

## Helicopter DOE – Design Phase

We want to maximize the average flight time of paper helicopters dropped from a fixed height. Here are the factors and levels:

Factor	Type	Level 1	Level 2	Level 3
Paper	Categorical	Light	Heavy	
Blade length	Continuous	3.25"	4.5"	5.75"
Stem length	Continuous	3.5"	4.0"	4.5"
Paper clip	Categorical	Small	Large	

For continuous factors you enter only the low and high levels

1. The expected  $\sigma_{noise}$  for flight time is 0.14 seconds. The desired difference to detect is 0.2 seconds. Do a sample size calculation. (Don't forget to change "D-Optimal" to "I-Optimal".)
2. The instructor will tell you how many blocks will be needed. Create a design matrix for an optimization experiment with the calculated sample size and the indicated number of blocks. (Don't forget to change "I-Optimal" back to "D-Optimal".)
3. Paper will be treated as a hard-to-change factor. Sort the matrix accordingly.
4. Save the data table as *Helicopter DOE*.
5. We will be dividing into teams to run this experiment. The instructor will show each team how to build the helicopters.
6. Build the helicopters called for in Block 1 of the design matrix in the data table saved by *one* of the team members. (The matrix produced by Custom Design will be different for each person.)
7. *Double-check the helicopters against the matrix!*
8. To simulate a shift change, everyone changes manufacturing jobs for Block 2. Block 1 people will provide cross-training as needed before starting Block 2. The new teams will then build the helicopters called for in Block 2.
9. *Double-check the helicopters against the matrix!*
10. Save your design file and give all team members a copy.