DS 1000 (Data Science Concepts)
Section 001
Fall 2021/2022 Course Outline

1. **Course information:**

Instructor	Day/Time	Location	Contact	Office hours
Matt Davison	Mondays, Wednesdays and Fridays 8:30 am to 9:30 am	In-person at WSc 55 (Western Science)	use OWL messages (contact "Instructor Role")	Mondays 4:00-5:00 pm at NCB 240D

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.

Pre-requisites: 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.

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, all remaining 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. In the event with online learning, stable internet connect with working microphone and webcam are required.

2. Course Objectives and Schedule

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.

→ **Course schedule:** see Pages 6 and 7.

3. Communication

- To communicate with the instructor **always use the OWL messages (to "Instructor Role")** tool.

- Messages sent to instructor's UWO email will **NOT** be answered.

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.

Students should check OWL (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. Students are responsible for checking OWL on a regular basis.

The Forum tool is enabled on the OWL website. Please use this Forum to post and respond to questions about course content (e.g., lecture, 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. Egregious misbehaviour will be addressed using the Student Code of Conduct.

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

5. 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=W2021A&courses%5B0%5D=002_UW/DATASCI1000A

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

6. Methods of Evaluation

Component	Weight	Deadlines/Due dates
Assignment 1	5%	Wed Sep 29
Assignment 2	5%	Wed Oct 20
Assignment 3	5%	Wed Nov 17
Assignment 4	5%	Monday Dec 6
Midterm (in-person and <u>closed book</u>)	35%	Week 8 Oct 27 3:30-5:30PM, location TBA
Final exam (in-person and <u>closed book</u>)	45%	During exam period (to be scheduled by the Registrar's Office). Cumulative.

i)   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 on-line 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 11:55pm (Eastern Time) on the due date</u>**. No credit will be given for submissions beyond this 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 wrong 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 during office hours.

ii)   Midterm and final exams

- The midterm will be **a 2-hour in-person closed-book exam, scheduled as noted above.**

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

iii)   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.

7. Accommodation and accessibility

- 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 either through a self-reporting of absence (SRA) or via the Dean's Office/Academic Counselling unit of your Home Faculty. Those **students obtaining such appropriate accommodation will have to submit their assignment via OWL messages within 24 hours of the end of the accommodation period**. Failure to submit a missed assignment within 24 hours of a valid academic accommodation period will result in a grade of 0%.

- If you miss the Midterm you must request 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.

- If you miss the Final Exam you must request accommodation from Academic Counseling in your Faculty's Dean's Office and contact the instructor immediately.

- Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The Academic Accommodation for Students with Disabilities policy can be found at: https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic Accommodation_disabilities.pdf

- Religious Accommodation: students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the Western Multicultural Calendar: https://multiculturalcalendar.com/ecal/index.php?s=c-univwo

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,

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 his/her official university address is attended to in a timely manner.

If you are unable to meet a course requirement due to illness or other serious circumstances, you must seek approval for the absence as soon as possible. Approval can be granted either through a self-reporting of absence or via the Dean's Office/Academic Counselling unit of your Home Faculty. For further information, please consult the university's policy on academic consideration for student absences:
https://www.westerncalendar.uwo.ca/PolicyPages.cfm?PolicyCategoryID=1&command=showCategory&SelectedCalendar=Live&ArchiveID=

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.

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.

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.

9. Support Services

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

- 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 Student Accessibility Services (SAS) at 661-2147 if you have any questions regarding accommodations.

- Learning-skills counsellors at the Student Development Centre (http://www.sdc.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.

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

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

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

	Week	Chapter	Topics	Lab tutorial
1	Sep 6-10 **Sep 8 first day of classes**	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 13-17	2 Sections: 2.1 to 2.5	- Mean, Median - Quartiles - Five-number summary	- Basic Python commands and functions
3	Sep 20-24	2 Sections: 2.5 to 2.8	- Inter-quartile range - Boxplots and spotting outliers - Standard deviation - Choosing measures of center and variability	- Import data - Histogram, pie chart and bar plot - Five-number summary - Boxplot - Calculating standard deviation
4	Sep 27 - Oct 1	3 Sections: 3.3 to 3.6	- 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 29**
5	Oct 4-8	4 Sections: 4.1 to 4.6	- Explanatory and response variables - Displaying relationships: scatterplots - Measuring linear correlation (Person's correlation coefficient)	- Scatterplot - Linear correlation (Python function for Pearson's correlation coefficient)

6	Oct 11-15	5 Sections: 5.1, 5.7, 5.2, 5.3, 5.4, 5.8	- Regression lines - Least-squares regression line - 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 18-22	6 Sections: 6.1, 6.2, 6.3	- Two-way contingency tables - Relative risk, odds ratio - Simpson's Paradox	- From raw data to a two-way table - Computing conditional and marginal proportions - Relative risk, odds ratio - Mosaic plot **Assig. 2 due Oct 20**
8	Oct 25-29	8 Sections: 8.1 to 8.7	- Population versus sample - Bad samples - Simple random sample - Stratified random sample - Why can we trust random samples? - Cautions about sample surveys	**Midterm**
9	Nov 1-5	**Reading week**		
10	Nov 8-12	9 Sections: 9.1 to 9.7	- Observational studies versus random experiments	- Generating samples
11	Nov 15-19	13 Sections: 13.1 to 13.5	- Rules of probability - Addition - Independence and the multiplication rule - Conditional probability - Venn diagrams	- Venn diagram **Assig. 3 Due Wed Nov 17**
12	Nov 22-26	15 Sections: 15.3 to 15.6	- Sampling distributions - Mean sampling distribution - Central limit theorem - Statistical significance	- Mean sampling distribution
13	Nov 29-Dec 3	16 Sections: 16.1 to 16.4 32 Sections: 32.3 and 32.4	- Quantifying estimation uncertainty - Confidence intervals (CIs) for a population mean - Bootstrap confidence intervals	- Building normal based CIs - Bootstrap samples - Bootstrap CIs
	Dec 6 - Dec 8		- Finish content from previous week and/or review for final exam	**Assig. 4 due Dec 6** **Dec 8 last day of class**