

STAT 2220 - Contemporary Statistics for Engineers

Time & Location: M/W/F, 1:30 p.m. – 2:20 p.m., Room 204 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, or 005.100. Prerequisite: a C or better in one of MATH 1232, MATH 1690 (136.169), the former MATH 1680 (136.168), MATH 1700, MATH 1701 (136.170), MATH 1710 (136.171), or the former 136.173.

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: Tuesday: 11:30 a.m. – 12:30 p.m.
Wednesday: 11:30 a.m. – 12:30 p.m.
Thursday: 11:30 a.m. – 12:30 p.m.
(or by appointment)

Mark Breakdown: i►clicker Questions/Participation (Tutorial) – 10%
First Midterm Test – 25%
Second Midterm Test – 25%
Final Exam – 40%

Voluntary Withdrawal: The voluntary withdrawal date is March 18, 2016, by which time you will have received your marks for the first midterm test and several tutorial.

Academic Dishonesty: I wish to draw your attention to the sections in the University of Manitoba General Calendar 2015-2016 dealing with academic dishonesty. Please see <http://umanitoba.ca/science/undergrad/resources/webdisciplinedocuments.html>.

Grading Scheme: The following are the minimum percentage grades required to receive each of the various letter grades: A⁺ (≥ 90), A (≥ 80), B⁺ (≥ 75), B (≥ 70), C⁺ (≥ 65), C (≥ 60), D (≥ 50).

Assignments: There will be no assignments to be handed in for marks. However, homework problems 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 February 11** and **Thursday March 17**, from 1:00 p.m. – 2:15 p.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, 1:00 p.m. – 2:15 p.m., Room 100 Fletcher Argue

Tutorials will begin Thursday January 21. The T.A. will go through i►clicker questions about material covered in the previous week's classes. For every i►clicker response that you give, you will be awarded one point. If you get the correct answer, one additional point will be awarded. Each tutorial will be weighted equally. The mark breakdown is as follows: [80, 100] = 10/10, [70, 80) = 8/10, [60, 70) = 6/10, [50, 60) = 4/10, [40, 50) = 2/10, [0, 40) = 0/10. You are responsible for bringing your i►clicker to the tutorial and ensuring that it has functional batteries.

Course Outline:

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 - 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 - 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