Data Science Concepts (DS 1000A) Course Outline

1. Course Information

Course Name: Data Science Concepts
Course Number: DS1000A
Term: Summer 2025

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, Statistical Sciences 2037A/B, Statistical Sciences 2857A/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	Zoom Office Hours
Ashley McAlpine	ashley.mcalpine@uwo.ca	By appointment

Teaching Assistants	Email	Zoom Office Hours
Diba Daraei	ddaraei@uwo.ca	Mon/Tues/Wed/Thurs 10am-12noon EST & 2-4pm EST (link on OWL)
Dinithi De Silva	kdesil4@uwo.ca	
Mahmoud Elwaraki	melwarak@uwo.ca	
Shiva Mehdipour Ghobadlou	smehdipo@uwo.ca	
Xize Ye	xye46@uwo.ca	

OWL Discussion Tool
All subject-specific questions must be asked during office hours or in the OWL Discussion tool (i.e. not via email). By using the OWL Discussion tool, all students can benefit from seeing the questions and help their peers by providing responses. The discussion 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, or to schedule a Zoom meeting with the instructor. The instructor will not answer any course-related questions via email. Students must use their Western (@uwo.ca) email addresses when contacting their instructor and be sure to indicate the course number (DS 1000) 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

Recommended Week to Learn	Textbook Chapters & Topics		Lab Topics
May 5	**Chapter 1** (1.1-1.6)	- Categorical variables (pie charts, bar plots) - Quantitative variables (histograms, stem plots, time plots)	**Lab 1** - Introduction to Google Colab - Introduction to basic Python programming: variables and data types; lists; functions; if statements
May 5	**Chapter 2** (2.1-2.8)	- Mean, Median - Quartiles, Interquartile range - Five-number summary - Boxplots and spotting outliers - Standard deviation - Choosing measures of center and variability	**Lab 2** - Introduction to Python programming (cont'd): loops - Python packages: NumPy and Pandas - Arrays and dataframe (df) manipulation
May 5/12	**Chapter 3** (3.1-3.8)	- The normal distribution - The 68-95-99.7 rule - Finding Normal proportions	**Lab 3** - Import data to Python - Plotting packages: Matplotlib and Seaborn - Creating plots: histogram, pie chart, bar plot, boxplots - Descriptive statistics (mean, standard deviation, five-number summary and etc) (Note: All coding required for A1 is introduced)
May 12	**Chapter 4** (4.1-4.6)	- Explanatory and response variables - Displaying relationships: scatterplots - Measuring linear correlation (Pearson's correlation coefficient)	**Lab 4** - Generating normal data and plotting the corresponding histogram - Calculating normal proportions - The 68-95-99.7 rule

May 12	**Chapter 5** (5.1-5.8, excl. 5.3)	- Regression lines - Least-squares regression lines - Examples of software regression output - Caution about correlation and regression - Association does not imply causation	**Lab 5** - Scatterplot and pairplot - Linear correlation (Python function for Pearson's correlation) - Correlation heatmap (Note: All coding required for A2 is introduced)
May 19	**Chapter 6** (6.1-6.3)	- Two-way contingency table - Relative risk, odds ratio - Simpson's Paradox	(Note: No lab this week)
May 19	Review for Midterm		
May 26	**Chapter 8** (8.1-8.7)	- Sampling	**Lab 6** - Least-squares regression fit - Interpretation and visualization of regression - Influential points and outlier
May 26	**Chapter 9** (9.1-9.7)	- Observational studies versus random experiments	**Lab 7** - From raw data to two-way table - Computing conditional and marginal proportions - Mosaic plot - Relative risk, odds ratio (Note: All coding required for A3 is introduced)
May 26 / June 2	**Chapter 12** (12.1-12.7, excl. 12.2)	- Intro to probability	**Lab 8** - Generating samples with: Simple random sampling, systematic sampling, and stratified sampling
June 2	**Chapter 13** (13.1-13.6)	- Rules of probability - Independence and multiplication rule - Conditional probability - Venn diagrams - Tree diagrams	**Lab 9** - Sets - Basic probability rules - Venn diagrams
June 2	**Chapter 15** (15.1-15.6)	- Sampling distributions - Mean sampling distribution - Central limit theorem - Statistical significance	**Lab 10** - Sampling distribution of the sample mean - Central limit theorem
June 9	**Chapter 16** (16.1-16.4) **Chapter 32** (32.3-32.4)	- Quantifying estimation uncertainty - Confidence intervals (CIs) for population mean - Bootstrap confidence intervals	**Lab 11** - Building confidence interval from normal distribution (CLT based CI) - Building confidence interval from bootstrapping samples (Bootstrapping CI) (Note: All coding required for A4 is introduced)
June 9	Review for Final Exam		

Delivery Mode

This is an asynchronous distance course. Students are responsible for learning the material at their own pace. All assessments will be conducted online.

4. Course Materials

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

Students can order a physical copy ($149.85) or purchase an e-book version ($89) using this link:
https://bookstore.uwo.ca/textbook-search?campus=UWO&term=N2025&courses%5B0%5D=650_UW/DATASCI1000A

Note: The e-book access code is "ppybbm"
Students are welcome to purchase earlier editions of this textbook. Be aware that I provide a list of suggested textbook exercises for practice so some questions may differ from earlier editions.

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.

The instructor has posted the following materials on the OWL site:
- detailed lectures slides with additional content in the presenter notes
- practice exercises at the end of each lecture slide deck with solutions in the presenter notes
- videos to help guide you through the labs (Python element of the course); a TA is currently improving the lab videos, so two or more lab videos will be made available at the beginning of each week.

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 Google Colab are the main tools for labs. The first lab will help you get everything set up on your computer.

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
Assignments x 4	20%	May 16, May 23, June 6, June 13
Midterm	30%	May 26 @ 2 – 4 pm EST
Final Exam	50%	June 13 @ 2 – 5 pm EST

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

Format of Exams: Online, closed-book, combination of multiple choice and short answer.
- Midterm covers material from Chapters 1-6
- Final Exam covers material from entire course
- Further details can be found in the Exam Information file posted on OWL

Assignments:

- Assignments will consist of written answer questions and Python programming questions, split about 50/50.

- Assignments will be posted on Gradescope. It is your responsibility to make sure that your assignment is submitted properly. Be sure to read the instructions on the first page of the assignment carefully as well as the Gradescope Information file posted on OWL.

- Assignment submissions are <u>due at 11:55 pm (Eastern Standard Time) on the due date</u>.
   - Assignments that are up to 24 hours late will receive a grade deduction of 15%.
   - Assignments up to 48 hours late will receive a grade deduction of 30%.
   - No credit will be given for submissions beyond 48 hours of the deadline time.

- After receiving an assignment grade, you will have **three days** to submit a regrade request in Gradescope (to ask any questions or to inquire about a potential grading error). After this three-day period, regrade requests will NOT be accepted.

General information about missed coursework
Students must familiarize themselves with the *University Policy on Academic Consideration – Undergraduate Students in First Entry Programs* posted on the Academic Calendar:
https://www.uwo.ca/univsec/pdf/academic_policies/appeals/academic_consideration_Sep24.pdf,

This policy does not apply to requests for Academic Consideration submitted for **attempted or completed work**, whether online or in person.

The policy also does not apply to students experiencing longer-term impacts on their academic responsibilities. These students should consult Accessible Education.

For procedures on how to submit Academic Consideration requests, please see the information posted on the Office of the Registrar's webpage: https://registrar.uwo.ca/academics/academic_considerations/
All requests for Academic Consideration must be made within 48 hours after the assessment date or submission deadline.

Academic Consideration

Assignments
All academic consideration requests will be denied for assignments, as assessment flexibility has already been given:

- Assignments: There are 4 assignments and the best 3 will count towards your final grade. You may choose not to submit one assignment and this grade of zero will be dropped.

Midterm & Final Exam
When requesting academic consideration for the midterm and final exam, you are required to provide formal supporting documentation.

- Midterm: There will be no make-up midterm. For those who have approval to miss the midterm, this weight will be transferred to the final exam, making it worth 80% of your course grade.

- Final Exam: For those who have approval to miss the final exam, there will be a make-up final exam scheduled for June 23.

6. Additional Statements

Religious Accommodation
When conflicts with a religious holiday that requires an absence from the University or prohibits certain activities, students should request an accommodation for their absence in writing to the course instructor and/or the Academic Advising office of their Faculty of Registration. This notice should be made as early as possible but not later than two weeks prior to the writing or the examination (or one week prior to the writing of the test).

Please visit the Diversity Calendars posted on our university's EDID website for the recognized religious holidays: https://www.edi.uwo.ca.

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.

Academic Policies
The website for Registrar Services is https://www.registrar.uwo.ca/.

In accordance with policy, 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 Web site: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

In the event of another health lock-down, the midterm and final exam in this course will be conducted using a remote proctoring service. By taking this course, you are consenting to the use of this software and acknowledge that you will be required to provide **personal information** (including some biometric data) and 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.

Support Services
Please visit the Science & Basic Medical Sciences Academic Advising 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.

To connect with a case manager or set up an appointment, please contact 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 if you have any questions regarding accommodations.

Learning-skills counsellors at Learning Development and Success (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.