

# Data Science Concepts (DS1000)

## Course Outline

### 1. Course Information

Course Name: Data Science Concepts  
 Course Number: DS1000  
 Term: Summer 2023

#### List of Prerequisites

One or more of Ontario Secondary School MCV4U, MHF4U, MDM4U, Mathematics 0109A/B, Mathematics 0110A/B, Mathematics 1229A/B, or equivalent.

#### List of Antirequisites

Statistical Sciences 1023A/B, the former Statistical Sciences 1024A/B.

Unless you have either the requisites for this course or written special permission from your Dean to enroll in it, you may be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees if you are dropped from a course for failing to have the necessary prerequisites.

### 2. Instructor Information

Instructors	Email	Office Hours
Ashley McAlpine	ashley.mcalpine@uwo.ca	Reach out via email if you would like to book office hours with me.
Teaching Assistants	Email	
Karzan Saeedi	ksaeedi2@uwo.ca	
Azar Eftekhari Targhi	aeftekh7@uwo.ca	
Ana Carolina Da Cruz	adacruz@uwo.ca	
Amirhossien Aminimanesh	aaminima@uwo.ca	
Pouya Faroughi	pfarough@uwo.ca	

#### TA Office Hours

For the weeks before each Assignment is due, and the midterm and final exam, office hours will be available Mon/Wed/Fri from 7:00-8:30pm over Zoom. You can find the link to join the office hours under the Zoom tool in OWL. The password is "DS1000!"

The following table shows which weeks the office hours will be held.

<u>TA Office Hours</u>	<u>Important Dates</u>
May 29, 31 & June 2	A1 due June 3
June 12, 14, 16	A2 due June 17
June 19 & 21	Midterm - June 22
July 3, 5, 7	A3 due July 8
July 24, 26, 28	A4 due July 29
July 31, Aug 1	Final Exam - TBD

### **OWL Forum**

All subject-specific questions must be asked in the OWL forum – this way all students can benefit from seeing the questions and help their peers by providing responses. The forum will be monitored on a regular basis and the TAs will interject with corrections or responses as necessary. As this is an open forum, please be respectful of your peers, instructor, and TAs. Derogatory, discriminatory, or otherwise inappropriate language or topics will be removed and dealt with at the instructor’s discretion.

### **Email**

Emails are reserved strictly for private and confidential communications. Course-related questions will not be answered via email. Students must use their Western ([@uwo.ca](mailto:@uwo.ca)) email addresses when contacting their instructor and be sure to indicate the course number (DS1000) in the subject line.

## **3. Course Syllabus, Schedule, Delivery Mode**

### **Description**

Students will learn how to visualize and analyze continuous and categorical data from various domains, using modern data science tools. Concepts of distributions, sampling, estimation, confidence intervals, experimental design, inference, correlation will be introduced in a practical, data-driven way.

### **Course Objectives**

By the end of this course, a successful student will be able to:

- Understand and correctly use foundational vocabulary associated with Statistics and Data Science.
- Interpret, create and critically evaluate graphical and numerical data summaries.
- Understand and appreciate probability, chance, randomness, and ‘average’.
- Understand, assess, and critique the conclusions of data analyses.
- Apply concepts learned in this course to future courses, careers, and everyday life.

## Lecture Schedule

Wk	Chapter	Lecture Topics	Lab Topics
1	Sections 1.1-1.6	- Categorical variables (pie charts, bar plots) - Quantitative variables (histograms, stem plots, time plots)	- Technical preparation for course
2	Sections 2.1-2.8	- Mean, Median, Quartiles, Interquartile range - Five-number summary - Boxplots and spotting outliers - Standard deviation - Choosing measures of center and variability	- Introduction to Python and Jupyter notebook - Data frames, arrays, types of variables
3	Sections 3.1-3.8	- The normal distribution - The 68-95-99.7 rule - Finding Normal proportions	- Basic Python commands and functions - Import data
4	Sections 4.1-4.6	- Explanatory and response variables - Displaying relationships: scatterplots - Measuring linear correlation	- Histogram, pie chart, bar plot - Five-number summary, boxplots - Calculating standard deviation
5	Sections 5.1-5.8 (excl 5.3)	- Least-squares regression lines - Caution about correlation and regression - Association does not imply causation	- Generating normal data and plotting the corresponding histogram - Calculating normal proportions
6	Sections 6.1-6.3	- Two-way contingency table - Relative risk, odds ratio - Simpson's Paradox	- Scatterplot - Linear correlation
7	Sections 8.1-8.7	- Sampling	- Least-squares regression fit - Interpretation of result table
8	Sections 9.1-9.7	- Observational studies versus random experiments	- From raw data to two-way table - Conditional and marginal proportions - Relative risk, odds ratio - Mosaic plot
9	Sections 12.1, 12.3-12.7	- Intro to probability	- Generating samples
10	Sections 13.1-13.6	- Rules of probability - Addition - Independence and multiplication rule - Conditional probability - Venn diagrams - Tree diagrams	- Probability - Venn diagrams
11	Sections 15.1-15.6	- Sampling distributions - Mean sampling distribution - Central limit theorem - Statistical significance	- Mean Sampling Distribution
12	Sections 16.1-16.4 32.3-32.4	- Quantifying estimation uncertainty - Confidence intervals for population mean - Bootstrap confidence intervals	- Confidence intervals - Bootstrap samples - Bootstrap confidence intervals

## 4. Course Materials

### Textbook

The Basic Practice of Statistics, 9th Ed, 2021, by D. S. Moore; W. I. Notz; M. I. Fligner

Students can order an e-book version through the Book Store's website: [https://bookstore.uwo.ca/textbook-search?campus=UWO&term=B2023&courses%5B0%5D=650\\_UW/DATASCI1000A](https://bookstore.uwo.ca/textbook-search?campus=UWO&term=B2023&courses%5B0%5D=650_UW/DATASCI1000A)

### OWL

Students are responsible for checking the course OWL site (<http://owl.uwo.ca>) on a regular basis for course material and updates. This is the primary method by which information will be distributed to all students in the class.

If students need assistance with the course OWL site, they can seek support on the OWL Help page. Alternatively, they can contact the Western Technology Services Helpdesk by phone at 519-661-3800 or ext. 83800.

### Technical Requirements

Python and Jupyter Notebook are the main tools for labs.

- Install Anaconda on your device: <https://www.anaconda.com/products/distribution>
- In the Anaconda Navigator desktop app, click on Jupyter Notebook.

The midterm and final exam will be conducted using a **remote proctoring service**. By taking this course, you are consenting to the use of this software and acknowledging that you will be required to provide **personal information** (including some biometric data) and that the session will be **recorded**. Completion of this course will require you to have a reliable internet connection and a device that meets the technical requirements for this service. More information about this remote proctoring service, including technical requirements, is available on Western's Remote Proctoring website at: <https://remoteproctoring.uwo.ca>.

## 5. Methods of Evaluation

The overall course grade will be calculated as listed below:

Component	Weight	Deadline	Coverage
Assignments x 4	20%	June 2 June 16 July 7 July 28	Chapters 1, 2, 3 Chapters 3, 4, 5 Chapters 6, 8, 9 Chapters 12, 13, 15
Midterm (2 hrs)	30%	June 22 @ 7-9 pm	Chapters 1 – 6
Final Exam (3 hrs)	50%	TBD – scheduled by Registrar's Office	Cumulative (all chapters)

Calculators: Any non-programmable calculator may be used in this course.

Format of Exams: Online, closed-book, combination of multiple-choice and short answer. A letter-sized handwritten cheat sheet is allowed. For the midterm, the cheat sheet can only be one-sided, but for the final exam, the cheat sheet can be double-sided.

## Assignments:

- There are 4 assignments; however, only the best 3 assignments will count towards your grade ( $20/3 = 6.67\%$  each). Students must submit at least 2 of the assignments to write the final exam.
- Assignments will be available on the course OWL site. You will submit your solutions through Gradescope. It is your responsibility to make sure that your assignment is successfully uploaded and legible. Submissions that cannot be read by the grader will receive a grade of zero.
- Assignment submissions are due at 11:55 pm (Eastern Time) on the due date. No accommodations will be given for assignments, so do not reach out to your instructor with reasons why you missed a deadline.
  - Assignments that are up to 24 hours late will receive a grade deduction of 15%.
  - Assignments between 24 and 48 hours late will receive a grade deduction of 30%.
  - No credit will be given for submissions beyond 48 hours of the deadline time.
- Solutions to assignments will not be posted; however, TAs will provide comments on incorrect answers using the Gradescope rubric, which will allow students to find out the correct solutions.
- After receiving an assignment grade, students will have seven days to submit a regrade request using the Gradescope tool “Regrade Request”. After this seven-day period, regrade requests will NOT be accepted.

## **Rounding of Marks Statement**

Across the Sciences Undergraduate Education programs, we strive to maintain high standards that reflect the effort that both students and faculty put into the teaching and learning experience during this course. All students will be treated equally and evaluated based only on their actual achievement. ***Final grades*** on this course, irrespective of the number of decimal places used in marking individual assignments and tests, will be calculated to one decimal place and rounded to the nearest integer, e.g., 74.4 becomes 74, and 74.5 becomes 75. Marks WILL NOT be bumped to the next grade or GPA, e.g. a 79 WILL NOT be bumped up to an 80, an 84 WILL NOT be bumped up to an 85, etc. The mark attained is the mark you achieved, and the mark assigned; requests for mark “bumping” will be denied.

## **6. Student Absences**

If you are unable to meet a course requirement due to illness or other serious circumstances, please follow the procedures below.

### **Assessments worth less than 10% of the overall course grade:**

Only the best 3 out of 4 assignments will count toward your final grade. You can choose to complete all 4 assignments, or only complete 3. There will be no further accommodations or make-ups for assignments. Please do not reach out to your instructor or an Academic Counsellor to ask for an accommodation.

### **Assessments worth 10% or more of the overall course grade:**

If you miss the midterm, you must provide valid medical or supporting documentation to the Academic Counselling Office of your Faculty of Registration as soon as possible. For further information, please consult the University's medical illness policy at

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/accommodation\\_medical.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf).

The Student Medical Certificate is available at

[https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/medicalform.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf).

Students who obtain appropriate accommodation will have the weight of the midterm redistributed to the final exam. There will be **no make-up** for the midterm.

### **Absences from Final Examinations**

If you miss the Final Exam, please contact the Academic Counselling Office of your Faculty of Registration as soon as possible. They will assess your eligibility to write the Special Examination (the name given by the University for a make-up Final Exam).

You may also be eligible to write the Special Exam if you are in a "Multiple Exam Situation" (e.g. more than 2 exams in 23-hour period or more than 3 exams in a 47-hour period).

## **7. Accommodation and Accessibility**

### **Religious Accommodation**

When a course requirement conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request accommodation for their absence in writing at least two weeks prior to the holiday to the course instructor and/or the Academic Counselling office of their Faculty of Registration. Please consult University's list of recognized religious holidays (updated annually) at <https://multiculturalcalendar.com/ecal/index.php?s=c-univwo>.

### **Accommodation Policies**

Students with disabilities are encouraged to contact Accessible Education, which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The policy on Academic Accommodation for Students with Disabilities can be found at: [https://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/Academic\\_Accommodation\\_disabilities.pdf](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic_Accommodation_disabilities.pdf)

## **8. Academic Policies**

The website for Registrarial Services is <http://www.registrar.uwo.ca>.

In accordance with policy, [https://www.uwo.ca/univsec/pdf/policies\\_procedures/section1/mapp113.pdf](https://www.uwo.ca/univsec/pdf/policies_procedures/section1/mapp113.pdf), the centrally administered e-mail account provided to students will be considered the individual's official university e-mail address. It is the responsibility of the account holder to ensure that e-mail received from the University at their official university address is attended to in a timely manner.

**Scholastic offences** are taken seriously, and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at the following website:

[http://www.uwo.ca/univsec/pdf/academic\\_policies/appeals/scholastic\\_discipline\\_undergrad.pdf](http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf).

## 9. Support Services

Please visit the Science & Basic Medical Sciences Academic Counselling webpage for information on adding/dropping courses, academic considerations for absences, appeals, exam conflicts, and many other academic related matters: <https://www.uwo.ca/sci/counselling/>.

Students who are in emotional/mental distress should refer to Mental Health@Western (<https://uwo.ca/health/>) for a complete list of options about how to obtain help.

Western is committed to reducing incidents of gender-based and sexual violence and providing compassionate support to anyone who has gone through these traumatic events. If you have experienced sexual or gender-based violence (either recently or in the past), you will find information about support services for survivors, including emergency contacts at [https://www.uwo.ca/health/student\\_support/survivor\\_support/get-help.html](https://www.uwo.ca/health/student_support/survivor_support/get-help.html).

To connect with a case manager or set up an appointment, please contact [support@uwo.ca](mailto:support@uwo.ca).

Please contact the course instructor if you require lecture or printed material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Accessible Education at [http://academicsupport.uwo.ca/accessible\\_education/index.html](http://academicsupport.uwo.ca/accessible_education/index.html) if you have any questions regarding accommodations.

Learning-skills counsellors at the Student Development Centre (<https://learning.uwo.ca>) are ready to help you improve your learning skills. They offer presentations on strategies for improving time management, multiple-choice exam preparation/writing, textbook reading, and more. Individual support is offered throughout the Fall/Winter terms in the drop-in Learning Help Centre, and year-round through individual counselling.

Western University is committed to a thriving campus as we deliver our courses in the mixed model of both virtual and face-to-face formats. We encourage you to check out the Digital Student Experience website to manage your academics and well-being: <https://www.uwo.ca/se/digital/>.

Additional student-run support services are offered by the USC, <https://westernusc.ca/services/>.