**Department of Statistical and Actuarial Sciences**

**Data Science Concepts (DS 1000B) Course Outline**

**1. Course Information**

Course Name: Data Science Concepts

Course Number: DS1000B

Term: Winter 2025

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Day** | **Time** | **Location** |
| **Class** | | | |
| Section 1 | Tue  Thu | 8:30 AM – 9:30 AM  8:30 AM – 10:30 AM | SEB-2200 |
| Section 2 | Mon/Wed/Fri | 12:30 PM – 1:30 PM | NSC-1 |
| Section 3 | Mon/Wed/Fri | 2:30 PM – 3:30 PM | NSC-1 |
| **Lab** | | | |
| Section 4 | Thu | 4:30 PM – 5:30 PM | BGSM-0153 |
| Section 5 | Tue | 2:30 PM – 3:30 PM |
| Section 6 | Tue | 3:30 PM – 4:30 PM |
| Section 7 | Tue | 4:30 PM – 5:30 PM |
| Section 8 | Thu | 2:30 PM – 3:30 PM |
| Section 9 | Thu | 3:30 PM – 4:30 PM |

**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** | **Office** | **Office Hours** |
|  | Ashley McAlpine | ashley.mcalpine@uwo.ca | WSC 274 | Mon & Wed  10 AM – 11AM |

\*Note: If your course schedule conflicts with the office hours listed above, feel free to email me and we will arrange another time to meet.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Teaching Assistants** | | **Email** | **Office Hours** | **Location** |
|  |  |  | Mon 3:30-5:30 PM | MC |
|  |  |  |
|  |  |  | Zoom |
|  |  |  | Wed 3:30-5:30 PM | MC |
|  |  |  |
|  |  |  | Zoom |
|  |  |  | Fri 3:30-5:30 PM | MC |
|  |  |  |
|  |  |  | Zoom |
|  |  |  | Weekday response within 24 hrs on OWL Discussion Tool | |

**TA Office Hours – Weeks 4, 6, 8, 10, 13**

TA office hours will be held every Mon/Wed/Fri from 3:30-5:30 PM during weeks where there is an assignment due or the midterm. Two TAs will be available in-person in MC 106. One TA will be available online by using the Zoom link provided on OWL (under Content, Zoom Office Hours).

**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(s), 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. We 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.

**Approximate Lecture Schedule**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Wk** | **Dates** | **Chapter** | **Class Topics** | **Lab Topics** |
| 1 | Jan 6-10 | Sections 1.1-1.6 | - Categorical variables (pie charts, bar plots)  - Quantitative variables (histograms, stem plots, time plots) | - Introduction to Python and Jupyter notebook  - Data frames, arrays, types of variables |
| 2 | Jan 13-17 | Sections 2.1-2.8 | - Mean, Median  - Quartiles  - Five-number summary  - Interquartile range  - Boxplots and spotting outliers  - Standard deviation  - Choosing measures of center and variability | - Basic Python commands and functions  - Import data |
| 3 | Jan 20-24 | Sections 3.1-3.8 | - The normal distribution  - The 68-95-99.7 rule  - Finding Normal proportions | - Histogram, pie chart, bar plot  - Five-number summary  - Boxplots  - Calculating standard deviation |
| 4 | Jan 27-31 | Sections 4.1-4.6 | - Explanatory and response variables  - Displaying relationships: scatterplots  - Measuring linear correlation (Pearson’s correlation coefficient) | - Generating normal data and plotting the corresponding histogram  - Calculating normal proportions |
| 5 | Feb 3-7 | Sections 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 | - Scatterplot  - Linear correlation (Python function for Pearson’s correlation) |
| 6 | Feb 10-14 | Sections 6.1-6.3 | - Two-way contingency table  - Relative risk, odds ratio  - Simpson’s Paradox | - Least-squares regression fit  - Interpretation of result table |
| 7 | Feb 17-21 | Reading Week | | |
| 8 | Feb 24-28 | Sections 8.1-8.7 | - Sampling | - review for Midterm on Mar 3 |
| 9 | Mar 3-7 | Sections 9.1-9.7 | - Observational studies versus random  experiments | - From raw data to two-way table  - Computing conditional and marginal proportions  - Relative risk, odds ratio  - Mosaic plot |
| 10 | Mar 10-14 | Sections 12.1, 12.3-12.7 | - Intro to probability | - Generating samples |
| 11 | Mar 17-21 | Sections 13.1-13.6 | - Rules of probability  - Addition  - Independence and multiplication rule  - Conditional probability  - Venn diagrams  - Tree diagrams | - Venn diagrams |
| 12 | Mar 24-28 | Sections 15.1-15.6 | - Sampling distributions  - Mean sampling distribution  - Central limit theorem  - Statistical significance | - Mean Sampling Distribution |
| 13 | Mar 31-Apr 4 | Sections 16.1-16.4  32.3-32.4 | - Quantifying estimation uncertainty  - Confidence intervals (Cis) for population mean  - Bootstrap confidence intervals | - Building normal based Cis  - Bootstrap samples  - Bootstrap Cis |

The classes and labs will be delivered in-person. Should any university-declared emergency require some or all of the course to be delivered online, either synchronously or asynchronously, the course will adapt accordingly. The grading scheme will not change. Any assessments affected will be conducted online as determined by the course instructor.

**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 or purchase an e-book version using this link: <https://bookstore.uwo.ca/textbook-search?campus=UWO&term=W2024B&courses%5B0%5D=001_UW/DATASCI1000B>

Note: The e-book access code is “383soo”

Students are welcome to purchase earlier editions of this textbook. I provide a list of suggested exercises for practice but be aware that some questions may differ or may have been removed in 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.

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.

**iClicker**

iClicker will be used for in class interaction, as well as for lab attendance.

Follow the link: <https://www.iclicker.com/> where you can install iClicker and join the class.

**Technical Requirements**

Python and Jupyter Notebook are the main tools for labs. Please remember to bring your own laptop to attend labs. If you need access to a computer for coursework, please contact the instructor as early as possible. Note: During the first lab, the TAs will help you set this up on your computer/

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

**5. Methods of Evaluation**

The overall course grade will be calculated as listed below:

|  |  |  |
| --- | --- | --- |
| Component | Weight | Deadline |
| Lab Attendance | 5% | n/a |
| Assignments x 4 | 15% | Feb 2, Feb 16, Mar 16, Apr 6 |
| Midterm (2 hrs) | 30% | Mar 2 @ 2pm |
| Final Exam (3 hrs) | 50% | TBD – to be scheduled by the Registrar’s Office |

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

Format of Exams: In-person, closed-book, combination of multiple choice and short answer.

* Midterm covers material from weeks 1 to 6
* Final Exam covers material from entire course, weeks 1-13

Assignments:

* You may do assignments individually or with a partner. If you chose to do your assignment with a partner, **only one** of you should submit the assignment; you need to link the other partner’s name to the assignment when you submit on Gradescope. You do not need to have the same partner for each assignment.
* Assignments will be available on 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.
  + 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, 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.

**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](http://academicsupport.uwo.ca/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**

**Labs & Assignments**

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

* Labs: There are 12 labs and you only need to attend 10 to earn 5% of your grade (10 \* 0.5%).
* Assignments: There are 4 assignments and the 3 best will count towards your final grade (5% each). 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 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 sometime in May (date is TBD).

**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](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](https://www.uwo.ca/univsec/pdf/academic_policies/appeals/Academic%20Accommodation_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](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.