*We recognize and acknowledge that McMaster University meets and learns on the traditional territories of the Mississauga and Haudenosaunee nations, and within the lands protected by the “Dish With One Spoon” wampum, an agreement amongst all allied Nations to peaceably share and care for the resources around the Great Lakes.*

# Arts and Science 2R03 – Applied Statistical Inference

**2022/23 Winter Term**

Instructor: Dr. David Lozinski**|E-mail:** [lozinski@math.mcmaster.ca](mailto:lozinski@math.mcmaster.ca) **|**Tel. Extension: 23409 **| Office:** HH 315

**Office hours:** We 9:30-10:20am, Fr 11:30am-12:30 **|Web Page:** The course web page can be found on Avenue to Learn

**Lectures:** Mo, We 8:30am - 9:20am, Fr 10:30am - 11:20am (in HH 104)

**Tutorials: T01:** Fr 12:30pm - 1:20pm (in HH 217) **| T02:** Fr 1:30pm - 2:20pm (in HH 217)

**Teaching Assistants:** Jessica Latimer ([latimerj@mcmaster.ca](mailto:latimerj@mcmaster.ca)) & Ella Brown ([browne27@mcmaster.ca](mailto:browne27@mcmaster.ca))

**Please Note:** 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, on the course web site, and by using the course email distribution list.**

## COURSE DESCRIPTION

Inferential statistics, with an emphasis on applications. Topics include data description, graphical methods, probability, confidence intervals, hypothesis testing, one-way ANOVA, and analysis of categorical

data. The course includes the use of the statistics software package R.

## COURSE AND LEARNING OBJECTIVES

***Introduction:***

The course objectives are to learn, exemplify and train the students 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 freeware statistical package R.

## REQUIRED MATERIALS/ RESOURCES

Textbook:

* *Introductory Statistics - A Problem-Solving Approach* by Stephen Kokoska, published by Macmillan Education. It is available at the Campus Store. The direct connection to the campus store is: <https://campusstore.mcmaster.ca/cgi-mcm/ws/txsub.pl?wsTERMG1=221&wsDEPTG1=ARTSSCI&wsCOURSEG1=2R03&wsSECTIONG1=DAY%20C01&crit_cnt=1>

**Supporting problems** are listed on the web site. Answers to selected problems are in the back of the textbook.

Calculator***:*** Only the standard Casio fx 991 MS or MS Plus calculator is permitted.

## COURSE OVERVIEW AND ASSESSMENT

Lectures:

Lectures will be in person. Attendance is required.

Assignments:

There will be 5 assignments to be completed during the term. Assignments will make use of the statistical

software R. R is freeware statistical software downloadable for Windows and MacIntosh platforms from

The R Project for Statistical Computing. The web page is:

http://www.r-project.org/

The assignments will be due by noon on the Tuesdays of:

Jan 31, Feb 14, March 7, March 21, and April 4.

Late assignments will not be accepted and a grade of zero will be assigned.

Participation:

A portion of the final grade will be computed based on participation in collaborative learning activities

done during the tutorials, and participation in lectures.

Project:

In addition to the above, a project consisting of a statistical analysis of appropriate data will be required. The project due date is Wednesday, April 12. Late assignments will not be accepted and a grade of zero will be assigned.

More information on the project will be presented in class.

Mid-Term Tests:

There are 2 midterm tests, each worth 20% of the final grade. The dates for the midterms are tentatively

Friday, February 10 during class time (10:30-11:20am)

Friday, March 17 during class time (10:30-11:20am)

More information, including the topics covered, will be announced in class.

Final Exam: A 2.5-hour final exam will be administered in person during the April Final Examination Period. It will cover all course material.

## EVALUATION

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| --- | --- | --- |
| **Assessment Weight** | | |
| 1. Two Midterm Tests | 40% (20% each) |  |
| 1. Final Examination | 30% |  |
| 1. Assignments | 15% (3% each) |  |
| 1. Project | 10% |  |
| 1. Participation | 5% |  |

The assignments will be due by noon on the Tuesdays of: Jan 31, Feb 14, March 7, March 21, and April 4.

The dates for the midterms are tentatively Friday, February 10 and Friday, March 17 during class time.

The project will be due on Wednesday, April 12.

## SENATE-APPROVED ADVISORY STATEMENTS

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. **It is your responsibility to understand what constitutes academic dishonesty.**

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. For information on the various types of academic dishonesty please refer to the [*Academic Integrity Policy*](https://secretariat.mcmaster.ca/app/uploads/Academic-Integrity-Policy-1-1.pdf)*,* located at [https://secretariat.mcmaster.ca/university-policies-procedures- guidelines/](https://secretariat.mcmaster.ca/university-policies-procedures-%20guidelines/).

The following illustrates only three forms of academic dishonesty:

* plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
* improper collaboration in group work.
* copying or using unauthorized aids in tests and examinations.

AUTHENTICITY / PLAGIARISM DETECTION  
**Some courses may** use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. A2L, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software. **All submitted work is subject to normal verification that standards of academic integrity have been upheld** (e.g., online search, other software, etc.). For more details about McMaster’s use of Turnitin.com please go to [www.mcmaster.ca/academicintegrity](https://mcmasteru365-my.sharepoint.com/personal/rbishop_mcmaster_ca/Documents/www.mcmaster.ca/academicintegrity).

COURSES WITH AN ONLINE ELEMENT **Some courses may** use online elements (e.g. e-mail, Avenue to Learn (A2L), LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses online elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

ONLINE PROCTORING **Some courses may** use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

CONDUCT EXPECTATIONSAs a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the [*Code of Student Rights & Responsibilities*](https://secretariat.mcmaster.ca/app/uploads/Code-of-Student-Rights-and-Responsibilities.pdf) (the “Code”). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students’ access to these platforms.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES  
Students with disabilities who require academic accommodation must contact [Student Accessibility Services](https://sas.mcmaster.ca/) (SAS) at 905-525-9140 ext. 28652 or [sas@mcmaster.ca](mailto:sas@mcmaster.ca) to make arrangements with a Program Coordinator. For further information, consult McMaster University’s [*Academic Accommodation of Students with Disabilities*](https://secretariat.mcmaster.ca/app/uploads/Academic-Accommodations-Policy.pdf) policy.

REQUESTS FOR RELIEF FOR MISSED ACADEMIC TERM WORKIn the event of an absence for medical or other reasons, students should review and follow the [*Policy on Requests for Relief for Missed Academic Term Work*](https://secretariat.mcmaster.ca/app/uploads/Requests-for-Relief-for-Missed-Academic-Term-Work-Policy-on.pdf).

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)  
Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the [RISO](https://secretariat.mcmaster.ca/app/uploads/2019/02/Academic-Accommodation-for-Religious-Indigenous-and-Spiritual-Observances-Policy-on.pdf) policy. Students should submit their request to their Faculty Office ***normally within 10 working days*** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

COPYRIGHT AND RECORDINGStudents are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors. The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done either by the instructor for the purpose of authorized distribution or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

EXTREME CIRCUMSTANCESThe University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.

## NOTES FOR ALL ARTS & SCIENCE COURSES

1. Some of the statements above refer to a “Faculty Office”; please note that the Arts & Science Program Office serves in this capacity.
2. It is the responsibility of students to check their McMaster email regularly. Announcements will be made in class, via A2L, and/or via the course email distribution list.
3. For additional information regarding requests for accommodation, relief for missed term work (e.g. MSAF), deferred examinations, etc., students should read carefully the [Requests](https://artsci.mcmaster.ca/forms-requests/) and [Resources](https://artsci.mcmaster.ca/current-students/resources/) pages on the Arts & Science Program website.

## Approximate lecture schedule

Week 1: Jan 9 to Jan 13

- Intro, graphing data, Intro to R

- Chapters 1 and 2

Week 2: Jan 16 to Jan 20

- Measured statistics (including mean, percentiles, variance and std dev)

- Chapters 2 and 3

Week 3: Jan 23 to Jan 27

- Probability, from counts of equally likely outcomes, 3 axioms and basic laws

- Chapter 4

Week 4: Jan 30 to Feb 3

- Inpendence, conditional probability, discrete probability districutions

- Chapter 4

Week 5: Feb 6 to Feb 10

- Baye's Formula, Binomial and Poisson distributions

- Chapters 4 and 5

TEST 1

Week 6: Feb 13 to Feb 17

- Continuous Random variable, PDFs, normal distribution, exponential

- Chapter 6

READING WEEK: Feb 20 to Feb 24

Week 7: Feb 27 to March 3

- parameters from sample, dist of statistic, C.I. and t distribution

- Chapter 8

Week 8: March 6 to March 10

- Dist of sample proportion and C.I., C.I. for variance and Chi square

- Chapter 8

Week 9: March 13 to March 17

- Hypothesis testing, null alternative, test statistic, decision rule, error types

- Chapter 9

TEST 2

Week 10: March 20 to March 24

- Examples, 1 tail, 2 tail,Hypothesis testing on proportion, 2 sample means

- Chapters 9 and 10

Week 11: March 27 to March 31

- 2 sample means, examples. Categorical data, contingency tables

- Chapters 10 and 13

Week 12: April 3 to April 5

- Chi square test, test for homogeneity, intro to ANOVA

- Chapters 13 and 11

NO CLASS APRIL 7 AS THAT IS GOOD FRIDAY

Week 13: April 10 to end of term

- Review.