Homework 2

1. Assume you have a CRD with a treatments and 1 control so that $n_{\cdot} = \sum_{i=1}^{a+1} n_i$. Assume you are interested in the contrasts $\alpha_i - \alpha_{a+1}, i = 1, \ldots, a$ and hence interested in minimizing $\sum_{i=1}^{a} V(\bar{Y}_{i\cdot} - \bar{Y}_{a+1\cdot})$. Simplify the expression as a function of σ^2; which values of n_i minimize this expression?

2. (Estimability) Consider the following data set:

Factor level		
1	2	3
12	15	17
14	13	21
9	12	18
8	11	18

   Write the normal equations for the unconstrained model (see slide 3 from Lecture 5); simplify the equations by entering the actual values for n (the number of replications at each factor level), $y_{\cdot\cdot}$ (the grand sum), $y_{1\cdot}$ (the sum of observations at factor level 1), etc. Find estimates for $\tilde{\mu}_{\cdot}$, $\tilde{\mu}_{\cdot} + \alpha_1 + \alpha_2$, $\alpha_1 - 2\alpha_2 + \alpha_3$ under the constraint $\sum \alpha_i = 0$. Estimate the same effects under the constraint $\alpha_1 = 0$. Compare your results. Comment on the estimability of these effects.

3. Problem 8.2. Analyze the data in SAS using a saturated full factorial model for the three factors, `speed, stride, mass`; the response is `vo2` (the SAS code on Yandell's homepage is not necessarily relevant). Find an appropriate model by deleting unimportant terms (but make sure your recommended model is hierarchical). Compute the contrast sum of squares for the `stride` main effect by hand–confirm that this equals the `stride` sum of squares from your output. Generate and interpret any relevant interaction plots.