

University of Guelph
College of Physical and Engineering Science
Department of Mathematics and Statistics

STAT*2040 Statistics I
Course Outline
Winter 2017

INSTRUCTOR: Jeremy Balka x54481 OFFICE: 550 MacN EMAIL: jbalka@uoguelph.ca
OFFICE HOURS: MWF 9:30–10:30, Monday 1:30–12:30 (I may be late getting back to my office after lecture, depending on how long it takes to answer questions after class.)
LECTURES: Section 1: MWF 08:30–09:20 in ROZH 101
Section 2: MWF 11:30–12:20 in War Memorial Hall
PREREQUISITES: 1 of 4U Advanced Functions and Calculus, OAC calculus, equivalent.
RESTRICTIONS: STAT*1000, STAT*2060, STAT*2080, STAT*2100, STAT*2120.
CREDIT WEIGHT: 0.5 credits.

ONLINE OFFICE HOUR: I will continue experimenting with online office hours by being in contact for one hour per week on Skype (Skype ID: stat2040). This is experimental (for me), and subject to change. Details will be posted on [courselink](#).

In a class with hundreds of students, I cannot answer lists of suggested exercise or quiz questions by email. If you have specific questions about course content, feel free to see me during office hours, after class, or get help in the other ways listed below.

CALENDAR DESCRIPTION: This course focuses on the practical methods of Statistics and the topics include: descriptive statistics; univariate models such as binomial, Poisson, uniform and normal; the central limit theorem; expected value; the t, F and chi-square models; point and interval estimation; hypothesis testing methods up to two-sample data; simple regression and correlation; introduction to analysis of variance. Assignments will deal with real data from the natural sciences and involve the use of statistical software for computing and visualization.

LEARNING OUTCOMES: After successful completion of the course, students will be able to:

- create and properly interpret numerical and graphical data summaries.
- properly interpret probability and carry out basic probability calculations.
- carry out probability calculations for various discrete and continuous probability distributions, and choose the appropriate probability distribution in different scenarios.
- explain statistical inference concepts and methods, including concepts related to sampling distributions, confidence intervals, and hypothesis tests.
- choose an appropriate statistical inference procedure in a variety of situations, carry out the procedure, and effectively communicate a proper interpretation of the results.
- explain the design of some basic experiments and observational studies, and describe how statistical conclusions differ between experiments and observational studies.
- carry out the calculations for statistical inference procedures using appropriate statistical software.

COURSE TEXT: *Introductory Statistics Explained* (by J.B.). This document is available in pdf format on [courselink](#).

Suggestions for improvements (areas that require greater clarification, topics for short videos, typos, etc.) are welcome.

I have created many supporting videos for my text (100+ and counting). I keep them concise (the majority are less than 10 minutes). Links to many of them are placed at appropriate places in the text. They can all be found at www.youtube.com/jbstatistics. A complete list of videos and video descriptions is available on courselink as well (I will update the list as new videos are added). The videos are always optional (but many students find them helpful). Videos are available for most topics in the latter 2/3 of the course. I may be adding to them during the semester. Feedback and suggestions are welcome.

LECTURE CONTENT AND FORMAT:

To a great extent, lectures will be a summary of the text. If my lectures sound similar to the text, it is because my text is based on my lectures (not the other way around).

On courselink I provide partially completed notes (“lecture outlines”) for each topic in pdf format. I will complete these notes during lectures, and I assume that you have these notes with you. Bringing these notes to lectures will greatly reduce your writing burden. Some students prefer to come to class and take minimal notes, relying instead on the online text. That is a reasonable approach. I will leave it up to you to decide what works best for you.

GRADING SCHEME:

- 10% Maple TA quizzes. There will be 8 quizzes. I will throw out your worst TA quiz and your grade will be based on your best 7. These will be online quizzes based on the text, lectures, and suggested exercises. Details will be posted on courselink.
- 10% Data analysis assignments. There will be 2 assignments that require the use of R software, and each of them will be worth 5% of your final grade. The assignments will be submitted electronically in pdf format. (Full details will be posted on courselink.)
- There will be 2 term tests. Your best test will count for 25% of your final grade, your worst for 15%.
Term test dates:
 - Test 1: Saturday February 10. 11:00–12:10. Location TBA.
 - Test 2: Friday March 17. 17:30–18:40. Location TBA.
- 40% Final exam. Tuesday April 11. 19:00–21:00. Location TBA.

In calculating your overall mark, I will throw out your worst Maple TA quiz grade. This is not done to be nice, but to account for possible illnesses, computer problems, car accidents, house fires, etc. If you have extremely serious issues that cause you to miss more than one quiz, see me in person.

The midterm and final exams will be multiple choice (computer-graded bubble sheet) exams. You must bring a calculator and pencil to the tests. A formula sheet containing relevant formulas will be supplied with the exam. The formula sheet will be available a week or so before each exam for study purposes.

POLICY FOR MISSED EXAMS: If you miss a midterm test due to medical illness or another valid (and documented) reason, your final exam will be reweighted to make up for the missed test.

LATE SUBMISSION: Any quiz question not answered by the deadline will receive a mark of 0. Any data analysis assignment not submitted by the deadline will receive a mark of 0.

DROP-IN HELP WITH R:

The graded assignments (and possibly some quiz questions) will require use of the statistical software R. R is free software that is widely used around the world. I will put up an “Introduction to R” document on course link that will outline the basics. There will be a TA available in the computer lab (SSC 1303) from 12:30 to 14:20 each weekday, to help with any R problems you may encounter.

EXERCISES: There are exercises and solutions available on courselink for all topics in the course. Although in the documents I call these *suggested* exercises, and they do not count for marks directly, I consider them

to be *required* exercises. It is best to work through these questions after each lecture, in order to consolidate the information we talked about in lecture. It is assumed that students are working through these exercises as we proceed through the course.

IMPORTANT DATES:

Date	Assessment
Friday January 20	Maple TA Quiz 1 (Deadline: 11:59 pm)
Friday January 27	Maple TA Quiz 2 (Deadline: 11:59 pm)
Friday February 3	Maple TA Quiz 3 (Deadline: 11:59 pm)
Saturday February 10	Term Test 1 (11:30-12:10 pm)
Friday February 17	Maple TA Quiz 4 (Deadline: 11:59 pm)
February 20-24	Winter Break
Friday March 3	Maple TA Quiz 5 (Deadline: 11:59 pm)
Friday March 10	Maple TA Quiz 6 (Deadline: 11:59 pm) Data Analysis Assignment 1 (Deadline: 11:59 pm)
Friday March 17	Term Test 2 (5:30-6:40 pm)
Friday March 24	Maple TA Quiz 7 (Deadline: 11:59 pm)
Friday March 31	Maple TA Quiz 8 (Deadline: 11:59 pm) Data Analysis Assignment 2 (Deadline: 11:59 pm)
Tuesday April 11	Final Examination 19:00-21:00

GETTING HELP IN THE COURSE: If you run into problems with course material, you have several options:

- Get help from your fellow students (either in person or online via the discussion feature on courselink).
- Go to the Mathematics and Statistics Learning Centre on the third floor of the library. It is staffed by graduate teaching assistants who are there to help students in introductory mathematics or statistics classes.
- Go to the R drop-in hours.
- Come to my office hours.
- Get a private tutor. The Math & Stats main office on the fourth floor of MacN keeps a list of private tutors. There is also the U of G tutoring site:
<http://www.uoguelph.ca/tutoring>
- Attend the Supported Learning Group (SLG) sessions. For more information, go to
<http://www.lib.uoguelph.ca/get-assistance/studying/slgs>

TOPIC OUTLINE: For the most part I cover the course material in lecture. But there will be times when I refer you to the text. Some students prefer to base their studies on the text.

- Chapter 1: *Introduction to Statistics*.
Descriptive statistics, inferential statistics.
- Chapter 2: *Gathering Data*.
Population, variables, samples, quantitative and qualitative data, bias, simple random samples, experiments, observational studies, lurking variables, confounding.
- Chapter 3: Descriptive Statistics.
Bar charts, pie charts, histograms, stem-and-leaf displays, summation notation, numerical measures of central tendency, numerical measures of variability, numerical measures of relative standing, boxplots, methods for detecting outliers, linear transformations.
- Chapter 4: Probability.
Simple events, events, Venn diagrams, combinations, unions, intersections, complements, mutually exclusive events, conditional probability, additive rule, multiplicative rule, independent events, Bayes' theorem.

- Chapter 5: *Discrete Random Variables and Discrete Probability Distributions.*
Random variables, discrete and continuous random variables, probability distributions, expected value and variance of a discrete random variable, the binomial distribution, the Poisson distribution, the hypergeometric distribution.
- Chapter 6: *Continuous Random Variables and Continuous Probability Distributions.*
Properties of continuous random variables and continuous probability distributions, the uniform distribution, the normal distribution, descriptive methods for assessing normality (normal quantile-quantile plots).
- Chapter 7: *Sampling Distributions.*
The concept of the sampling distribution, the sampling distribution of the sample mean, the central limit theorem.
- Chapter 8: *Confidence Intervals.*
Basic concepts of confidence intervals, confidence intervals for a population mean when sigma is known, confidence intervals for a population mean when sigma is unknown, sample size determination.
- Chapter 9: *Hypothesis Testing.*
Motivation for hypothesis testing, null and alternative hypotheses, significance levels, p -values, Type I and Type II errors, power, tests of hypothesis on a single mean.
- Chapter 10: *Inference for Two Means.*
Confidence intervals and hypothesis tests for the difference between population means, independent sampling, paired difference experiments.
- Chapter 11: *Inference for Proportions.*
Confidence intervals and hypothesis tests for a single proportion, sample size determination, confidence intervals and hypothesis tests for the difference between two population proportions.
- Chapter 12: *Inference for Variances.*
Confidence intervals and hypothesis tests for a single variance, confidence intervals and hypothesis tests for two population variances.
- Chapter 13: *Chi-square tests for count data.*
Chi-square goodness of fit tests. Tests for one-way tables, chi-square tests of independence.
- Chapter 14: *One-Way Analysis of Variance.*
Using one-way ANOVA to test for a difference in population means. (One-way ANOVA extends the two-sample pooled-variance t test to more than two groups.)
- Chapter 15: *Simple Linear Regression and Correlation.*
Least squares regression, model assumptions, inference on the slope, the correlation coefficient, the coefficient of determination, estimation and prediction using the fitted line.

University Policies

Email Communication

As per university regulations, all students are required to check their uoguelph.ca email account regularly: email is the official route of communication between the University and its students.

Academic Accommodation of Religious Obligations

If you are unable to complete a course requirement due to religious obligations, please let the instructor know within the first two weeks of class. See the academic calendar for more information:

<https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-accomrelig.shtml>

Academic Consideration

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor in writing, with your name, id, and email contact. See the academic calendar for information on regulations and procedures for Academic Consideration:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml>

Academic Misconduct

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community, faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy is detailed in the Undergraduate Calendar:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml>

Accessibility

The University of Guelph is committed to creating a barrier-free environment. Providing services for students is a shared responsibility among students, faculty and administrators. This relationship is based on respect of individual rights, the dignity of the individual and the University community's shared commitment to an open and supportive learning environment. Students requiring service or accommodation, whether due to an identified, ongoing disability or a short-term disability should contact Student Accessibilities Services (SAS) as soon as possible.

For more information, contact SAS at 519-824-4120 ext. 56208 or email sas@uoguelph.ca or see the website:

<http://www.uoguelph.ca/csd/>

Course Evaluation Information

The evaluation questions for the Department of Mathematics and Statistics can be found here: https://mathstat.uoguelph.ca/sites/uoguelph.ca.mathstat/files/public/TeachevaluationformW16_1.pdf

Drop date

The last date to drop one-semester courses, without academic penalty, is Friday, March 10, 2017. For regulations and procedures for Dropping Courses, see the Academic Calendar:

<http://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml>

Recording of Materials

Presentations which are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Resources

The Academic Calendars are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs: <http://www.uoguelph.ca/registrar/calendars>