

## Power Analysis Exercise

I would like you to work in informal groups in discussing coding changes and running the code. Hand in typed responses to questions.

Suppose you have a Completely Randomized Design with 4 levels: 3 treatments and 1 control. In the analysis, you are particularly interested in comparing the control mean against the average of the treatment means:

$$H_o : \frac{\mu_1 + \mu_2 + \mu_3}{3} - \mu_4 = 0$$

1. What are the contrast coefficients? Substitute your answer into the formula for the noncentrality parameter for a contrast and simplify in preparation for coding changes in the following steps.
2. Suppose  $\sigma^2 = 4$  and you would like to detect an alternative contrast of 1; use this information to rewrite the noncentrality parameter as a simple function of  $n$ . Now modify `power.sas` in order to conduct a power analysis. Note that you do not need to loop on `s02` since  $L$  is fixed at 1; eliminate this loop. Based on your modified code, use your output file to construct a scatterplot of the power as a function of  $n$ ; what range of  $n$  values gives you good power to detect  $L = 1$ ?
3. With  $\sigma^2 = 4$ , modify `power.sas` to compute power for a range of choices of  $L$  and  $n$ ; it helps if you rewrite the noncentrality parameter `nc` as a function of  $L$ . The output file should contain the power for a grid of values of  $n$  and  $L$ .
4. Produce a power contour plot in Minitab (see class webpage for using Minitab's contour plot menu). You may have to manipulate your choice of  $n$  in order to obtain a satisfactory plot. What are some choices of  $(L, n)$  for the .80 power contour?