BASKIN SCHOOL OF ENGINEERING
Department of Applied Mathematics and Statistics
Graduate Program in Statistics and Applied Mathematics

Name: _____

First Year Exam, Take Home Question (Statistics)

Please work individually on this problem. Do not share with anyone any information or comments about your findings or the models and methods you use. You have to turn in your solutions by Monday, June 14, 2010 at 9:00am. You can either print them and take them to Nic Brummell's office (BE 125), or send a pdf file to brummell@ams.ucsc.edu. Please take care to organize and present the material in the best possible way. Be informative but concise. You should include a summary of your work at the beginning of the paper, include and annotate all relevant figures and tables in the body of the paper, write your conclusions in a separate section and list the references (if any) that you consider appropriate. Provide information about the method and the software you use to fit the models. Do not exceed an 8-page limit, including all figures, tables, and appendices; answers longer than 8 pages will lose credit for their lack of concision.

Problem: An osteopath is testing a new treatment for reduction of stress. Two measures of self-perceived stress are PSM9 and PSS10 scores (integer-valued scores, higher scores relate to higher levels of stress). The osteopath runs a two-group cross-over design with five subjects in each group. In the first group, the subjects receive the control treatment in the first week and the osteopathic treatment in the second week. In the second group, the subjects receive the osteopathic treatment in the first week and the control treatment in the second week. Evidence of an effect is based on the change in score before and after the control or treatment
The data are available in the file: `http://www.ams.ucsc.edu/~herbie/hpa.csv`
The first column is the subject identifier, then the difference in PSS10 score before and after control and treatment, and the difference in PSM9 score before and after control and treatment (a positive difference is a reduction in stress, a negative difference is an increase in stress).

1. Perform an exploratory data analysis.
2. Fit a hierarchical model with an effect for osteopathic treatment and a random effect for each subject.
   (a) Is there a difference between the osteopathic treatment and the control?
   (b) Is there a difference between the two groups, i.e., does it matter whether the osteopathic treatment or the control was applied first?