# STAT 323/523: DESIGN & ANALYSIS OF EXPERIMENTS I

## Project 1 – Design Protocol Form

* Answers must be typed under the questions, and then the completed form is to be saved as a PDF and uploaded to *Canvas.*
* Your answers must be typed in right under the question they are addressing.
* Make sure to use a different font (e.g. Calibri or Arial) or different color for your answers.

### Check list:

* Is the treatment structure for your experiment factorial?
* Are the factors in your experiment categorical (and not being treated as quantitative)
* Is the response variable clearly quantitative and continuous? (Eg. Should NOT be a rating or count taking values between 1 to 5 or 1 to 10.)

**Record the names of team members here: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

PROJECT TITLE:

STUDY DESCRIPTION:

Address the following.

1. State your research question.
2. Provide a description of your response variable; would you like high values or low values of the response variable; what are the units of measurement going to be.
3. Provide a description of your factors/explanatory variables of interest; including the number and levels of the factor, and the treatment structure.
4. A description of the experimental unit; how you will acquire your experimental units/subjects; how many you are planning to use; how many reps per treatment:
5. List *other* possible sources of variation that could affect the response variable(s).
6. Describe in detail how you will use direct control and which of the sources of variation from (e) will be addressed by direct control.

1. Will you be using blocks? If so, what are the blocks? How many are you planning for? (Note: The experimental unit and block cannot be the same thing. Remember that blocks are made up of homogenous or alike experimental units.)
2. Describe in detail how you will use randomization of run order and which of the sources of variation from (e) will be addressed by randomizing the run order.
3. Describe in detail how you will use random assignment and which of the sources of variation from (e) will be addressed by random assignment.
4. Include the first two columns of the ANOVA table (SOURCE and DF) you expect for your experiment.
5. Use *JMP* to create the table showing how the treatments will be randomized to experimental units, with blocking if relevant to your design. Provide a screenshot of this design. (**Note:** Please save this JMP table because when you collect data, you will be using this randomization table to decide what order you are going to carry out the experimental runs.)

**JMP instructions for creating this table, if using a CRD**

* Launch JMP
* From the top menu > DOE, select Classical > Full Factorial Design
* Rename the response variable from Y to something meaningful for this experiment, e.g. Flight time (Note: Move the mouse over to “Y” and click on it to make it editable.)
* Add one categorical factor with *g* levels (*g is the number of levels your factor has*). (Note: Click on “Categorical” under Factors, and select the relevant number of levels.) Give the factor a relevant name; e.g. “Wing length”. Change the L1, L2, etc. to appropriate category labels.
* Add another categorical factor with *g* levels. Give the factor a relevant name; e.g. “Foot weight”. Change the L1, L2, etc. to appropriate category labels.
* Click “Continue”.
* Set “Number of replicates” to *at least 2*. (This will provide a total of at least 3 experimental units per treatment. This number depends on how many reps per treatment you are planning.)
* Click on Make Table.
* This will give you a data spreadsheet ready to enter your response variable data in, when you start your data collection. Note that this will also randomize the run order for you.

[Here’s a video link to demo how to create the data table for a CRD.](https://www.youtube.com/watch?v=Rwa85Lhqntk)

JMP instructions for creating this table, if using an RCBD

* Launch JMP
* From the top menu > DOE, select Custom Design
* Rename the response variable from Y to something meaningful for this experiment, e.g. Stacking time (Note: Move the mouse over to “Y” and click on it to make it editable.)
* From the Add Factor dropdown, add one categorical factor with *g* levels (*g is the number of levels your factor has*). Give the factor a relevant name; e.g. “Which hand”. Change the L1, L2, etc. to appropriate category labels; eg. Dominant, non dominant.
* Add another categorical factor with *g* levels. Give the factor a relevant name; e.g. “music”. Change the L1, L2, etc. to appropriate category labels e.g. none, fast, slow.
* From the Add Factor dropdown, add one Blocking variable, and click on Other to specify the total number of treatments in the study. Because if you want an RCBD, you need to have all the treatments appear in every block – so you need the number of runs per block to be the same as the number of treatments. In the above example, where the treatment structure is 3x2 factorial, with 6 treatments, the number of runs per block will be 6, in an RCBD.
* Change the “Values” of the blocking variable to be the same as the number of blocks you want to include in the study. In the cup stacking example, let’s say I will have 3 participants, so I’ll set that value to 3.
* Make sure to label the blocking variable appropriately.
* Click on “Continue”
* Set “Number of runs” to what you anticipate the total number of experimental units will be; number of treatments multiplied by number of blocks. In our example, 6 x 3 = 18.
* Click on Make Design.
* Click on Make Table.
* This will give you a data spreadsheet ready to enter your response variable data in, when you start your data collection. Note that this will also randomize the run order for you.

[Here’s a video link to demo how to create the data table for an RCBD.](https://www.youtube.com/watch?v=FlD_7sW0gbE)