.990
8	-0.322	-0.806
9	0.639	0.671
10	0.918	0.963
11	1.308	1.372

- page 339, exercise 5: solution should be:

  (a) $\phi_M(D) = ||(\mathbf{X}_2'\mathbf{X}_2)^{-1}\mathbf{X}_2'\mathbf{X}_3|| = \frac{1}{N^2}||\mathbf{X}_2'\mathbf{X}_3|| = \frac{1}{N^2}\text{trace}(\mathbf{X}_3'\mathbf{X}_2\mathbf{X}_2'\mathbf{X}_3)$.

(b) If N is large enough to accommodate a Resolution IV (or more) fraction, this is optimal because $\mathbf{X}_2'\mathbf{X}_3 = \mathbf{0}$ for such designs. If N is smaller, the non-zero elements of $\mathbf{X}_2'\mathbf{X}_3$ all have absolute value N, and the number of them is 3 times the number of words of length 3 in the generating relation; therefore the optimal designs are minimum aberration designs of Resolution III.