Power Analysis Exercise

In the following exercise, we will be studying power analysis for contrasts, using the hypotheses and methods in Lecture 3, slides 15 through 18. 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 for this contrast? What is the numerical value that would be assigned to $\sum c_i^2$?

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 the code used to create the data set `cpower` in `power_crd.sas` (available on the website) in order to conduct a power analysis. Note that you do not need to loop on `L` since L is fixed at 1; eliminate this loop for now. 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 $L = 1$? You can construct the scatterplot either in Minitab or SAS (the SAS source code for Class Exercise 1 includes an example of scatterplot code).

3. With $\sigma^2 = 4$, modify `power_crd.sas` to compute power for a range of choices of L and n; be sure to reintroduce the loop on L. The output file should contain the power for a grid of values of n and L.

4. Produce a power contour plot using SAS's PROC GCONTOUR or 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)* that lie close to the .80 power contour?