The University of British Columbia, Faculty of Forestry
Forestry 430 Advanced Biometrics
Course Outline for Fall 2008

Instructor:
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Calendar Description:
NOTE: The prerequisite for FRST 430 is an introductory course in probability and statistics (e.g., FRST 231), which is essential to understanding the course content.

Lectures:
Monday, Wednesday, and Friday 1200 to 1300 Location: FSC 1003

Labs/Tutorials:
Tuesday 1100 to 1300 FSC 1222
Thursday 1400 to 1600 FSC 1222

Graduate Teaching Assistants:
Leah Rathbun and Enrico Goberti

Course Objectives and Overview:
The objectives of this course are:
1. To be able to use simple linear and multiple linear regression to fit models using sample data;
2. To be able to design and analyze lab and field experiments;
3. To be able to interpret results of model fitting and experimental analysis; and
4. To be aware of other analysis methods not explicitly covered in this course.
In order to meet these objectives, background theory and examples will be used. A statistical package called “SAS” will be used in examples, and used to help in analyzing data in exercises. Texts are also important, both to increase understanding while taking the course, and as a reference for future applied and research work.

Evaluation:
Assignments 25%
Midterm 25%
Project 15%
Final Exam 35%
NOTE: A reduction in grade of 1 mark per day will be assigned to late labs. Labs will not be accepted for grading once graded labs have been handed back to the class.
Required Texts:
Notes for the course: Purchase from Lyn or Marissa in FSC 2045. $20.00. You must have these notes for the course. You can also find an electronic version in the www.forestry.ubc.ca/biometrics website. It is cheaper to buy the printed copy (double-sided, two pages per side, and hole-punched).

Kutner, M.H., C.J. Nachtsheim, J. Neter, and W. Li. 2005. Applied linear statistical models, 5th edition. [library two copies in 3 hour reserve; you may purchase a copy from the book store on online book sellers such as Indigo/chapters or Amazon – NOTE: There is a 4th edition (1996) with a slightly different listing of authors that is also good]

Freese, F. Elementary statistical methods for foresters. [www.forestry.ubc.ca/biometrics and then clink on “links” to find a .pdf copy of this simple textbook with good examples.

Other Reference Materials:
Biometrics Pamphlets (www.forestry.ubc.ca/biometrics and then clink on “links” to find the biometrics pamphlets by Ministry of Forests, Research Branch [excellent with a variety of examples for each experiment]


Course Content: You will find greater details on the specific course content in the course notes, along with page reference for the course notes for each topic.

I. Course Objectives, Short Review of Probability and Statistics [Week 1]

II. Fitting Equations [Weeks 2 to 5]
• Simple Linear Regression (SLR) [Weeks 2 and 3]
• Multiple Linear Regression [Weeks 3 through 5]

III. Experimental Design and Analysis [Weeks 5 to 12]
• Completely Randomized Design (CRD) [Weeks 5 and 6]
• Restrictions on Randomization [Weeks 7 to 9]
• Nested and hierarchical designs [Week 9 and 10]
• Adding Covariates (continuous variables) [Weeks 10 and 11]
• Expected Mean Squares – Method to Calculate These [Week 11]
• Power Analysis [Week 11]

IV. Course Review [Week 12]
## Assignments/Exams/Project Schedule:

<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Assignments/Exams/Project</th>
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<tbody>
<tr>
<td>1</td>
<td>Sept 1 to 5; Holiday Sept 1</td>
<td>Class on Wednesday and Friday. Assigned readings, but no lab sessions.</td>
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<tr>
<td>2</td>
<td>Sept 8 to 12</td>
<td>Assignment 1: Review and SLR</td>
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<td>3</td>
<td>Sept 15 to 19</td>
<td>Assignment 1 (con’t): Simple Linear Regression (SLR) and using SAS</td>
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<td>4</td>
<td>Sept 22 to 26</td>
<td>Assignment 2: Multiple Linear Regression (MLR)</td>
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<td>5</td>
<td>Sept 29 to 3</td>
<td>Assignment 3: MLR – model selection</td>
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<td>6</td>
<td>Oct 6 to 10</td>
<td>Assignment 4: Completely Randomized Design (CRD) – due Week 8; <strong>Midterm, Friday, Oct10</strong></td>
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<td>7</td>
<td>Oct 13 to 17; Holiday Oct 13</td>
<td>Assignment 4: CRD (con’t)</td>
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<td>8</td>
<td>Oct 20 to 24</td>
<td>Assignment 5: Randomized Block Design (RBD)</td>
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<td>9</td>
<td>Oct 27 to Oct 31</td>
<td>Assignment 6: Split plot; nested designs</td>
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<td>10</td>
<td>Nov 3 to 7</td>
<td>Assignment 7: Sub-sampling</td>
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<td>11</td>
<td>Nov 10 to 14; holiday Nov 11</td>
<td>Assignment 8: Analysis of covariance</td>
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<td>12</td>
<td>Nov 17 to 21</td>
<td>Review in class; <strong>Project Time in lab times</strong></td>
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<tr>
<td>13</td>
<td>Nov 24 to Nov 28</td>
<td><strong>Project Time in class and lab time</strong></td>
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<td>Monday, December 1</td>
<td><strong>PROJECT DUE</strong></td>
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<td></td>
<td>December 3 to 17</td>
<td><strong>Final Exam: Date To be Announced</strong></td>
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Project: Due, Monday, Dec 3

Option 1: (often the easier option) research report for some data that you analyze using methods from the class.

- maximum 10 pages, including outputs
- layout:
  - 1.0 Introduction – briefly introduce the problem, any background papers and information, and end with your objective for this report
  - 2.0 Methods – describe the data and the analysis used
  - 3.0 Results – present graphs, tables, fitted equations in a formal report style. Any results should appear only if introduced in the text. For example, if you put in a graph of y versus x, indicate in the text that this graph will appear (“A graph of height versus dbh indicated a curved relationship (Figure 2)”) along with observations about this graph.
  - 4.0 Discussion – discuss your results and tie back to any references from your introduction.
  - 4.0 Summary – refer back to your objective, give a couple of statements about how well you did meet your objective and what could be done to improve the results.
- 5.0 References Cited
- Calculations/SAS outputs either formatted as tables and figures within the text, or as LABELLED appendices.

Start early! Begin with getting some data, along with a description of this data. Write up the introduction, and methods to begin with – better to do this in parts, rather than leave it all at the end with other assignments and commitments.

Option 2: Report describing another technique not covered in class

- maximum 10 pages, including outputs
- layout:
  - 1.0 Introduction – briefly introduce the technique, briefly, and what it might be used for
  - 2.0 Background – explain the technique in detail, with equations where necessary;
  - 3.0 Example – provide a worked out example of the use of the method, along with SAS outputs. Format outputs into tables and graphs and insert these into the text.
  - 4.0 Summary – summarize what the method is and how it might be used
- 5.0 References Cited

Start early! Begin with selecting a method we will not be covering in detail (see the italicized items in the detailed listing of course contents). Then, conduct a brief library search to make sure there are examples that you can use to illustrate. Get a data set that you can use as an example, and get help from TA’s and the instructor regarding background reading on the method and setup in SAS.