DS 1000 (Data Science Concepts)
Section 001
Fall 2022/2023 Course Outline

1. Course Information

Course Information

Instructor	Day/Time	Location	Contact
Holly Steeves	MWF 8:30 – 9:30	<u>In-person</u> at SH-3345	Holly.steeves@uwo.ca

Calendar 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.

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

Anti-requisites
Statistical Sciences 1023A/B, the former Statistical Sciences 1024A/B.

Extra Information
1 hour of laboratory tutorial per week conducted by TAs.

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 in the event that you are dropped from a course for failing to have the necessary prerequisites.

2. Instructor Information

Instructors	Email	Office	Phone	Office Hours
Dr. Holly Steeves	Holly.steeves@uwo.ca	WSC 233	519-661-2111 x86426	MF 10:00 – 11:00 T 2:00 – 3:00

Students must use their Western (@uwo.ca) email addresses when contacting their instructors.

You can expect a response to a message to the instructor within **approximately 48 hours** during the work week (during busy times, it may take a little longer). ***Note that messages will not be answered within the 24-hour period before exams or project deadlines***, nor can I guarantee responses over weekends/holidays.

3. Course Syllabus, Schedule, Delivery Mode

Calendar 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.

Tentative Course Schedule - Textbook: The Basic Practice of Statistics 9th Ed.

Week		Chapter	Topics	Lab Tutorial
1	Sep 5-9	1 Sections: 1.1 to 1.6	- Categorical variables (pie charts and bar plots) - Quantitative variables (histograms, stem plots, time plots)	- Introduction to Python and Jupyter notebook - Data frames, arrays, types of variables
2	Sep 12-16	2 Sections: 2.1 to 2.5	- Mean, Median - Quartiles - Five-number summary	- Basic Python commands and functions
3	Sep 19-23	2 Sections: 2.5 to 2.8	- Interquartile range - Boxplots and spotting outliers - Standard deviation - Choosing measures of center and variability	- Import data - Histogram, pie chart, and bar plot - Five-number summary - Boxplots - Calculating standard deviation
4	Sep 26-30	3 Sections: 3.1 to 3.8	- The normal distribution - The 68-95-99.7 rule - Finding Normal proportions	- Generating normal data and plotting the corresponding histogram – - Calculating normal proportions - Assig. 1 due Sep 30
5	Oct 3-7	4 Sections:	- Explanatory and response variables - Displaying relationships: scatterplots	- Scatterplot

		4.1 to 4.6	- Measuring linear correlation (Pearson's correlation coefficient)	- Linear correlation (Python function for Pearson's correlation)
6	Oct 10-14	5 Sections: 5.1, 5.2, 5.4 to 5.8	- Regression lines - Least-squares regression lines - Examples of software regression output - Caution about correlation and regression - Association does not imply causation	- Least-squares regression fit - Interpretation of result table
7	Oct 17-21	6 Sections: 6.1-6.3	- Two-way contingency table - Relative risk, odds ratio - Simpson's Paradox	- From raw data to two-way table - Computing conditional and marginal proportions - Relative risk, odds ratio - Mosaic plot - <mark>Assig. 2 due Oct 21</mark>
8	Oct 24-28	8 Sections: 8.1 to 8.7		
9	Oct 31-Nov 4	**Reading Week**		
10	Nov 7-11	9 Sections: 9.1 to 9.7	- Observational studies versus random experiments	- Generating samples
11	Nov 14-18	12 Sections: 12.1, 12.3 to 12.7	-	- <mark>Assig. 3 due Nov 18</mark>
12	Nov 21-25	13 Sections: 13.1 to 13.6	- Rules of probability - Addition - Independence and the multiplication rule - Conditional probability - Venn diagrams - Tree diagrams	- Venn diagram
13	Nov 28-Dec 2	15 Sections: 15.1 to 15.6	- Sampling distributions - Mean sampling distribution - Central limit theorem - Statistical significance	- Mean sampling distribution
14	Dec 5-8	16 Sections: 16.1 to 16.4 32	- Quantifying estimation uncertainty - Confidence intervals (Cis) for a population mean - Bootstrap confidence intervals	- Building normal based Cis - Bootstrap samples - Bootstrap Cis - <mark>Assign 4. Due Dec 8</mark>

		Sections: 32.3, 32.4		

Key Sessional Dates
Classes begin: September 8, 2022
Fall Reading Week: October 31 – November 6, 2022
Classes end: December 8, 2022
Exam period: December 10 – 22, 2022

Contingency plan for an in-person class pivoting to 100% online learning
In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, affected course content will be delivered entirely online, either synchronously (i.e., at the times indicated in the timetable) or asynchronously (e.g., posted on OWL for students to view at their convenience). The grading scheme will **not** change. Any remaining assessments will also be conducted online as determined by the course instructor.

4. Course Materials

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

UWO bookstore listing
https://bookstore.uwo.ca/textbook-search?campus=UWO&term=W2022A&courses%5B0%5D=001_UW/DATASCI1000A&courses%5B1%5D=002_UW/DATASCI1000A&courses%5B2%5D=003_UW/DATASCI1000A

iClicker
iClicker will be used for in class feedback and non-graded assessments. There is a link on the OWL site where you can install and join the class.

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

All course material will be posted to OWL: http://owl.uwo.ca.

The Forum tool is enabled on the OWL website. Please use this Forum to post and respond to questions about course content (e.g., lectures, readings, etc). The Forum will be monitored on a regular basis and the instructor or TAs will interject with corrections or responses as necessary. As this is an open Forum, please be respectful of your peers, instructor(s), and TAs. Derogatory, discriminatory, or otherwise inappropriate language or topics will be removed and dealt with at the instructor's discretion.

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. They can be contacted by phone at 519-661-3800 or ext. 83800.

Technical Requirements

Laboratory tutorials
Python and Jupyter Notebook are the main tools for laboratory tutorials. Instructions on how to install them on your own machine are available on OWL under Resources. If you need access to a computer for coursework, please contact the instructor as early as possible.

5. Methods of Evaluation

Component	Weight	Deadlines/Due dates
Lab tutorial quizzes	5%	TBD
Assignment 1	5%	September 30
Assignment 2	5%	October 21
Assignment 3	5%	November 18
Assignment 4	5%	December 8
Midterm (in-person and <u>closed book</u>)	30%	to be scheduled by the Registrar's Office Tentatively scheduled Oct 26
Final exam (in-person and <u>closed book</u>)	45%	to be scheduled by the Registrar's Office

The overall course grade will be calculated as listed below:

Assignments

- **Assignments will be available on the course OWL site. However, you will not submit your solutions to OWL. Instead, <u>assignments must be submitted through Gradescope</u>** (https://www.gradescope.com/) an online collaborative grading system. 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.

- After receiving the grades from an assignment, **students will have seven days to submit any regrade requests on that assignment**. After this seven-day period, regrade requests will NOT be accepted. Regrade requests must be made using the Gradescope tool "Regrade Request".

- <u>**Students must submit at least 2 out of the 4 assignments to write the final exam.**</u>

- **<u>Assignment submissions are due 11:55 pm (Eastern Time) on the due date</u>**. Assignments that are up to 24 hours late will receive a deduction of 15% on their mark. Late assignments up to 48 will receive a deduction of 30% on their mark hours that. No credit will be given for submissions beyond 48 hours of the deadline time unless a valid academic accommodation is obtained (see Section 7 for details on accommodation).

- Solutions to assignments **<u>will not</u>** be posted; however, TAs will provide comments on incorrect answers using Gradescope, which will allow students to find out the correct solutions. In addition, students can ask the instructor and TAs for more details on solutions via the Regrade Request tool on Gradescope and during office hours.

Midterm and final exams

- There will be a **2-hour in-person closed-book midterm exam, and its time will be scheduled by the Registrar's Office**.
- There will be a **3-hour in-person closed-book final exam, and its time will be scheduled by the Registrar's Office**.

Rounding of marks

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:

If you are unable to submit an assignment by the due date/time, you must seek approval for the absence as soon as possible and contact your instructor immediately. Approval can be granted via the Dean's Office/Academic Counselling unit of your Home Faculty. Those **<u>students obtaining such appropriate accommodation will have to submit their assignment via OWL messages within 24 hours of the end of the accommodation period</u>**. Failure to submit a missed assignment within 24 hours of a valid academic accommodation period will result in a grade of 0%.

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

For work totalling 10% or more of the final course grade, 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.

The Student Medical Certificate is available at

https://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

If you miss the Midterm, you must request an accommodation from Academic Counseling in your Faculty's Dean's Office. Students who obtain appropriate accommodation will have the weight of the midterm redistributed to the final exam.

Absences from Final Examinations

If you miss the Final Exam, please contact the Academic Counselling office of your Faculty of Registration as soon as you are able to do so. They will assess your eligibility to write the Special Examination (the name given by the University to a makeup 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, more than 3 exams in a 47-hour period).

6. 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.

7. 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,

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.

Participants in this course are not permitted to record lectures and/or labs, except where recording is an approved accommodation, and the participant has the prior written permission of the instructor.

Online services such as Chegg are actively monitored. Any questions that are coming out from assignments and are posted to an online service will be searched. Such an activity will be considered as a scholastic offence and will result in an academic penalty.

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:

http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

Clickers, specifically iClicker will be used in this class for instant feedback and non-graded assessments. Clickers will not be used for any marks towards the course.

Professionalism & Privacy

Western students are expected to follow the Student Code of Conduct (https://www.uwo.ca/univsec/pdf/board/code.pdf). Additionally, the following expectations and professional conduct apply to this course:

All course materials created by the instructor(s) are copyrighted and cannot be sold/shared

Recordings are not permitted (audio or video) without explicit permission

Permitted recordings are not to be distributed

Copyright Statement

Please be aware that all course materials created by the instructor(s) are copyrighted and **cannot be sold/shared**. Those include materials used in assignments, tests/quizzes, midterms, and finals. Any posting/sharing of such materials in part or whole without owner's consent is considered as violation of the Copyright Act and will be considered as a scholastic offence.

8. 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.

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 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.

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