

ARTSSCI 2R03: Applied Statistical Inference

McMaster University

Term 2, 2017-18

Course Objectives:

“Statistics is the science, the art, the philosophy, and the technique of making inferences from the particular to the general,” is a well-known quote attributed to John W. Tukey, one of the greatest statisticians of all times. With a strong footing on applications, this course demonstrates the statement repeatedly all along its run. The course objectives are to learn, exemplify and train the student on: (a) methods to summarize data numerically and graphically, (b) the most widely used statistical methods to draw inferences from observed data, (c) some of the mathematical details behind the methods, and (d) handling data and carrying out basic statistical analyses using the statistical package R.”

Course Webpage: We will use **Avenue To Learn** (<http://avenue.mcmaster.ca/>) as the main site for posting course-related material. In Avenue we will post assignments, midterms, solutions, R code, marks and other relevant information.

Instructor: Dr. Román Viveros-Aguilera, HH/212, ext. 23425, rviveros@ms.mcmaster.ca.

Lectures: Monday & Thursday 12:30-1:20 pm, and Tuesday 1:30-2:20 pm, BSB/137.

Office Hours: Monday, Wednesday and Thursday, 9:00--10:00 am.

Tutorials:

T01: Tuesdays, 2:30–3:20 pm, BSB/104, Tutor: Benjamin Feldman, feldmanb@mcmaster.ca.

T02: Tuesdays, 3:30–4:20 pm, BSB/104, Tutor Juliana Harris, harrij1@mcmaster.ca.

Software: The computing work will be done in R, a freeware statistical software down-loadable for Windows and Macintosh platforms from **The R Project for Statistical Computing**, webpage at [http:// www.r-project.org/](http://www.r-project.org/). You are strongly advised to download the software at your earliest convenience.

Textbook: *Probability and Statistics - The Science of Uncertainty*, Second Edition by Michael J. Evans & Jeffrey S. Rosenthal. Download it **for free** from <http://www.utstat.toronto.edu/mikeevans/jeffrosenthal/>

Assignments: There will be six assignments in the course. Make sure you write your complete name and student number on each page of every assignment. You are required to write well-

organized and readable solutions. After marking, your assignments will be returned to you, approximately one week after the due date. Solutions to the assignments will be posted in the course webpage. To be fair to all, no late assignments will be accepted. Assignment due dates:

Assignment #1: Thursday January 18, 3:30 pm.

Assignment #2: Thursday February 1, 3:30 pm.

Assignment #3: Thursday February 15, 3:30 pm.

Assignment #4: Thursday March 8, 3:30 pm.

Assignment #5: Thursday March 22, 3:30 pm.

Assignment #6: Thursday April 5, 3:30 pm.

The assignment questions will be posted in the course webpage one week prior to the deadline.

Penalty for Late Assignments: To be fair to all, no late assignments will be accepted. However, the assignment with the lowest score will be dropped in calculating the term assignment average.

Tests: There will be two midterm tests and a 2.5-hour final exam in the April examinations. The midterms are scheduled as follows:

Test #1: Thursday February 8, class hour, 50 minutes, room: UH/213.

Test #2: Thursday March 15, class hour, 50 minutes, room: UH/213.

Solutions to the midterm tests will be posted in the course webpage.

Final Exam: In April, 2.5 hours, scheduled by the Registrar's Office. The final exam period runs from Wednesday April 11 to Thursday April 26. The final exam will be based on all the material covered in the course. Only the McMaster standard calculators Casio FX-991 MS or MS Plus are allowed.

Practical Project: Working in groups of 2 to 3 students, a required project will be conducted. The minimum requirements:

- (i) At least 50 cases of real data.
- (ii) At least 2 variables measured on each case.
- (iii) At least 2 plots.
- (iv) At least two statistical methodologies involved in the analysis.
- (v) At least 10 pages in the report (including plots).

The deadline to submit the project proposal is **3:30 pm on Thursday March 1**, and for the submission of the final report is **3:30 pm on Friday March 30**.

Marking Scheme: The final mark will be the highest between **Option 1** and **Option 2** below:

Assignments (6, due-dates: Jan. 18, Feb. 1, 10% Feb. 15, Mar. 8, Mar. 22, Apr. 5)	10%
Midterms (2, dates: Feb. 8, Mar. 15) 20%	30%
Project (deadlines – proposal: Mar. 1, 10% report: Mar. 30)	10%
Final Exam 60%	50%
TOTAL 100%	100%

Expectations:

(a) **Come to class.** I know you will think that this is an obvious one but it is important nonetheless. Learning statistics is a cumulative experience; what we learn in one class builds upon what was covered in previous sessions. Missing class creates gaps in your knowledge base that will make hard to build on, and the degree of difficulty will increase rapidly.

(b) **Complete all assignments.** Much like the practice required in learning a foreign language, you will have to practice the techniques we learn in each class to get them to take hold and the homework is a good way to accomplish that. These exercises also will help you familiarize yourself with the software necessary to perform efficiently even simple analyses.

(c) **Ask questions.** Office and tutorial hours provide a great opportunity to ask for clarifications of the material and questions about your own attempts to solve a problem. When you are stuck, try to explain someone else (classmate friend, tutor, instructor) what you are trying to do. This can often help you identify for yourself the problem you are having. Often the step we are missing is readily obvious to someone who is not trying to solve the problem.

(d) **Be respectful of others.** Show your respect to your classmates by keeping a quiet and pleasant atmosphere in the classroom so that everyone focus their attention on the presentations and discussions.

These are my secrets for success about learning statistics, they come from my own personal experience as a student and as a teacher of the subject for over 25 years.

McMaster Policy on Academic Integrity. You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences—e.g., the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university. It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty, please refer to the Academic Integrity Policy, located at: <http://www.mcmaster.ca/academicintegrity>.

The following illustrates only three forms of academic dishonesty: 1) Plagiarism—e.g., the

submission of work that is not one's own or for which other credit has been obtained. 2) Improper collaboration in group work. 3) Copying or using unauthorized aids in tests and examinations.

McMaster Student Absence Form (MSAF). In the event of an absence, students should review and follow the Academic Regulations in the Undergraduate Calendar "Requests for Relief for Missed Academic Term Work." Please consult the MSAF statement on our website (<https://artsci.mcmaster.ca/forms-requests/>) and direct any questions or concerns to Shelley Anderson or Rebecca Bishop in the Arts & Science Program Office as appropriate.

Academic Accommodation of Students with Disabilities. Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or email sas@mcmaster.ca. For further information, consult McMaster University's Policy for Academic Accommodation of Students with Disabilities.

Email Contact and Student Responsibility Statement. The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of students to check **their McMaster email** and course websites weekly during the term and to note any changes. Announcements will be made in class and by using the course email distribution list.

Course Schedule

Week 1: Jan. 4	Mean, median and mode (Notes)
Week 2: Jan. 8, 9, 11	Variance, standard deviation, pie charts, bar plots, histograms (Notes)
Week 3: Jan. 15, 16, 18	Boxplots (Notes); Introduction to R
Probability, probability models, conditional probability, and Independence (Ch. 1)	Assignment 1 – Due Jan. 18
Week 4: Jan. 22, 23, 25	Probability, probability models (Ch. 1)
Week 5: Jan. 29, 30; Feb. 1	Conditional probability and independence (Ch. 1)
	Assignment 2 – Due Feb. 1
Week 6: Feb. 5, 6, 8	Random variables: discrete and continuous (Ch. 2)
	Midterm 1 – Feb. 8 (Room TBA, class time)
Week 7: Feb. 12, 13, 15	Cumulative distributions; change of variable (Ch. 2)
	Assignment 3 – Due Feb. 15

Mid-term Recess – Feb. 19-23

Week 8: Feb. 26, 27; Mar. 1	Expectation: mean and variances (Ch. 3) Project proposal – Due Mar. 1
Week 9: Mar. 5, 6, 8	Conditional expectation (Ch. 3) Assignment 4 – Due Mar. 8
Week 10: Mar. 12, 13, 15	Sampling distributions; Central Limit Theorem; Chi-squared and t distributions (Ch. 4) Midterm 2 – Feb. 15 (Room TBA, class time)
Week 11: Mar. 19, 20, 22	Likelihood; maximum likelihood (Ch. 6) Assignment 5 – Due Mar. 22
Week. 12: Mar. 26, 27, 29	Confidence intervals; tests of hypotheses (Ch. 6) Project report – Due Mar. 30
Week 13: Apr. 2, 3, 5	Simple linear regression: estimation and inference (Ch. 10) Assignment 6 – Due Apr. 5
Week 14: Apr. 9	Review Assignment 6 – Due Apr. 6