STAT 2220 - Contemporary Statistics for Engineers

Time & Location: Slot 6 (MWF, 11:30 a.m. - 12:20 p.m.), Room 201 Armes

Instructor: Andrew Morris
Rm. 333 Machray Hall
Telephone: 480-1073
E-mail: andrew_morris@umanitoba.ca

Calendar Description: Descriptive statistics, basic probability concepts, special statistical distributions, statistical inference-estimation and hypothesis testing, regression, reliability, statistical process control. Not to be held with STAT 1000, STAT 1001, 005.100. Prerequisite: A grade of C or better in MATH 1700 (or 136.171).

Course Objectives: Upon completion of this course, the student will have an understanding of the fundamental concepts of statistics and an appreciation for the application of statistics in the field of Engineering.

Textbook (Optional): "Probability and Statistics for Engineers and Scientists, Third Edition", Anthony J. Hayter, Thomson Brooks/Cole 2007, ISBN 0-495-10757-3.

Office Hours: Tuesday: 1:00 - 2:00
Wednesday: 10:00 - 11:00
Thursday: 1:00 - 2:00

If the above times are not convenient for you, please call or e-mail me to arrange another time to meet. I teach during slots 6, 8 and 9. When I am not teaching, I am usually in my office, so feel free to drop by anytime.

Mark Breakdown: Assignments - 20%
Midterm Test - 30%
Final Exam - 50%

Voluntary Withdrawal: The voluntary withdrawal date is November 18, 2009, by which time you will have received your marks for the midterm test and three assignments.

Academic Dishonesty: I wish to draw your attention to the sections in the University of Manitoba General Calendar 2009-2010 dealing with academic dishonesty. Please see http://umanitoba.ca/science/student/webdisciplinedocuments.html.

Grading Scheme: There are no predetermined cut-offs for each of the letter grades. However, the following are guarantees to you: A^+ ($\geq$ 90), A ($\geq$ 80), B^+ ($\geq$ 75), B ($\geq$ 70), C^+ ($\geq$ 65), C ($\geq$ 60), D ($\geq$ 50).

Assignments: There will be six assignments given during the course, only the first five of which will be submitted for marks. Assignments will be due approximately every two weeks, and are of equal value. Please use the following guidelines when doing your assignments:

- Assignments should be written on regular 8.5"x 11" paper.
- Include a title page, with your name, student number and assignment number.
- Write only on **one side** of the sheet.
- Staple your assignment in the upper left-hand corner.
- Assignments can be either hand-written or typed.
- You may work on your assignments with other students. However, the answers you submit **must be your own**.
- **Show all your work!**
- Assignments are due at the **beginning** of class on the due date. Late assignments will not be accepted, except for health-related or compassionate reasons.

Test & Exam: The midterm test is tentatively scheduled for **Thursday November 5**, from 8:00 - 9:45 a.m. in a location to be determined. It will cover material from the first three assignments (Units 1 - 7). The final exam will be scheduled by student records and will be cumulative, with an emphasis on material covered after the midterm. The midterm test and final exam will consist of both multiple choice and long-answer questions.

Lab/Tutorial: Slot 4 (Thursday, 8:30 - 9:45 a.m.), Room 110 E2

Tutorials will begin Thursday September 24. The T.A. will do sample problems and answer students' questions. You may also wish to work on your assignments during this time.

Course Outline:

Unit 1 (Chapter 6) - Descriptive Statistics

- sample, population, variables, data, distributions
- graphical tools for categorical data (bar charts, pie charts)
- graphical tools for quantitative data (histograms, stemplots, boxplots)
- quantitative measures (mean, median, standard deviation, five-number summary)

Unit 2 (Chapter 12) - Correlation and Simple Linear Regression

- scatterplots
- correlation
- simple linear regression model, least squares regression

Sampling

- simple random sample, stratified random sample, multistage sample
- sampling bias

Unit 4 - Experimental Design

- experiment vs. observational study
- types of experimental design (completely randomized design, randomized block design, matched pairs design)

Unit 5 (Chapters 1 & 17) - Probability Theory

- sample space, outcomes, events
- probability properties
- mutually exclusive events, independence
- conditional probability
- Law of Total Probability, Bayes' Theorem
- system reliability

Unit 6 (Chapter 2) - Random Variables

- discrete random variables (probability mass function, cumulative distribution function)
- continuous random variables (probability density function, cumulative distribution function)
- expectation and variance of a random variable
- functions of random variables

Unit 7 (Chapters 3, 4 & 5) - Common Discrete and Continuous Distributions

- discrete uniform distribution
- Bernoulli random variables, binomial distribution
- geometric and negative binomial distributions
- hypergeometric distribution
- Poisson distribution
- continuous uniform distribution
- exponential and gamma distributions (Poisson process)
- normal distribution

Unit 8 (Chapter 7) - Estimation and Sampling Distributions

- distribution of the sample mean, Central Limit Theorem
- distribution of a sample proportion
- parameters & statistics, point estimators, unbiased statistics

Unit 9 (Chapter 8) - Inferences on a Population Mean

- confidence intervals (population standard deviation known), sample size determination
- hypothesis testing (population standard deviation known), P-value method, critical value method
- power, Type I and Type II errors
- confidence intervals (population standard deviation unknown)
- hypothesis testing (population standard deviation unknown)

Unit 10 (Chapter 9) - Comparing Two Population Means

- paired vs. independent samples
- matched pairs t procedures
- two-sample t procedures (equal and unequal variances)

Unit 11 (Chapter 10) - Inferences on a Population Proportion

- confidence intervals, hypothesis test, power
- comparing two proportions

Unit 12 (Chapter 16) - Quality Control Methods (Time Permitting)

- Statistical Process Control
- control charts ($\bar{x}$-charts, R-charts)
- attribute control charts (p-charts)