

University of Manitoba
Department of Statistics

STAT 3470 A01
Statistical Methods for Research Workers 1
Fall Term, 2010 - 2011

- Instructor:** Dr. Xikui Wang
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- Office Hours:** Tuesdays and Thursdays 1:30 p.m. – 3:30 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
- Pre-/Co-requisite:** Prerequisite: STAT 2000 or STAT 2001 (or 005.200)
Prerequisite 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:**
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| Five Assignments | (3% each) | 15% |
| Midterm Test | (In class, October 28, 2010) | 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 21. 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 17, 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:

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

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

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

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

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

matrix approach:

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

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

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