STAT 2220 - Contemporary Statistics for Engineers

Time & Location: Slot 6 (M/W/F, 11:30 a.m. – 12:20 p.m.), Room 200 Armes

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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: There is no textbook for this course.   However, I have several engineering statistics textbooks in my office that you are free to borrow if you wish.

Office Hours: Monday: 1:00 – 2:00
Tuesday: 1:00 – 2:00
Wednesday: 1:00 – 2:00
(or by appointment)

Mark Breakdown: Lab Quizzes – 10%
First Midterm Test – 25%
Second Midterm Test – 25%
Final Exam – 40%

Voluntary Withdrawal: The voluntary withdrawal date is November 16, 2011, by which time you will have received your marks for the first midterm test and several quizzes.

Academic Dishonesty: I wish to draw your attention to the sections in the University of Manitoba General Calendar 2010-2011 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 no assignments to be handed in for marks. However, homework assignments will be given (as well as solutions) for you to practice. You are strongly encouraged to try these problems on a regular basis to prepare you for the tests and exam.

Test & Exam: The midterm tests are tentatively scheduled for **Thursday October 13** and **Thursday November 17**, from 8:30 - 9:45 a.m. in a location to be determined. The final exam will be scheduled by student records. Both midterm tests and the final exam will consist of both multiple choice and long-answer questions.

Lab/Tutorial: Thursday, 8:30 – 9:45 a.m.
Section B01 – Room 305 St. Paul's
Section B02 – Room 306 Buller

Tutorials will begin Thursday September 22. The T.A. will go over homework problems and answer students' questions. You will then be given approximately 30 minutes to do a short quiz.

<u>Course Outline:</u>

Unit 1 – 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 – Correlation and Simple Linear Regression

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

Unit 3 – Experimental Design

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

Unit 4 – Sampling

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

Unit 5 – Probability Theory

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

Unit 6 – 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 – 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 – 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 – 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 – Comparing Two Population Means

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

Unit 11 – Inferences on a Population Proportion

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