Replications and Normal Probability Plots

Which effects are distinguishable from error? As the number of replications increases, our ability to distinguish effects from background noise should improve. In this exercise, with n=1 replication, all effects should be indistinguishable from error. As n increases, the variance of the negligible effects decreases and the slope of the error line in the normal probability plot increases, revealing the real effects.

You first need to download sim_mac, a Minitab macro, from the course webpage to a local drive (I've used the stat506 folder on my z drive here). If you download it as a text file (I recommend this), it will probably be called sim_mac.txt. You will want to verify the complete name and substitute where appropriate. In Minitab, you need to go to Edit on the main menu and select Command Line Editor. Then enter

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%'z:\stat506\sim_mac.txt' 1
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to run the macro for n=1 replication (note that all macro commands in Minitab start with a percentage sign). Do any effects seem to be important? Repeat the macro a few times with 1 rep–what do you observe?

Try the macro using values other than 1 for the number of replications (change the 1 in the command line to the number of replications you wish to run)–it is always worthwhile to repeat the macro a few times for the same number of replications. As you increase the number of replications, notice that the significant effects never change in magnitude but the slope of the negligible effects does. Which effects are present in this experiment? How many replications are needed before each of these effects becomes distinguishable from error? What are the magnitudes of these effects?

When you are finished, you can analyze the upper boot rope pull exercise in Minitab. I would like you to analyze the first and second runs separately and then the combined runs together. The combined runs should be analyzed as both raw data in 16 runs and as averages in 8 runs–there is a note for analyzing replicated designs in "Some notes on analyzing factorial designs in Minitab". When creating the design, enter the factors in reverse order (A as C, B as B, and C as A) so that the order the runs are listed in Minitab's worksheet corresponds to the book's Standard Order–this will make data entry easier. Be ready to discuss your results in class.