**Blockex: Analysis of block designs in JMP**

The data discussed in class are in mead53b.csv. This analyzes a small study using an RCBD with 3 treatments and 10 blocks. The treatments are labeled T1, T2 (the two treatments) and C (control). The blocks are numbered 1, 2, ... 10.

Read the data from the .csv file. Nothing new here.

Make sure that both the blocking variable and the treatment variable are red bar (nominal) variables. That’s because we want to estimate means for each block (to adjust the responses for differences between blocks) and we want to analyze treatment means. Treatment is a character variable, so it will be automatically set to red bar (nominal). Blocks are numbered, so block is a blue ramp (continuous) variable by default. Set it to red bar (nominal).

If you don’t remember how to change the modeling type for a variable, it can be done in various ways. The simplest is to look in the Columns box (left middle of the JMP window), where you see the blue ramp. Right click on the blue ramp and select nominal. You see the icon change to red bar.

**Blocks as fixed effects**

You can fit a block model either using the Analyze / Fit Y by X dialog and specifying a variable in the Block box. The more general way, which we’ll use, is Analyze / Fit model with a model that includes both block and treatment effects.

Start the Analyze / Fit Model dialog, put height in the Y box and both block and trt in the Model Effects box. Run the model. The left-most column has results for the model. The middle and right column have results for blocks and treatments.

Starting with the model results (left most column), I ignore the actual vs predicted value plot and the Effect Summary.

The Residual vs Predicted value plot is what I use to check assumptions, which is almost always a good idea. You’re looking for a “flat fat sausage”. A trumpet shape or an unusually large residual are signs of trouble (unequal variances or outlier). This plot looks fine to me.

The most useful number in the Summary of Fit box is the Root Mean Square Error. This is the pooled standard deviation.

The next two items in the output are two tables that look like ANOVA tables. These can be understood by remembering that every F test corresponds to a comparison between two models.

The Analysis of Variance table looks the most like an ANOVA table. This compares the entire model (block + trt) to an intercept only model. This question is rarely of interest in any study, and especially not in a block design, because you expect there to be differences among blocks. The most useful number in this table is the error MS, which is the pooled error variance. The error SD = sqrt(Error MS) is reported as Root Mean Square Error in the table immediately above the Analysis of Variance table.

The parameter estimates table is usually minimized. We won’t often want this information.

The second table is labelled Effect Tests. This gives results for partial tests. These compare the model with all terms to the model with in the indicated term. Here, the block line compares block + trt to trt. You should note that blocks have 9 df, which is what you should expect, i.e. # blocks – 1. The trt line compares block + trt to block. This trt comparison is the appropriate one when the data have blocks.

The block table has information about each block average, which rarely is of interest.

The trt table has information about each treatment average, which is of extreme interest. All the ‘after the ANOVA’ comparisons of treatment means are found under the red triangle at the top of box, by trt.

If you forget to switch block to a red bar variable before running the model, you will still get results, including the F test of treatments. But, these are quite wrong, because the wrong model was used to adjust the data for differences among blocks. When block is a red bar variable, the model estimates a mean for each block. This is what is used to remove block differences. When block is a blue ramp variable, the model estimates a regression line (X= block number, Y = height), which is completely meaningless in this situation.

There are two ways to check that you fit the intended model (means for each block).

1) Look at the df for blocks in the Effect Tests box. It is 1 if you fit a regression and B-1 (here, 9) if you fit the model you should have fit.

2) Look at the column of output for blocks. If you fit a regression, you won’t see any information about block means.

**Blocks as random effects**

This combines the above model with concepts from last week’s discussion of random effects.

Set up the block + trt model. Before running it, declare block as a random effect (select block then click the Attributes red triangle and select Random Effect).

Also, look at the Emphasis item in the Model Specification box. The default for fixed effects models is Effect Leverage, which gives you information about the block and trt means. The default for a mixed model is Minimal Report, which suppresses information about the block and trt means. If you want to do any “after the ANOVA” analyses (which I encourage), you need to change the Emphasis to Effect Leverage. Then run the model.

If you don’t see the trt means in the output, you forgot to switch Emphasis to Effect Leverage before running the model.

The output is a combination of the fixed effects output (described above) and variance components output (described last week). You don’t get an ANOVA table, but you do get the error variance in the Variance Component Estimation box. The Root Mean Square Error number in the Summary of Fit is the pooled sd (square root of the Var Component for Residual). All the “after the ANOVA” analyses of means are available by clicking the red triangle by trt.