STAT 2220
Contemporary Statistics for Engineers

Instructor
Alan Forbes, P.Eng.
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Office Hours:
Tuesday 1:00 PM to 2:15 PM
(or by appointment via email)
319 Machray Hall

Time/Location:

- Lecture - Mon, Wed, Fri 1:30 to 2:20 PM in EITC E2-110

- Lab/Tutorial - Thu 1:00 to 2:15 PM in 201 Armes

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. Course notes will be posted on the JUMP portal.

Mark Breakdown:

- Lab Quizzes 10%

- Two Midterm Tests 25% each

- Final Exam 40%

Academic Dishonesty: Please review the sections in the University of Manitoba General Calendar 2011-2012 dealing with academic dishonesty,

and in particular see `http://umanitoba.ca/faculties/science/resources/Science_StatementOnAcademicDishonestyJul09.pdf`.
Note that a student must have a signed academic honesty form on file to receive marks in the course.

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

Lab/Tutorial: The lab demonstrator is Jenna Tichon (a Ph.D. student in Statistics). The lab will be held Thursday 1:00 PM to 2:15 PM in 201 Armes. Note that the Faculty of Engineering has designated that the lab session be mandatory. The lab session on Thursday January 5th will be used as an additional lecture slot, with the lab formally starting the week after. Starting on January 12th, Jenna will go over some sample problems and answer students' questions. As well, there will be a weekly quiz for marks.

Assignments: There will be assignments posted on the JUMP portal for each unit of the course. The assignments do not have to be handed in and will not be marked but are primarily for you to apply what you have learned in class. Doing them will help you prepare for the exams and the weekly quiz will include some questions directly from the assignments. Solutions to the assignments will be posted on JUMP after completion of the quiz(s) for that unit.

Software: The use of statistical software, available on the University computer network (and free to download for personal use), will be incorporated to some extent into the lectures and the labs. The software is R and is part of the GNU project. (for more information, see http://CRAN.R-project.org/doc/FAQ/R-FAQ.html)

Test & Exam: The midterm tests (no deferrals) are tentatively scheduled for the lab time slot on Thursday February 9th and Thursday March 15th, with 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.

Voluntary Withdrawal: The voluntary withdrawal date is March 16, 2012, by which time you will have received your marks for the first midterm test and several quizzes.

Course Outline

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)

2. Correlation and Simple Linear Regression

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

3. Experimental Design

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

4. Sampling

    - types of sampling design (simple random sample, stratified random sample, multistage sample)
    - sources of bias

5. Probability Theory

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

6. Random Variables

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

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

8. Estimation and Sampling Distributions

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

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)

10. Other Topics (Time permitting)

- Comparing Two Population Means
- Inferences on a Population Proportion