University of Manitoba
Department of Statistics

STAT 3470 A01
Statistical Methods for Research Workers 1
Fall Term, 2009 - 2010

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Office Hours: Tuesdays and Thursdays 1:00 p.m. – 2:30 pm, or by appointment

Text (required): *Applied Linear Statistical Models with Student CD* (**Fifth Edition**)
by M.H. Kutner, C.J. Nachtsheim, J. Neter, and W. Li. McGraw-Hill 2005.
ISBN 0-07-310874-X (**All chapters 1 – 14 will be covered, if time permits**)
A copy of the text is on reserve in the Science Library!

Description: Linear regression, multiple regression, correlation analysis, introduction to one way analysis of variance, some related topics.

Prerequisite: Prequisite: STAT 2000 or STAT 2001 (or 005.200)
Prequisite or Corequisite: STAT 3400 or the former STAT 3500 (005.350)
Not to be held with STAT 3000 or the former STAT 3120 (005.312).

Computer Package: SAS statistical software will be used as computational tools to implement statistical methodology in practice, and to reinforce statistical ideas through experience with various data sets.

SAS References (Optional):
1. *SAS Applications Programming: A Gentle Introduction* by F. C. DiIorio, Duxbury Press 1991, ISBN 0-534-92390-9

2. *SAS System for Regression* (Second Edition) by R. J. Freund and R. C. Littell, SAS Institute Inc. 1991, ISBN 1-55544-429-6

3. *Regression and ANOVA – An Integrated Approach Using SAS Software* by K. E. Muller and B. A. Fetterman, SAS Institute Inc. 2002, ISBN 1-58025-890-5

Evaluation:

Five Assignments	(3% each)	15%
Midterm Test	(In class, October 29, 2009)	35%
Final Examination	(2 hours, TBA)	50%

Academic dishonesty: **Plagiarism or any other form of cheating in the assignments and exams is subject to serious academic penalty.** We wish to draw you attention to the university policy on academic dishonesty including 'plagiarism and cheating' and 'examination impersonation' as outlined in *The Undergraduate calendar*.
It is the responsibility of the student to know the rules! For details, see http://umanitoba.ca/science/student/webdisciplinedocuments.html

Test and Examination: Both the midterm test and final examination are closed book.
A Formula sheet and relevant statistical tables will be provided if required.
A non-programmable calculator is necessary (graphing calculators are not permitted). However, other electronic devices, such as cell phones and MP3, are strictly prohibited.

The midterm test covers all lectures given on and before Thursday October 22. The final exam covers all lecture materials, but with emphasis on the second half.

There will be NO make-up midterm test. Students who miss the midterm test with legitimate reasons will have the midterm weight (35%) added to the final examination.

Assignments: All assignments are due in class before the lectures.

Voluntary Withdrawal: The voluntary withdrawal date is November 18, by which time you will have received your marks for the midterm test and three assignments.

Topics: Simple, multiple and other regression models, correlation analysis, other topics

Formulas to be given on the midterm test and final examination

Simple and multiple linear regression:

$$SS_{xy} = \sum (x_i - \bar{x})(y_i - \bar{y}) = \sum (x_i y_i) - (\sum x_i)(\sum y_i)/n$$

$$SSE = \sum (y_i - \hat{y}_i)^2 = \sum y_i^2 - b_0 \sum y_i - b_1 \sum x_{i,1} y_i - \ldots - b_k \sum x_{i,k} y_i$$

$$s(\hat{y}) = s\sqrt{1/n + (x^* - \bar{x})^2 / SS_{xx}}, \quad s(pred) = s\sqrt{1 + 1/n + (x^* - \bar{x})^2 / SS_{xx}}$$

$$s(pred\ x) = \left[s\sqrt{1 + 1/n + (\hat{x} - \bar{x})^2 / SS_{xx}} \right] / |b_1|$$

$$\text{modified Levene test}: t = \frac{\bar{d}_1 - \bar{d}_2}{s\sqrt{1/n_1 + 1/n_2}} \text{ where } s^2 = \frac{\sum (d_{i,1} - \bar{d}_1)^2 + \sum (d_{i,2} - \bar{d}_2)^2}{n - 2}$$

matrix approach:

$$H = X(X'X)^{-1}X', \quad SSE = Y'(I - H)Y, \quad SSR = Y'(H - J/n)Y$$

$$s^2(e) = MSE(I - H), \quad s^2(b) = MSE(X'X)^{-1}$$

$$s^2(\hat{Y}) = MSE[(X^*)'(X'X)^{-1}(X^*)], \quad s^2(pred) = MSE[1 + (X^*)'(X'X)^{-1}(X^*)]$$