STT 814 Advanced Statistics for Biologists
Sections 1&2
Spring 2014

Instructor:  Email       Phone       Office
Sasha Kravchenko  kravche1@msu.edu   355-0271 ext.1241   A376 Plant & Soil Sci Bldg
Office Hours:
    Monday and Wednesday, 2 pm -2:45 pm - 118 Farrall Ag Eng Hall – after class

TA:         Email
Rich Price   priceri1@gmail.com
Office Hours: TBA

Course webpage:
https://courses.css.msu.edu/
Username: your MSU Net ID
Password: the last 5-digits of your PID

Class meets:
Lecture Sections 1&2: MW 12:40-2:00 PM at 118 Farrall Ag Eng Hall.
Lab Section 1: Friday 12:40-2:30 PM at 38 McDonel Hall
Lab Section 2: Friday 3:00 - 4:50 PM at 38 McDonel Hall

Required:
2) Course notes on the web

Recommended additional reading:

For Design of experiments:
For Regression

Grading scale:
90% of the total points for the semester 4.0
80% of the total points for the semester 3.5
70% of the total points for the semester 3.0
60% of the total points for the semester 2.5
50% of the total points for the semester 2.0
40% of the total points for the semester 1.5
Less than 40% of the total points for the semester 1.0

Percentage distribution:
Lab presentation/project 20%
Homework assignments, paper critiques, and lab reports 20%
   All assignments - one day late 10 % off, not accepted after that
Tests:
Midterm
  First: ~February 10 Two-sided page of handwritten notes 20%
  Second: ~ March 24 Two-sided page of handwritten notes 20%
Final
  Tuesday April 29th 3-5 pm (in 118 Farrall Ag Eng Hall)
  Two-sided page of handwritten notes 20%

Course outline:


Treatment comparison. Planning comparisons among treatments. Comparisonwise vs. experimentwise errors. Multiple comparisons with the best treatments. Comparison of all treatments with a control. Pairwise comparison of all treatments.
The data and the model: validity of the assumptions. Residuals are the basis of diagnostic tools. Statistical tests for homogeneous variances. Looking for outliers. Data transformations to stabilize variances.


Complete block designs. Randomized complete block designs with one blocking criterion. Latin square designs with two blocking criteria. Missing data in blocked designs.


Split-plot designs. Plots of different size in the same experiment. Analysis of split-plot designs. Relative efficiency of subplot and whole-plot comparisons. The split-block designs.


Power analysis. Ad-hoc and post-hoc power analyses in designed experiments.

Review of the simple linear regression: model, parameter estimation, hypothesis testing, prediction.

Analysis of covariance. Local control with a measured covariate. Analysis of covariance for completely randomized designs. Analysis of covariance for blocked experiment designs.

Multiple regression: introduction, parameter estimation and hypothesis testing, coefficient interpretations, predictions.

Multiple regression: checking model assumptions, graphical diagnostic, influence, leverage, outliers. Variable transformation. Weighted least squares and dealing with correlated errors.

Multiple regression: Multicollinearity and variable selection.
Lab presentation/project info:

1) Sign up for a 20-minute initial discussion of your experiment during the first two weeks of classes. The available times are on sign-up sheets. Please consider bringing visual materials (diagrams, schemes, plot outlines, graphs etc.) that will facilitate description of your study.

2) Based on the initial discussion, your experiment will be placed in one of the class topics. You will be given a tentative date for your lab presentation. Final date may vary but will be within 1-2 weeks of the tentative date. The final date will be set at least 2 weeks prior to your presentation.

3) The lab presentation/project assignment will consist of the following components:

   a. Power Point presentation of your research topic and experiment design delivered to the class during the lab

   The presentation should be no more than 15-20 minutes in length and should include the following components:
   i. Introduction
   ii. Research hypothesis and objectives
   iii. Description of the treatment design
   iv. Description of the experimental design
   v. Your assessment of why your experiment fits a particular class topic
   vi. How would you like to present the results of your study?

   The presentation should not include the data analyses – we will discuss the data analysis in class after your presentation.

   The draft of your presentation should be prepared one week prior to the presentation date. During the lab (Friday) preceding the lab when your presentation is scheduled you need to informally rehearse the presentation for me and provide me with your data. If your presentation draft is late, that is, if you missed rehearsing for me on Friday you can make arrangements with me to present on the following week Monday-Wednesday, however you will get 10% off. No presentation will be allowed without rehearsal of the draft.

   b. Data analysis report submitted prior to the presentation

   The report should include the following components:
   i. A brief introduction of the study topic
   ii. Research hypotheses and objectives
   iii. Description of the treatment and experimental design
   iv. A very detailed description of the statistical methods that you have used for the data analysis
   v. Presentation of the key results, including tables, graphs, and discussion of the findings and conclusions. The tables and figures must be formatted consistent with format of the main journals of your field.
   vi. SAS code used for data analyses

   Parts i-iii should not exceed 400 words. Parts i-v should not exceed 3 two-sided pages (either single or double spaced).

   No page limit on SAS code. However, for full credit, it must be the final code used to get the results presented in the report; it must be well annotated with comments briefly identifying the purpose and key outcome of each portion of the code.

   The data analysis report should be a result of your independent work using relevant class and reference material and recommendations from me or the TAs.

   The data analysis report is due a day before your presentation (Thursday). Send it to me by e-mail. If you prefer to turn in a hard copy it will need to be brought to class a day earlier (Wednesday). If you turn in your report on Friday before your presentation it is 10% off. No report will be accepted after the lab presentation is delivered.