Statistics 5303
Spring 2016

Exam #2 Data

Our second exam is Friday, May 6. The exam is open book and open notes. Those of you who have your text and notes electronically on your laptops or devices may bring and use your laptop (or tablets) to access the book and notes. No other use of electronic devices is allowed during the exam.

Answer the exam questions on these data using your notes; your solutions should refer to specific analyses on specific pages of your notes (e.g., see Box-Cox plot on page 3). Attach your notes to your exam when done.

In your analyses, remember to check for assumptions and study interactions. Your analysis should go beyond just the ANOVA and what is significant; it should try to explain what is going on in the data.

This preliminary analysis should be considered part of your exam. *Do your own work!* Discuss these data only with the instructor.

Everyone enjoys paper airplanes, and one the great mysteries and grand challenges of youthful experimentation is how to design and launch paper airplanes to fly as far as possible. This experiment examines the influence of three designs (the Moth, the Arrow, and the Stealth) and three angles (0, 22.5, and 45 degrees above horizontal) on distance traveled (in feet). The paper airplanes will be launched from an apparatus on a table three feet above the floor. The launch apparatus can supply consistent launch force for the airplanes, and the three launch angles can be reproduced consistently and accurately using the apparatus.

We begin with 18 sheets of paper. These 18 sheets of paper are randomly assigned to the three designs (folding patterns), with six sheets of paper per design. Each of the 18 paper airplanes will be launched twice, and each flight distance will be recorded as a response. Launch angles are randomized to the launches subject to the restrictions that:

- Each airplane is launched at two different angles.

- Each launch angle is used four times for each design (ie, for four of the six example planes of that design).

- Each launch angle is used an equal number of times as first or second launches.

- Each pair of launch angles is used twice for each design.

Equivalently, the six airplanes of a given design are randomly assigned to the launch angle orders (0, 22.5); (22.5, 0); (0, 45); (45, 0); (22.5, 45); (45, 22.5).

Our interest is focussed on the factors that affect flight distance. The data for this experiment are in the file `planes.txt` on the class web page and are also displayed on the next page.

design	angle	plane	launch	distance
# data from Parker Ottinger				
Moth	45	5	1	19.6
Arrow	0	3	1	17.8
Moth	22.5	6	1	14.7
Arrow	22.5	4	1	12.6
Moth	0	2	1	19.3
Moth	22.5	1	1	15.2
Stealth	45	1	1	18.6
Arrow	0	5	1	17.2
Stealth	45	3	1	9.6
Stealth	22.5	4	1	7.2
Stealth	0	2	1	13.6
Arrow	22.5	2	1	12.2
Arrow	45	1	1	10.6
Stealth	0	6	1	12.2
Stealth	22.5	5	1	10.8
Arrow	45	6	1	16.6
Moth	45	4	1	8.66
Moth	0	3	1	15.7
Stealth	45	5	2	9.3
Stealth	0	4	2	15.5
Moth	45	6	2	14.0
Moth	22.5	3	2	9.9
Arrow	0	6	2	6.7
Arrow	0	2	2	17.1
Moth	45	2	2	22.5
Arrow	45	5	2	12.7
Arrow	22.5	1	2	15.5
Moth	0	1	2	12.8
Stealth	45	6	2	13.1
Moth	22.5	4	2	17.6
Stealth	0	3	2	9.7
Stealth	22.5	1	2	12.1
Arrow	22.5	3	2	13.5
Moth	0	5	2	11.6
Stealth	22.5	2	2	8.8
Arrow	45	4	2	17.3