**BIOLOGY 2244B—Analysis & Interpretation of Biological Data**
*and*
**STATISTICS 2244B—Statistics for Science**
**Winter 2019**

## Calendar Descriptions

***Stat 2244:*** An introductory course in the application of statistical methods, intended for honors students in departments other than Statistical and Actuarial Sciences, Applied Mathematics, Mathematics, or students in the Faculty of Engineering. Topics include sampling, confidence intervals, analysis of variance, regression and correlation. Cannot be taken for credit in any module in Statistics, Actuarial Science, or Financial Modeling.

***Biol 2244:*** Measurement, sampling, estimation, and statistical hypothesis testing are considered: theory, intuitive background, and practical relevance will be stressed.

**Note:** Students registered in 2244 under 'Biology 2244' will have the course listed as 'Biology 2244' (and the associated course title) on their transcript; those registered under 'Statistics 2244' will have the course listed as 'Statistics 2244' (and the associated course title). The naming of the course is set once a student registers and will not be changed retroactively after the add/drop deadline for the term of registration.

***Prerequisites:*** A full mathematics course, or equivalent, numbered 1000 or above. Statistical Sciences 1024A/B can be used to meet 0.5 of the 1.0 mathematics course requirement.
***Anti-requisites:*** All other courses or half courses in Introductory Statistics **except** Statistical Sciences 1023A/B, Statistical Sciences 2037A/B and Statistical Sciences 1024A/B.

Unless you have either the requisites for this course or written special permission from your Dean to enrol 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.

## Course Timetable

**Lectures:** Sect 001: Wednesdays and Fridays, 12:30 pm–1:30 pm in NS 1
Sect 002: Tuesdays and Thursdays, 3:30 pm–4:30 pm in NCB 101

**Labs:**

| Section | Day | Time | Location |
|---|---|---|---|
| **003** | Tu | 6:30–9:20 pm | HSB 14 |
| **004** | Tu | 6:30–9:20 pm | NCB 105 |
| **005** | W | 6:30–9:20 pm | HSB 16 |
| **006** | W | 6:30–9:20 pm | HSB 14 |
| **008** | Th | 6:30–9:20 pm | HSB 13 |
| **011** | Tu | 1:30–4:20 pm | HSB 13 |
| **012** | W | 1:30–4:20 pm | HSB 14 |
| **013** | Th | 6:30–9:20 pm | NCB 105 |
| **014** | Tu | 1:30–4:20 pm | HSB 16 |

## Instructor Information

**Name:** Jennifer Peter
**Departments:** Biology *and* Statistical & Actuarial Sciences
**Drop-in hours**:

- *Tuesdays, 10:00 am to 12:00 noon in NCB 301L*
- *Thursdays, 10:00 am to 12:00 noon in NCB 301L*

There is no need to make an appointment for drop-in hours; simply stop by. We get together around a large table and collaborate with a white board on problems/questions. Bring your snack/lunch/homework/ questions, or just come to listen.

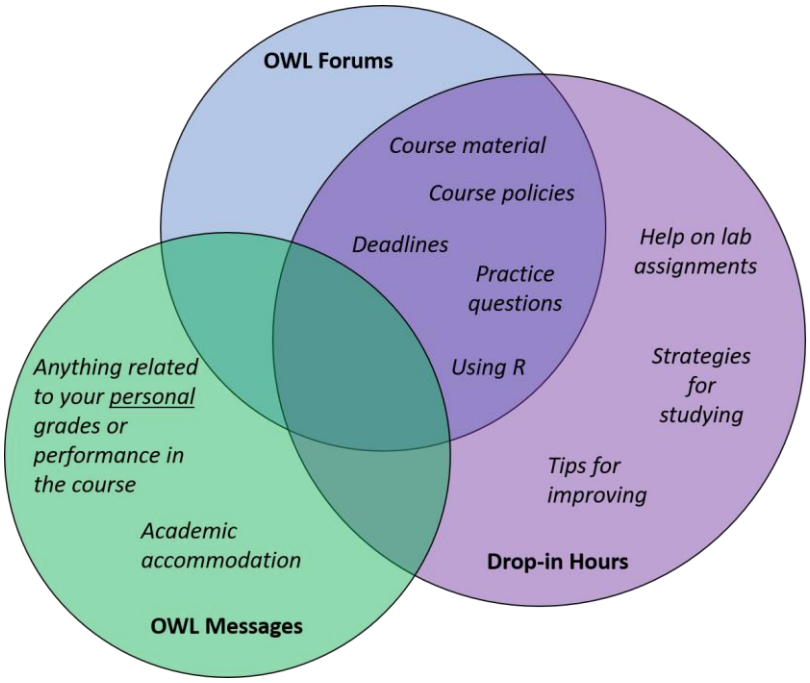
**Email:** Please use the OWL "Messages" tool on our course site; send messages to ***Instructor Role***

***What is the best method of connecting with me?***

As you move through the course, you may find you have questions or need clarification. There are several ways to connect with me; this Venn diagram highlights the appropriate methods for some common topics.

You can expect a response to an OWL Message or Forum posting within about 48 hours during the Monday to Friday work week. Note that Messages or Forum questions will generally not be answered in the 24-hour period before exams; this is meant to encourage proactive studying and help-seeking behaviour.

Be sure to check OWL announcements and your UWO email on a regular basis for news and updates related to the course.




## Learning Objectives

For many of you, this will be the only formal Statistics course taken during your undergraduate degree. Consequently, it must be both introductory *and* comprehensive, theoretical *and* practical. By the end of the course, then, you should be able to:

- **LO1:** Describe, distinguish among, and select appropriate data collection procedures (i.e. sampling and study designs) *(assessed by lab assignments, quizzes, clicker participation, and exams)*,
- **LO2:** Compute, interpret, and evaluate summaries of data *(assessed by lab assignments, quizzes, clicker participation, and exams)*,
- **LO3:** Select, conduct, and interpret common statistical inference procedures *(assessed by lab assignments, quizzes, clicker participation, and exams)*,
- **LO4:** Interpret results of data analysis *(assessed by lab assignments, quizzes, clicker participation, and exams)*
- **LO5:** Understand the conceptual or foundational underpinnings of common inference procedures *(assessed by clicker participation, activities, and exams*).
- **LO6:** Communicate and discuss statistical results in a scholarly fashion *(assessed by lab assignments)*
- **LO7:** Use statistical software (e.g. R/R Studio) to explore, summarize, and analyse data *(assessed by lab assignments and activities)*

## Learning Resources

We will be using a variety of resources to support your learning; these resources are "required" in the sense that each student needs access to the resources to be successful in the course. However, whether that access is associated with an individual, shared by a group of individuals, or borrowed from the commons (e.g. in-campus computer labs, etc.) is up to you and/or depends on the resource.

**Statistical software package(s)**: R (www.r-project.org) and R studio (www.rstudio.com)
A major learning objective for the course is using statistical software (see learning objectives, **LO4** and **LO7**). The lab component of the course (including associated assignments) involves using R (and I recommend the integrated development environment, R Studio). Both software packages are free programs that students can download to their personal computer/laptop and/or use on computers in any campus GenLab. Instructions for downloading these programs are available on our OWL course site.

**Textbook:** Baldi, B. and DS. Moore. 2018. *The Practice of Statistics in the Life Sciences.* 4th Edition, W.H. Freeman and Company.
This course uses a combination of independent study and classroom-based activities to cover the course material. Much of the independent study material comes from assigned sections of this textbook. The textbook is available for purchase at the UWO Bookstore in several formats. The various formats are *briefly* described here; you are **strongly encouraged** to review the more detailed information available on the OWL course site about textbook use in this course before making your selection.

- ***Option 1: "Sapling Plus for Practice of Statistics"*** – This is the online portal + 'ebook' version of the textbook; it provides students with access to an online copy of the textbook (a one-term subscription) plus various interactive resources provided by the textbook publisher. **I am promoting this option as the 'Required' version** because I have organized the online portal into distinct Modules that identify key vocabulary, common misconceptions, suggested practice questions, etc. It is also the cheapest option.
- ***Option 2: "Practice of Statistics W/Sapling Plus (6 months access)" –*** This is a hard cover copy of the textbook PLUS the online portal + ebook described under Option 1.
- ***Option 3: "Practice of Statistics Looseleaf W/Sapling Plus"*** – This is a copy of the textbook in soft cover format with three-hole punching, suitable for putting in a binder; like Option 2, it also comes with the online portal + ebook described under Option 1.

**Course website (OWL):** https://owl.uwo.ca, "Biology 2244B 003 FW18"
The OWL course site (accessible with your UWO user ID and password) will be the launching point for all online learning and assessment, as well as for major forms of communication. This includes:

- lecture slides (PDF format, suitable for integration into OneNote, for example, or printing);
- content for independent study (e.g. lecture videos, summary of textbook readings, etc.);
- online modules associated with the lab component;
- portal for virtual application sessions;
- quizzes, activities, and assignment submissions;
- communication tools (i.e. messages, forums, announcements);
- practice questions (i.e. former exam questions);
- single-sign on access to iClicker (for clicker participation).

**Other resources:**
In addition to the three main resources listed above, we will occasionally use articles, videos, and applets available online (either free, or through the University's subscription) to supplement your learning. Of course, if you find (open access) resources that are helpful to you for this course, I encourage you to share those resources with the rest of the class!

## Expectations for Students & Instructor

This course is a required course in several degree programs (e.g. Biology, Medical Sciences, Computer Science, Environmental Sciences). There is a reason for this requirement. Statistics is a science that deals with collecting, analyzing, interpreting, and presenting data; that is, statistics *is* science. However, it is a science for which many students have little experience, and as such, this course can be challenging. To help us maintain a safe and respectful community in which we can productively tackle potential challenges, we should endeavor to follow these expectations:

| **Student Expectations** | **Instructor Expectations** |
|---|---|
| a. be active and participate in class settings;<br>b. listen and respect others (e.g. peers, instructor, and TAs) in all settings (in class, lab, and online);<br>c. be prepared for class (e.g. by completing the relevant preparatory work or activities);<br>d. be comfortable taking risks in your learning;<br>e. be willing to learn from your mistakes and seek support when needed;<br>f. be cognizant of the constraints associated with a large, multi-section class (e.g. for response time in returning marks and answering questions); | a. be active and enthusiastic to facilitate/motivate student learning<br>b. listen to and respect students' and TAs' views and suggestions;<br>c. be prepared for, and ready to begin (and end) class at the scheduled times;<br>d. promote an inclusive and safe environment to take risks in learning;<br>e. provide support and opportunities to learn from mistakes;<br>f. respond effectively to student questions and concerns in a reasonable time frame;<br>g. grade objectively, consistently, and in a timely manner; |
| *If you have suggestions or comments on how to promote a safe and inclusive community, I welcome any feedback you are willing to offer, at any time.* | |

In addition to the above expectations, we are a learning community within an academic setting. While it may not be immediately obvious, there are some additional expectations related to being part of an academic community:

- ask your Instructor and/or TA before you make an audio recording of class. This expectation provides basic respect for their privacy and personal safety, and is in keeping with Intellectual Property rights. If you would like to make *audio* recordings of our lecture sessions, please send an OWL message to me (via *Instructor Role* or *Jennifer Peter*)
- use materials and resources provided on OWL or through class for your *individual use* during the course. Sharing or reproducing class materials online (for free or for profit) and/or sharing materials with individuals who are not taking the course is not acceptable without first receiving permission from the owner or creator of those resources/materials. Again, this is based on Intellectual Property rights.

## Course Structure

This course follows a *blended* learning approach; that is, we will engage in learning and assessment through a mix of online and in-person formats. The following table gives an overview of the split:

| **Online** | **In-person** |
|---|---|
| • interactive modules for lab component<br>• modules to prepare for class<br>• activities to promote and motivate learning<br>• activities/quizzes to assess preparedness for class<br>• assignment submissions<br>• virtual application sessions | • class sessions associated with lecture<br>• class sessions associated with labs<br>• drop-in hours for help and support<br>• clicker participation to motivate and assess learning<br>• tests and exams to assess learning |

## Assessment and Evaluation

The evaluation in this course is set up to promote mastery of the material and skills by the end of the course, and to provide opportunities to learn from mistakes. To achieve these objectives, I use a flexible assessment and evaluation scheme. The baseline distribution of grades for the course initially follows the following two schemes, and then it is tailored further by alternative test weighting scenarios (*described below under Flexible Grading). In all cases, your final course grade will automatically be calculated to give you the **highest mark possible**.

| Component | Scheme 1 | Scheme 2 | Learning objectives |
|---|---|---|---|
| Course Structure Quiz | 1% | 1% | - |
| Clicker Participation | 5% | 0% | LO1-5 |
| Preparation Quizzes | 5% | 5% | LO1-4 |
| Activities | 4% | 4% | LO5, 7 |
| 5 Lab Assignments | 20% total | 25% total | LO1-4, 6, 7 |
| *Highest lab* | *6%* | *7%* | |
| *2nd & 3rd highest labs* | *4% each* | *5% each* | |
| *4th & 5th highest labs* | *3% each* | *4% each* | |
| Test 1* | 10% | 10% | LO1-5 |
| Test 2* | 15% | 15% | LO1-5 |
| Final Exam* | 40% | 40% | LO1-5 |

***Flexible Grading.***

Test 1, Test 2, and the Final Exam are subject to reweighting at the end of the course, depending on your individual success on each of these three components. Each of these tests/exams is initially worth a fraction of your final grade as outlined above. However, your final course grade will ***automatically*** be calculated under each of the following scenarios; whichever scenario gives you the highest final course grade will be used when submitting your course grade:

| Item | Scenario 1 | Scenario 2 | Scenario 3 | Scenario 4 |
|---|---|---|---|---|
| Test 1 | 10% | 0% | 10% | 0% |
| Test 2 | 15% | 20% | 0% | 0% |
| Final Exam | 40% | 45% | 55% | 65% |
| Description: | Standard distribution of test marks | Redistribution of Test 1 weight: half to Test 2, half to Final Exam | Redistribution of Test 2 weight: all 15% to Final Exam | Redistribution of Tests 1 and 2 weights: all 25% to Final Exam |

The purpose behind this flexible grading scheme is to provide you with two opportunities (i.e. Test 1 and Test 2) during the course for feedback on your understanding of course material under exam conditions. If you discover that your understanding is not complete, or you perform below your desired level of success during the Test(s), you still have another opportunity to improve on your achievement for that component of the course grade on the next Test and/or Final Exam (i.e. after you seek additional help/clarification to improve your mastery of the material). Because all assessments in this course are cumulative, the relative weighting of 'early' versus 'late' course material will be approximately equivalent under each scenario.

### *Course Structure Quiz.*

Purpose: To motivate you to understand the course structure and policies, so you know what is expected/needed to be successful in the course

Format: Multiple choice/true-false quiz administered through OWL Tests & Quizzes. Approximately 7-10 questions. Students may use non-programmable calculators.

Details: Requires thorough understanding of the content of this course syllabus, and a careful exploration and observation of the structure and content of the OWL course website.

Grading scheme: Your mark out of 1% is calculated based on the percentage of questions answered correctly (e.g. 6/10 correct questions results in a mark of 0.6% from the possible 1%).

Accommodations: The quiz is available for approximately one week at the beginning of the course; students should endeavor to complete the quiz as early as possible in the availability period so that any problems can be dealt with accordingly. No accommodation for missing the quiz will be provided after the final deadline.

### *Clicker Participation.*

Purpose:
- To provide real-time, formative feedback on your preparation for class and comprehension of course material;
- To provoke thought, discussion, and engagement with course material during class.

Format: Multiple choice questions asked at various times during each lecture session. Approximately 3-5 questions each class.

Details:
- Information on setting up your clicker account is provided on the OWL course site under Course Materials→Administration→Clicker Registration and Setup.
- Please also refer to the "Use of Clickers in this Course" section under the Policies segment of this syllabus.

Grading scheme: Participation is awarded for answering the questions, not for obtaining the *correct* answer(s). The percentage of questions that you answer across the entire course places you in one of six (6) categories described in the table at right, and determines your Clicker Participation grade. While there is no set number of questions 'offered' each lecture, each lecture will be weighted equally when calculating Clicker Participation grades at the end of the course.

| Percentage of answered questions | Mark (out of 5%) |
|---|---|
| 0 | 0 |
| 0 < % < 20 | 1 |
| 20 ≤ % < 40 | 2 |
| 40 ≤ % < 60 | 3 |
| 60 ≤ % < 80 | 4 |
| 80 ≤ % ≤ 100 | 5 |

Accommodations: The mark allocation is set up to account for occasional technical problems, absences, etc. by allowing you to miss up to 20% of the clicker questions across the course without affecting your final Clicker Participation Grade. If you have extenuating circumstances that lead you to being absent for several classes such that the 20% 'buffer' may be insufficient, please speak with Academic Counseling from your Faculty's Dean's Office. For reference, the 20% generally covers absence at ~4 lectures, or the equivalent in individual clicker questions (e.g. if arriving late/leaving early for class).

***Preparation Quizzes.***

Purpose:
- To assess your understanding of foundational vocabulary or concepts needed for upcoming lectures/labs;
- To encourage you to actively complete and engage with the course material on a regular schedule.

Format: Multiple choice/true-false/numeric response questions administered through OWL Tests & Quizzes. Limited time for completion once a quiz is started. Typically 2-4 questions. Students may use non-programmable calculators.

Details: Information on the testable content for each quiz is described on the relevant Module on Sapling (i.e. the online textbook portal). The quizzes are **not** intended to represent the level of difficulty or comprehension involved in assignments or tests/exams.

Grading scheme: Quizzes are graded for correct answers. The percentage of questions for which you choose the correct answers will place you in one of the six (6) categories shown in the table at right, and determines your final Preparation Quizzes mark (out of 5%).

| Percentage of correct answers | Mark (out of 5%) |
|---|---|
| 0 | 0 |
| 0 < % < 20 | 1 |
| 20 ≤ % < 40 | 2 |
| 40 ≤ % < 60 | 3 |
| 60 ≤ % < 80 | 4 |
| 80 ≤ % ≤ 100 | 5 |

Accommodations: Quizzes are typically available for ~36 hours; the time frame is the same regardless of which lecture section students are registered in. The mark allocation is set up to account for occasional missed deadlines, incomplete understanding, etc. by giving you a 20% buffer on your quiz grades. If you have extenuating circumstances that make you unable to take several of the quizzes, please speak with Academic Counseling from your Faculty's Dean's Office.

***Activities.***

Purpose:
- To explore concepts as a precursor to class discussion/elaboration;
- To collect authentic data for use in lecture/lab learning activities or assignments;
- To provide opportunities for you to reflect on your learning;
- To encourage you to actively complete and engage with the course material on a regular schedule.

Format: The format of Activities varies; most Activities will involve following some instructions and/or collecting data, followed by submission of results in the form of a 'survey' administered through OWL Tests & Quizzes. However, other formats may be used.

Details: Each activity will include instructions for completion and submission requirements; these instructions will be provided on the OWL course site.

Grading scheme: Each Activity will be assigned points (typically based on workload) that contribute to the overall Activity grade. Points may be awarded for correctness and/or completion with reasonable responses; the specific criteria for successful completion will be described in the Activity instructions. The percentage of points that you collect across the course places you in one of five (5) categories described in the table above, and determines your final Activities grade.

| Percentage of points collected | Mark (out of 4%) |
|---|---|
| 0 | 0 |
| 0 < % < 25 | 1 |
| 25 ≤ % < 50 | 2 |
| 50 ≤ % < 75 | 3 |
| 75 ≤ % ≤ 100 | 4 |

Accommodations: Activities are typically available for 36 hours, or frequently, longer. Consequently, no accommodation will be given for missed Activities. If you have extenuating circumstances that make you unable to complete many Activities, please speak with Academic Counseling from your Faculty's Dean's Office.

***Lab Assignments***.

Purpose:
- To assess your understanding and application of course material;
- To assess your use of statistical software to summarize and analyze real data to address research questions;
- To introduce and assess your understanding and application of conventions in communicating and discussing results of statistical analyses.

Format: Lab assignments involve written (including graphs) responses to short answer questions. Typically 3-4, multiple part questions.

Details: The lab assignments are designed to work through the phases of the PPDAC scientific inquiry framework (MacKay & Oldford 2000). An overview of the research background and objective for the lab assignments will be presented at the beginning of the course. Then, each lab assignment will address a series of related research questions that involve applying different course concepts. These involve: cleaning and summarizing data, applying inference procedures, and communicating/discussing the results of these analyses in a scholarly format. More details about each assignment will be discussed in lab sessions and/or posted on OWL.

MacKay, R.J. and R.W. Oldford. 2000. Scientific method, statistical method, and the speed of light. Statistical Science 15(3): 254-278.

Grading scheme: Labs are marked for correct answers/applications of course concepts. To earn credit for a lab assignment, students need to submit their assignment file in two (2) formats by the assignment deadline: (1) to OWL "Assignments", and (2) to CrowdMark. Questions or concerns about grading must be submitted within one week of graded assignments being returned; more information on this policy is described on OWL.

Accommodations: **Labs are required for successful completion of this course** (see Learning Objectives, **LO4** and **LO7**): students need to submit and receive a non-zero grade for a minimum of three (3) lab assignments to earn credit for Biol/Stat 2244 (a failing grade for the course will be issued otherwise). For any missed assignment, students need to obtain recommendation for academic accommodation from Academic Counselling in the Dean's Office, otherwise a grade of zero (0) will be awarded for the lab assignment. Up to two (2) missed and accommodated lab assignments will have their weighting(s) (starting with the lowest weighting) calculated as the mean mark for the other three completed lab assignments. If more than two (2) lab assignments are missed *with* appropriate accommodation, the student will be issued a course grade of *Incomplete* ("INC") and will be required to make up the remaining missed lab assignments in the next offering of the course.

**Lab exemptions for repeating students**

Students who previously took Biology/Statistics 2244 (starting with the **Fall 2014 term (i.e. Sept 2014 or more recently)** are eligible for the lab 'exemption'. Eligible students have the option of using their lab grades (Assignments 1 to 5) from the previous time they took the course as their grades for the five lab assignments this term. This is an 'all or nothing' exemption. More detailed information about the Lab exemption (including a form that eligible students must complete before the first lab assignment) is available on the OWL course site under **Course Materials→Administration→Lab exemption for repeating students**.

***Tests***.

Purpose: To assess your understanding, application, and integration of course concepts.

Format: Multiple choice/true false questions (using Scantrons), administered on campus. Approximately 15-20 questions. Students may use non-programmable calculators.

Details: Information on the testable content for each test will be posted on OWL under Course Materials→Test Information and Resources.

Grading scheme: Your mark on each test is based on the number of correct answers submitted.

Accommodations: The two tests are subject to the Flexible Grading scenarios described above. Consequently, students who miss one or both tests do NOT need to obtain academic accommodation of their absence(s). The weight of the test(s) will automatically be shifted as described in the Flexible Grading scenarios table. The test questions are released after grades are posted so students missing a test can still have the opportunity of 'trying' the test questions and obtaining formative feedback on their preparation.

***Final Exam***.

Purpose: To assess your understanding, application, and integration of course concepts.

Format: Multiple choice/true false questions (using Scantrons), administered on campus. Approximately 45 questions. Students may use non-programmable calculators.

Details: The exam is *cumulative* and integrates both 'lecture' and 'lab' components of the course material. Information on the testable content for the exam will be posted on OWL under Course Materials→Test Information and Resources.

Grading scheme: Your mark on the final exam is based on the number of correct answers.

Accommodations: Students who miss the final exam must speak with Academic Counseling from their home Faculty to request academic accommodation. See information on Academic Policies section under the *Policies and Supports* segment of this document.

## Required Readings

This course uses a mixture of textbook, online material, and in-class instruction to cover the course material. Consequently, we often draw heavily on the textbook to prepare for, extend, and/or review what is discussed during class. The following table summarizes the *anticipated* required textbook reading for the course, broken down by topic. This material will be further broken down into two major pieces on our OWL site:

(i) sections that need to be covered to prepare for the Preparation Quizzes or Activities, and,
(ii) all remaining sections that should be covered at your chosen time (but before labs and/or tests/exams).

Note that some of the material in the 'remaining sections' may be covered during class; in which case, reading this content prior to lecture would be a good *pre*view, or, reading it post-lecture will be good *re*view.

| ***Topic*** | ***Textbook Sections*** |
|---|---|
| Sampling and study designs | Chapter 6; Chapter 7 |
| Summarizing & exploring data | Chapter 1: p. 3-22; Chapter 2 |
| Probability | Chapter 9: p. 215-232; Chapter 10: p. 241-248 |
| Binomial probability model | Chapter 12: p. 299-308 |
| Normal probability model | Chapter 9: p. 224-231; Chapter 11 |
| Sampling distributions | Chapter 13 |

| | |
|---|---|
| One sample confidence intervals for a mean | Chapter 14: p. 345-356; Chapter 15: p. 375-382; Chapter 17: p. 417-425 |
| One sample confidence interval for a proportion | Chapter 12: p. 308-310; Chapter 19: p. 473-479 and p. 482-484 |
| One sample hypothesis tests | Chapter 14: p. 356-364 and p. 367-369; Chapter 17: p. 426-434; Chapter 19: p. 484-489 |
| Cautions on hypothesis testing | Chapter 15: p. 383-388 and p. 391-195 |
| Two sample inference on means | Chapter 18: p. 444-460 |
| Two sample inference on proportions | Chapter 20: p. 495-500, and p. 504-507 |
| Inference on Regression (slope) | Chapter 4: p. 93-105, and p. 107-115; Chapter 23: p. 573-583, p. 586-587, and p. 591-597 |
| Correlation | Chapter 3; Chapter 4: p. 111-113 |
| One-way ANOVA | Chapter 24: p. 603-627 |
| Follow up analyses | Chapter 26: pages 26-1 to 26-8; Chapter 18: p. 462 |

## Policies and Supports

### *Comments on Assessments in Biol/Stat 2244*

The mark allocation (see Assessments and Evaluations, above) for this course has been structured to:

(i) recognize the workload/effort necessary to complete each component,
(ii) highlight the importance and relevance to the learning objectives (i.e. from a knowledge/understanding perspective) for each component, and,
(iii) acknowledge that mastery of the course material takes time.

The mark allocation has also been organized with an awareness that individual students are not 'perfect' every day of the term; by extension, I recognize that sometimes not-so-good days might be the days of a test or leading up to an assignment. As such, the *flexible mark allocation* (both in terms of weighting for lab assignments, and for tests/exams) is set up to place higher value on your better work, and reduce the value of other work. Because this flexibility is *already present in the course structure,* I will not re-weight assessment components, nor accept additional/revised assignments to accommodate perceived poor performance on an assessment item, or for absence(s) for which accommodation has not been recommended by Academic Counseling. For reference, I do not apply special rounding rules or 'bump' grades (e.g. to meet GPA cut-offs, minimal requirements for programs/continuation, etc.), nor force the mark distribution to fit a theoretical model (e.g. Normal curve) when finalizing course grades.

### *Senate definitions of grades*

For your reference, our Departments follow the Senate definition for meaning of letter grades:

| *Letter Grade* | *Corresponding grade range (%)* | *Definition* |
|---|---|---|
| A+ | 90 – 100 | One could scarcely expect better from a student at this level. |
| A | 80 – 89 | Superior work which is clearly above average. |
| B | 70 – 79 | Good work, meeting all requirements, and eminently satisfactory. |
| C | 60 – 69 | Competent work, meeting requirements. |
| D | 50 – 59 | Fair work, minimally acceptable. |
| F | Below 50 | Fail. |

### *Academic Policies*

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

In accordance with policy, http://www.uwo.ca/its/identity/activatenonstudent.html, 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.

Scholastic offences are taken seriously and students are directed to read the appropriate policy, specifically, the definition of what constitutes a Scholastic Offence, at this website: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/scholastic_discipline_undergrad.pdf.

If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or supporting documentation to the Academic Counselling Office of your home faculty as soon as possible. If you are a Science student, the Academic Counselling Office of the Faculty of Science is located in NCB 240, and can be contacted at scibmsac@uwo.ca.

For further information, please consult the university's medical illness policy at http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_medical.pdf

If you miss the Final Exam, please contact your faculty's Academic Counselling Office as soon as you are able to do so. They will assess your eligibility to write the Special Exam (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" (see http://www.registrar.uwo.ca/examinations/exam_schedule.html)

It is Faculty of Science policy that a student who chooses to write a test or exam deems themselves fit enough to do so, and the student must accept the mark obtained. Claims of medical, physical, or emotional distress after the fact will not be considered.

Computer-marked, multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between The University of Western Ontario and **Turnitin.com** ( http://www.turnitin.com ).

This course will use **CrowdMark**, an online collaborative grading and analytic platform. For information on their privacy policy, please visit their website, https://crowdmark.com/privacy

During tests/exams, proctors will inspect all personal belongings on your desk (and even your baseball cap if you are wearing one). If any items are discovered that are not permitted (e.g. any electronic device other than a non-programmable calculator, or notes) they will be confiscated and the incident will be officially reported as an academic offence. Proctors have the discretion to move students between desks during the Tests or Exam periods.

### *Classroom Environment*

The Department of Statistical and Actuarial Sciences has adopted a "Mutual Expectations" policy governing the classroom environment and all work submitted by students. The full text of the policy can be found at: http://www.uwo.ca/stats/undergraduate/mutual-expectations.html. In summary, the policy was developed under the premise that all interactions between students and faculty should be governed by the principles of courtesy, respect and honesty.

### *Support Services*

Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 ext. 82147 for any specific question regarding accommodation.

The policy on Accommodation for Students with Disabilities can be found here:
www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_disabilities.pdf

The policy on Accommodation for Religious Holidays can be found here:
http://www.uwo.ca/univsec/pdf/academic_policies/appeals/accommodation_religious.pdf

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.uwo.ca/uwocom/mentalhealth/) 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.

### *Clicker Use in this Course*

A "clicker" is a browser page or 'app' opened on a personal WiFi device (e.g. a smartphone, tablet, or laptop). In class, instructors can ask a variety of structured questions to which you may respond by pressing the appropriate button on your device. Individual responses are collected and summarized in a graph at the front of the room. If the instructor chooses, individual responses may also be saved for future analysis.

#### *Clicker Responsibility*

For Biol/Stat 2244, we subscribe to and use clicker software produced by iClicker (https://www.iclicker.com/) because it is the company supported by Western's technology services and is free to registered students. A student choosing to use a clicker will be responsible for (a) bringing their own device to use as a clicker, and (b) setting up their iClicker account correctly. Note that the course and instructor is not responsible (and therefore, no accommodation will be made) for WiFi failure.

#### *Clicker Academic Record*

Your clicker use will be recorded in lecture and will become part of your academic record. As such, your clicker record will be afforded the same degree of security, confidentiality, and transparency that is customary for test marks, etc.

#### *Research*

Your clicker data will not be used for any non-academic or research purpose without your consent. For any research study in which you are invited to participate, you will be provided with a Letter of Information with an

opportunity to give or withhold consent. Such research will not replace the usual end of term Student Questionnaire given by the University.

***Academic Integrity***

Use of a clicker associated with an identity other than your own is an academic offense. Granting permission for someone else to submit answers on your behalf in your absence is an academic offence. In a test, lab, lecture, or tutorial, possession of more than one clicker device, or one associated with the identity of another student, will be interpreted as intent to commit an academic offense and will be reported as such. This means that it will be considered an academic offense to answer a clicker question using an account other than your own.

## Course Schedule

The following schedule is *tentative*; some adjustments may be made as the course progresses, depending on the rate at which individual topics are covered. At certain points in the course, you will be responsible for covering some course material on your own time (e.g. through textbook readings or posted videos/resources); these "Independent Study" topics have been strategically chosen based on recommendation from previous students and level of complexity. Their position in this schedule is a suggestion, i.e. based on when they are most relevant and students will have the relevant background. Individual students, however, may choose to cover the material at any time they wish (acknowledging that the material may be testable on subsequent tests, labs, etc.).

Due dates provided in this schedule are currently tentative. Generally, Assignments for labs will be due the week specified, although the particular day of the week may vary (to align with coverage of relevant material in lectures). For Activities, the time required for completion is a rough estimate only; this may vary from student to student. As well, some Activities may be added/removed throughout the course; changes will always be announced during class and clearly documented (with deadlines) through the OWL site. For Quizzes, chapters listed are *relevant* to the quizzes; the quiz may not test on the entire chapter.

| Week | Course Topics | Projected Due Dates (quizzes, activities, labs, tests) |
|---|---|---|
| Jan 7-11 | *Lecture 1.* Being successful in 2244<br>*Lecture 2.* PPDAC: a scientific inquiry framework ("Problem")<br>*Independent Study:* Sampling and study designs<br>*Labs: none* | *Activity:* How will you study for 2244? (2 points, 10 min)<br>*Activity:* Gettysburg Address (2 pts, 15 min)<br>*Activity:* Data collection Part 1 (3 pts, 15 min) |
| Jan 14-18 | *Lecture 3.* Sampling designs and considerations ("Plan")<br>*Lecture 4.* Study design and considerations ("Plan")<br>*Labs:* Introduction to Lab research program | *Quiz 1:* Sampling designs (Chapter 6, videos)<br>*Quiz 2:* Study Designs (Ch. 6&7)<br>*Activity:* Data collection Part 2 (3 pts, 10 min)<br>**Course Structure Quiz due**<br>**Lab exemption form for repeating students due** |
| Jan 21-25 | *Lecture 5.* Study design and considerations ("Plan"), cont'd.<br>*Lecture 6:* Planning ahead: Sampling variability and inference ("Plan")<br>*Labs:* none | *Quiz 3:* Summarizing & exploring data (Ch. 1&2, videos)<br>*Activity:* Online Module 1, part 1 (3 pts, 1 hour)<br>**Introductory Lab Assignment due** |
| Jan 28-Feb 1 | *Lecture 7.* Summarizing & exploring data ("Data")<br>*Lecture 8:* Probability (foundations)<br>*Labs:* Assignment 1 work/help period | *Quiz 4:* Review |
| Feb 4-8 | *Lecture 9.* Probability (foundations), cont'd.<br>*Lecture 10.* Binomial probability model (foundations)<br>*Labs: none* | *Quiz 5:* Binomial probability models<br>*Activity:* Online Module 1, part 2 (3 pts, 1 hour)<br>**Lab Assignment 1 due** |
| Feb 11-15 | *Lecture 11.* Normal probability model (foundations)<br>*Lecture 12.* Normal probability models (foundations), cont'd.<br>*Labs:* none | *Quiz 6:* Normal probability models (Ch. 11)<br>*Activity:* Sampling distribution of means (3 pts, 30 min)<br>**Test 1: Friday, Feb 15, 3:30 pm to 5:00 pm** |
| Feb 18-22 | ***Winter Reading Break (no classes)*** | |

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|---|---|---|
| Feb 25-Mar 1 | *Lecture 13.* Sampling distributions (foundations)<br>*Lecture 14.* One sample Z CI for a mean ("Analysis")<br>*Labs:* Science communication—*Figures* & Assignment 2 work/help period | *Quiz 7:* Sampling distributions (Ch. 13)<br>*Quiz 8:* introduction to confidence intervals (Ch. 14)<br>*Activity:* Online Module 2 (4 pts, 1.5 hour)<br>*Activity:* Meaning of confidence (3 pts, 15 min)<br>*Activity:* Exam wrapper (2 pts, 5 min) |
| Mar 4-8 | *Lecture 15.* One sample t CI for a mean ("Analysis")<br>*Lecture 16.* One sample Z CI for a proportion ("Analysis")<br>*Labs:* none | *Quiz 9:* t confidence intervals for a mean (Ch. 14)<br>*Quiz 10:* confidence intervals for a proportion (Ch. 19)<br>*Activity:* Online Module 3 (3 pts, 40 min)<br>*Activity:* Online Module 4 (2 pts, 40 min)<br>**Lab Assignment 2 due** |
| Mar 11-15 | *Lecture 17.* Introduction to hypothesis testing<br>*Lecture 18.* One sample Z test for a proportion ("Analysis")<br>*Independent Study:* Cautions for hypothesis testing<br>*Labs:* Science communication—*Reporting results*, & Assignment 3 work/help period | *Quiz 11:* Introduction to hypothesis tests (Ch. 14)<br>**Test 2: Friday, Mar 15, 7:30-9:30 pm** |
| Mar 18-22 | *Lecture 19.* One sample t-test for a mean ("Analysis")<br>*Lecture 20.* Two sample inference on means ("Analysis")<br>*Independent Study:* Two sample inference on proportions ("Analysis")<br>*Labs:* Assignment 4 work/help period | *Quiz 12:* Two sample inference (Ch 15, 17, & 18)<br>*Quiz 13:* Introduction to regression (Ch. 4 & 23)<br>*Activity:* Online Module 5 (3 pts, 40 min)<br>*Activity:* Online Module 6 (3 pts, 40 min)<br>**Lab Assignment 3 due** |
| Mar 25-29 | *Lecture 21.* Inference on regression (slope) ("Analysis")<br>*Lecture 22.* One-way ANOVA ("Analysis")<br>*Independent Study:* Correlation ("Analysis")<br>*Labs: none* | *Quiz 14:* Introduction to ANOVA (Ch. 24)<br>**Lab Assignment 4 due** |
| Apr 1-5 | *Lecture 23.* One-way ANOVA ("Analysis")<br>*Lecture 24.* Follow up analyses ("Analysis")<br>*Labs:* Science Communication—*Discussion of results*, & Assignment 5 work/help period | *Quiz 15:* Follow up analyses (Ch. 26)<br>*Activity:* Online Module 7 (4 pts, 40 min)<br>*Activity:* Online Module 8 (3 pts, 40 min) |
| Apr 8-12 | *Lecture 25.* To be announced<br>Study day (Apr 10): Lab review session (tentative) | *Activity:* Reflection (2 pts, 5 min)<br>**Lab Assignment 5 due** |
| Apr 11-30 | ***April exam period (do not book travel until exam schedule is finalized)*** | |