

STAT 2220 – Contemporary Statistics for Engineers

CRN – 10118

Time & Location:

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

Instructor

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

Office Hours:

Monday & Wednesday, 1:30 – 2:30 p.m.

If the above times are not convenient for you, please call, email or speak to me to arrange an alternate time to meet.

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.

Web Pages:

StatsPortal: www.stats.umanitoba.ca/statsportal
Gradebook: <http://www.stats.umanitoba.ca/gradebook>
JMP Download: www.stats.umanitoba.ca/download/jmp

Text & Supplementary Material (Required)

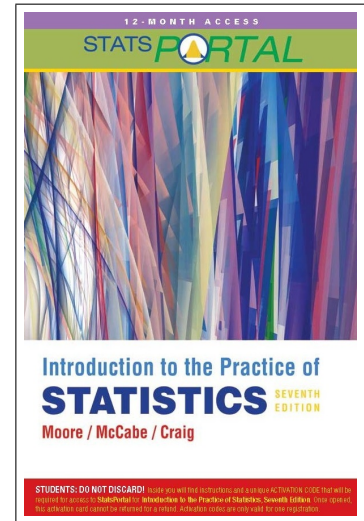
Introduction to the Practice of Statistics (IPS), David S. Moore, George P. McCabe and Bruce A. Craig, 7th edition, W.H. Freeman, New York, 2012. There are two options for purchasing the required material:

Option 1: (ISBN 1-4292-9926-6) This option includes all required and supplementary materials for this course in electronic form, including the textbook. This may be a good option if you happen to have a copy of the book, or do not wish to have a hard copy, but would like access to the electronic supplements and the JMP software. This option must be asked for at the check-out counters in the bookstore.

This includes the StatsPortal access card (which gives you access to the electronic version of the book, with associated tools such as StatTutor, the *Study Guide*, the *JMP Manual*, and access to the JMP software).

Option 2: (ISBN 1-4292-9925-8) This option includes all materials from Option 1 above, plus a hard copy of the textbook and a CD to accompany the book (containing statistical applets, tables, data sets, supplementary material and companion chapters).

Note that JMP software (included in both options above) is required for this course. There are many computers on campus that can be used for running JMP. In particular, the Department of Statistics has a number of Macintosh computers in the Statistics Lab (Room 311 Machray Hall) that you may use and the software is also available on the computers in the “open area” ACN computer labs. More details will be given in class.



Web Registration

This course requires you to register online with the Department of Statistics by going to <http://www.stats.umanitoba.ca/statsportal>.

Here you will complete the online honesty declaration for this course, register to your i►clicker, and signup for StatsPortal.

You will need the code in the StatsPortal package shown at the top right of this page. If you previously registered for StatsPortal (for either STAT 1000 or STAT 2000), you do not need to purchase StatsPortal again.

If you do not sign up for StatsPortal through the Department of Statistics at <http://www.stats.umanitoba.ca/statsportal>, you **cannot** receive marks for your assignments.

i►clickers

Throughout the course, extensive use of the i►clicker classroom response system will be made in order to enhance your understanding of the material and promote classroom participation. Note that i►clicker participation constitutes a portion of your grade in this course and as such you are required to bring your i►clicker to each class.

The use of another student's i►clicker constitutes impersonation and is strictly forbidden under the University of Manitoba's academic dishonesty policy. (See page 4.)

Mark Breakdown

Assignments	15%
i►clicker Questions / Participation (Tutorial)	10%
Two Term Tests	35%
Final Examination	40%

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

The assignments in this course will be done in StatsPortal, using their online assignment system. There will be at least five assignments. Your lowest assignment grade will not count towards your final grade. All assignments will be **due at 10:00 p.m.** on the respective due dates.

Assignment extensions will not be given to individual students.

Lab/Tutorial

Thursday, 8:30 – 9:45 a.m.
Section B01 – Room 306 Buller
Section B02 – Room 201 Armes

Tutorials will begin Thursday September 18. The T.A. will go through i►clicker questions about material covered in the previous week's classes. If there is time remaining, you may work on your assignments or ask the T.A. questions.

For every i►clicker response that you give, you will be awarded 1 point. For questions with a correct answer, an additional point will be awarded for selecting the correct response. The mark breakdown is as follows: $[80, 100] = 10/10$, $[70, 80) = 8/10$, $[60, 70) = 6/10$, $[50, 60) = 5/10$, $[40, 50) = 3/10$, $[0, 40) = 0/10$. You are responsible for bringing your i►clicker to class and ensuring that it has functional batteries.

Tests and Examination

The term tests are tentatively scheduled for Thursday, October 9 and Thursday, November 13, from 8:30 to 10:15 a.m. in a location to be determined.

The material to be covered on the term tests will be announced in class. The final examination will be three hours in duration and will be scheduled by the Registrar's Office. It will cover the entire course with emphasis on material covered after the second term test. The term tests and the final examination will consist of both multiple-choice and long answer questions.

For the tests and examination: (i) non-programmable hand-held calculators are permitted (graphing calculators are not permitted), (ii) electronic devices, such as cell phones and head phones, are prohibited, (iii) statistical tables will be provided, if required, (iv) selected formulae will be provided.

Voluntary Withdrawal

Note that the voluntary withdrawal date is November 12, 2014 (by which time you will have received your marks for the first term test and several assignments).

Academic Dishonesty

It is important that you understand what constitutes academic dishonesty and that you are familiar with the very serious consequences. Links to resources that describe academic dishonesty (including plagiarism, cheating, inappropriate collaboration and examination impersonation) can be found at:

<http://umanitoba.ca/faculties/science/undergrad/resources/webdisciplinedocuments.html>.

Typical penalties imposed within the Faculty of Science for academic dishonesty are also described in the Academic Calendar.

Course Content

The following is a non-exhaustive list of topics. Most of these are covered in the text. The course covers the material in Chapters 1–8, plus some additional topics not covered in the text, mostly in Units 5, 6 and 7. However, some material is omitted: density estimation (p. 67), scatterplot smoothers (pp. 92–93), residual plots (pp. 124–125), data mining (p. 132), §2.5, capture-recapture sampling (p. 209), §4.4, the continuity correction (pp. 327–328), the Weibull distributions (pp. 330–332), the bootstrap (pp. 355–356), §6.4, the power of the t -test (pp. 419–420), inference for non-normal populations (pp. 420–425), inference for small samples (pp. 442–446), §7.3, plus-four confidence interval for a single proportion (pp. 477–478), §8.2.

Unit 1 – Descriptive Statistics

Chapter 1 (§1.1 and §1.2)

- 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

Chapter 2 (omit §2.5)

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

Unit 3 – Experimental Design

Chapter 3 (§3.1)

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

Unit 4 – Sampling

Chapter 3 (§3.2)

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

Unit 5 – Probability Theory

Chapter 4 (§4.1, 4.2 & 4.5)

- 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 (Chapter 5 (§5.2))
- geometric and negative binomial distributions
- hypergeometric distribution
- Poisson distribution
- continuous uniform distribution
- exponential and gamma distributions (Poisson process)
- normal distribution (Chapter 1 (§1.3))

Unit 8 – Estimation and Sampling Distributions

Chapter 3 (§3.3) & Chapter 5

- 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

Chapter 6 & Chapter 7 (§7.1)

- 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

Chapter 7 (§7.2)

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

Unit 11 – Inferences on a Population Proportion

Chapter 8 (§8.1)

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