STA 2004F Homework 1.

1. (*cf. CR 1.3)* Find a news article that reports the results of a medical study, and then find the source article on which the news article is based. Describe the type of study, the experimental (or observational) units, the treatments and the response(s). Note any features of the study that might limit the strength of the conclusions. Discuss to what extent the news article is an accurate reflection of the original source. (Please submit a copy of the news article and the journal article with your homework.)

2. (*CR 1.5)* As part of a study of the accuracy and precision of laboratory chemical assays, laboratories are provided with a number of nominally identical specimens for analysis. They are asked to divide each specimen into tow parts and to report the separate analyses. Would this provide an adequate measure of reproducibility? Why or why not?

3. In this exercise the data of Table 5.11 on p.125 of CR will be analysed as a randomized block experiment, where days form the blocks, and the factorial structure of the 16 treatments is ignored. This exercise should be solved using your favorite statistics package, and the computational work provided as an appendix. The solutions to (a) and (b) should be provided separately printouts of the computations.

   (a) Construct the table of treatment means and use the analysis of variance table to provide an estimate of the standard error of the difference between two treatments.

   (b) Devise two orthogonal linear contrasts of interest, and partition the sums of squares due to treatments according to these two contrasts.

4. In a completely randomized design to compare two treatments, assume the model

$$\begin{aligned} Y_{1j} &= \mu + \delta + \epsilon_{1j} \\ Y_{2j} &= \mu - \delta + \epsilon_{2j} \end{aligned}$$

   and assume that the ϵs are all independent with mean zero and variance σ^2. Let $\Delta = 2\delta$, $\hat{\Delta}$ be its least squares estimator, and show that with cn observations in group 1 and $(1-c)n$ observations in group 2, $\text{var}(\hat{\Delta})$ is minimized when $c = 1/2$. What is the extension of this result to more that two treatments?

5. *(CR 3.2): Optional for M.Sc.* Suppose in a matched pair design the responses are binary. Construct the randomization test for the null hypothesis of no treatment difference. Compare this with the test based on that for the binomial model, where Δ is the log odds ratio.