Stat 713 Course Project

Spring 2008

Due: Thursday May 1 - Thursday May 8

You'll run an experiment on one of two topics below: describe how it was run (include details on randomization, replication, blocking, etc.), record the data, set up the ANO(CO)VA model, analyze the data, make conclusions and implications (paying attention to the running of the experiment and the mathematical results), and present your results in a report.

To do the experiment, you will work in one of two teams and should discuss and work on all details of the project with your team members. **However, each individual must turn in their own report written in their own words.** Your written report should include at least the following components:

- names of team members
- goal of the experiment (e.g. to determine the effects of ******** on ********)
- description of how the experiment was conducted, including what factors (which is/are main, which is/are blocking factor(s) and why block on it/them, which is/are covariate(s) and why bother — uncontrollable but measurable variables)
- the design (why run it this way with this type of replication and randomization – must address practical feasibility)
- experimental units
- randomization procedure (treatment allocation, etc.)
- who was responsible for what component of the study (e.g. Amy designed the experiment and made measurements on the experimental units, Bobby created the treatments and experimental units, both entered the data on the computer, etc.) — Perhaps the easiest way to do this is through an activities table.
- what equipment was used, and how the equipment replicates (if any) were created, why equipment replicates were or were not included device(s) used to record the data
- whether the data were all recorded in one instance or in several batches, sequentially or not, etc.
- the data, presented in a sensible fashion
- graphical displays and comments
- the most appropriate initial ANO(CO)VA model for your data (must consider random effects if deemed appropriate)

- the set of hypotheses to be tested
- the code in R (or other packages) and data analysis (relevant computer output and relevant comments), including
- ANOVA table, F-stat(s) and p-value(s) for the initial model (and final model, if applicable – see below)
- if necessary for C.I.'s, consider Bonferroni's or Fishers Protected LSD
- model checking
- if necessary, model reduction – clearly state (i) the steps taken for model reduction and (ii) the final ANO(CO)VA model
- conclusions for the entire study; if necessary, include comments on inadequacies and/or limitations of this study (such as confounding due to other factors, invalid assumptions, pseudo-replication, etc.)

Projects

1. **Paper Helicopter**: It is your task to design, run, and analyze an experiment to determine what factors lead to a paper helicopter which has the longest flight time. A basic plan for a paper helicopter can be found at NASA:

   `www.nasa.gov/pdf/154940main_Rockets.Guide.Paper.Helicopter.pdf`

2. **Paper Airplane**: It is your task to design, run, and analyze an experiment to determine what factors lead to a paper airplane which has the longest flight time. A basic plan for a paper airplane can be found at:

   `http://www.amazingpaperairplanes.com/Basic_Dart.html`

For each project you must consider at least **three factors** related to the design of the plane or helicopter that may contribute to flight length. The best approach would be to determine simple modifications of the basic plans. However, since this is all about experimentation, I will entertain greater modifications of the plans. To begin, as with any statistical work in area with which you unfamiliar, I suggest reading some basic literature on the subject. Most paper airplane books discuss basic topics related to flight.

Finally, so I can monitor your progress I will include some of the key steps of the project in your assignments. But at the end you still must submit a complete well written report.

Always remember the three principles in experimental design: randomization, replication, and blocking.