BIOL 343 Syllabus

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Brief Overview

This syllabus is long and contains important information. A table of contents is provided at the top to help you navigate to specific sections. Here is a very brief summary/overview of the syllabus:

Course Philosophy

- Learn by **doing**: Coding is a skill developed through practice, not memorization.
- Expect **frustration**: Finding and fixing mistakes are normal and essential to learning.
- Be **resilient**: Debugging and problem-solving are key skills.
- Work with **real data**.

Tech Setup (Before Week 1)

You must bring a laptop to class and install the following (select 'free version' of each):

1. **Install R**: https://cran.r-project.org/
2. **Install Positron** (the successor to RStudio): https://positron.posit.co/
3. In Positron, install tidyverse:
```
install.packages("tidyverse")
library(tidyverse)
```
4. In Positron, install positpal:
```
install.packages("remotes")
remotes::install_url("https://quantitative.bio/downloads/positpal.tar.gz")
library(positpal)
```

Course Materials

- **All material needed for this course** is freely available through OnQ. This includes electronic copies of the two main **textbooks** (optional printed copies available for purchase):
  - *R Crash Course for Biologists* AND *R STATS Crash Course for Biologists*

Weekly Routine

- **Before Lecture**:
  - Complete **assigned readings** (textbook; self-tutorials). TYPE EVERYTHING OUT.
  - Upload your **coding log** (explained in tutorial)
- **During Lecture Session**:
  - Short overview (30 to 60 minutes).
  - Work on weekly **coding challenge** (90 to 120 minutes)
- **During Tutorial/Help Sessions**:
  - Review coding challenge with your group
  - Submit an .**Rmd document** (1 per group) together with your **coding log** (1 per individual)
  - Ask the TA questions about current or previous assignments.
  - Review feedback and prepare for the next week.

Assessments

- **20% Coding Challenges:** Best 8 of 9 weekly mini-assignments (2.5% each)
- **10% Mid-term project**: Apply what you learned to analyze an original dataset
- **15% Final Project:** Group analysis of a complex dataset, presented in week 12
- **10% Self-reflection exercises:** 2x 5% each
- **10% Participation:** Engage with the assigned readings in **Perusall** and **Positron**
- **35% Final Exam**: a very simple, hand-written exam (~1.5h) to discourage unsanctioned AI use

Penalties (does not apply to students with pre-arranged accommodations)

- -**100%** on late coding challenges (but note that the lowest 5 grades are dropped).
- **-50%** for working with a group other than the one to which you were assigned on OnQ.
- **-100%** on final project. It is presented in week 12, so it can't be late.

Support & Flexibility for Students with Accommodations

- **Grace period**: Typically 24 to 48 hours for coding challenges.

- **Office hours**: Scheduled in **hour 3 of the weekly tutorial sessions;** no appointment needed.
- **Missed class**: Coding challenges can be completed individually, outside of class. Please stay home if you are sick.
- **Accessibility**: QSAS accommodations and OnQ videos available.

Using AI Tools

- You may use the course LLM tutor **to help debug or explain code**.
- **Do not use AI** to write code or any part of the coding challenges or projects. **NEVER copy-paste any text out of an LLM**.

Communication

- Ask questions in lecture/tutorial or office hours. ***Email is usually an unnecessary distraction that is used minimally in this course*** (both for students and for instructors/TAs).
- Check OnQ regularly for updates.

Course Information

General Course Information

Course: Biol 343

Course title: Advanced Data Analysis for Biologists

Pre-requisites: BIOL 243 or equivalent

Semester and year: Fall 2026

Number of credits: 3.0

Learning hours: 120 (36 Lecture; 19 Tutorial; 65 Private Study + Group Work

Modality (on campus, blended, or online): On campus

Course Description

Welcome to BIOL 343!

This course is designed for biology students who want to develop the kinds of analytical skills that are essential to the life sciences. These skills are taught primarily through textbook tutorials that have been written specifically for this class, building on the foundations of BIOL 243.

In this course, we focus on the R coding environment and learn how to gain biological insights through data visualization and formal statistical analysis, translate between biological observations and the mathematical language of statistics, and then interpret and present findings in a professionally formatted document. We emphasize a professional mindset, with an emphasis on personal growth. This is taught through an applied, hands-on approach that emphasizes regular practice and assessments, supplemented with short, conceptual topics in lecture format.

This course covers fundamentals of statistics through real-world application in biology, beginning with frequency distributions, central moments, and summary statistics, followed by linear models as a basis for exploring more advanced models. To help you apply these methods in a global context, examples related to the United Nations Sustainable Development Goals (UN SDGs) are used in the tutorials and learning assessments in this course.

University courses in biology tend to emphasize observation, phenomenon, and foundational theory. In contrast, this course is more like learning a written language. Coding and quantitative skills (i.e., math) learned in this course are developed through extensive practice, trial, and repeated failure. The

philosophy of this course is that you won't learn to code and analyze data by reading and rote memorization – only through extensive application and practice.

To get the most from this course, you are **STRONGLY ENCOURAGED** to find opportunities to practice coding wherever possible, not just in activities associated with this class. In many applications you will find that it will take longer at first, but it will get easier with practice, and save time in the long run. Finally, be prepared to get frustrated – you will make many errors and most of your coding time will be spent debugging and searching for answers on the internet. It is important to know that **this is COMPLETELY NORMAL.** Perhaps the most crucial skill you will learn in this course is how to use self-directed research to identify, understand, and solve coding problems. Office hours are scheduled as weekly 1-hour tutorials to ensure that there are no schedule conflicts preventing you from receive additional help.

Quotes from Previous Students (anonymous, QSSET forms):

The quotes below come from past student evaluations and point to key features of the course design that may not be typical of other biology courses you have taken. Understanding these differences will help you better prepare for this course.

"I took this course because I need a statistics prerequisite to apply for veterinary school, and I did not put in the effort required in intro stats to get an adequate grade. I put more effort into this class than any of my other courses this semester, and it did pay off."

"In some cases the lack of background doing this kind of assignments required much more effort and time from my side which was sometimes quite frustrating even though the answer was not really complicated."

"The assignments sometimes were very quick and brief and sometimes took a long time."

"The weekly assignments were also extremely time consuming, often taking up to 7-10 hours for each."

Lesson Learned: This course requires a lot of dedicated focus time, problem solving, and practice. This is a very different kind of effort than most biology courses and there are not many shortcuts.

"We were being tested on week 1 material in week 8."

Lesson Learned: Everything in this course is cumulative, because coding involves only a few key elements that are remixed and recombined into larger and more complicated programs. If you skip over something in the early weeks, it can come back to haunt you.

Quotes from Previous Students (emails):

"I just wanted to say that I learned a lot in your classes. The tutorials and assignments worked well for me, and you and your TAs were very helpful… Most importantly, the coding skills turned out to be transferrable (who could have guessed!) and I have been making use of this knowledge a lot lately." – Amelie Mahrt-Smith, former undergraduate student

"I took your BIOL 343 and 432 course in Fall 2022 and Winter 2023 and these courses provided me with a strong foundation in understanding R, statistical analyses, and data visualization. These skills I developed

in your class have been invaluable and have helped me to better understand the importance of data-driven decision making." – Sam Kam, former undergraduate student

"*Your classes made me love the statistics applied to biology and have inspired me to pursue a modelisation/data analysis for Ecology Masters in France*." – Helouri Bosser le Dren, former undergraduate student

"something else that I've been meaning to mention is that I use the regex skills you taught in your big data in R course constantly at my current job, and I just wanted to say thanks for incorporating all the R work into your courses and lab development! So glad to have been able to learn R to the extent I did in my undergrad, it's been so helpful all the way through my undergrad, masters, and now at work." – Claire Smith, former undergraduate student and Biol 343 TA

Lesson learned: Quotes from former students confirm that the extra effort pays dividends long beyond the timeline of the course! Employers won't care which grades you received, but they will value the skills you develop.

Expectations

For Instructors & Teaching Assistants

The teaching team is responsible for developing and editing the course material, which was written specifically for this course and for you, the biology student. We will ensure that all relevant course material is available online and released on a weekly basis so that you know where you should focus your available time and energy. The course content is always a work in progress, so we welcome any feedback on this material, from small spelling/grammar errors to points of confusion and general suggestions for improvement.

To accommodate variability in learning, we will make the main content available in complementary forms including two original textbooks and pre-recorded videos with annotated scripts. The textbooks lean heavily on a tutorial style, with step-by-step instructions that are reiterated in the online videos. The videos and textbook are designed to be complementary, with overlap emphasizing important skills and techniques.

You will make mistakes, both in coding and in learning about coding. Everyone makes mistakes, and coding is particularly prone to error, especially when there are distractions. I will use these opportunities to demonstrate how to troubleshoot errors by carefully reading the warning messages and running smaller subsets of code to identify where the problems lie. **Learning how to troubleshoot code is perhaps the most important skills you can learn in this course.** But it requires a different kind of mindset (see 'For Students' Section).

The entire teaching team (instructor + teaching assistants) is committed to establishing and maintaining a healthy and inclusive learning environment. We recognize that mistakes and errors are an important part of your learning process. We respect and value students who are not afraid to take risks or try things that might be 'wrong'. Above all, we value students who are not afraid to fail. We will use frequent assignments and testing to limit the impact of mistakes on your final grade. We will provide timely feedback – usually within two to three weeks. This represents a very large time and energy investment from the teaching team. We do it to help you learn from your mistakes, focus on learning, and succeed on future assignments.

We will communicate twice per week during lecture and tutorial. Lectures will cover only part of the assigned readings, so that there will be ample time available for questions or assistance.

For Students

It is expected that you will attend weekly lectures and tutorials, though we understand this may not be possible for everyone, all the time, particularly in the post-COVID era. Therefore, everything you need to succeed in this course will also be available online.

You are expected to bring a laptop capable of running Windows, MacOS, or Linux programs, and you must be able to access Queen's wireless network during lecture and tutorial sessions (see also "Technology Requirements"). Be sure to charge your laptop battery as there may not be enough plugs for everyone who needs one. When working in class or following recorded lectures, **you will code along in real-time**. The only way to effectively learn to program is to practice, and you are expected to practice as much as possible!

You are expected to complete the assigned readings each week, write down any questions that you have, and bring them to class. Then, review your answers to check for sources of confusion. You are expected to organize your thoughts into questions to ask during class. Please do not email questions that can be addressed during lecture or tutorial/office hours. If you aren't comfortable asking questions verbally, you may hand in written questions to the instructor or TA during class or tutorial. These steps help to ensure that you are organized and prepared before attending lectures and tutorials.
Weekly assignments are also submitted online and generally due with 48-72 hours of being posted online. Working through the assigned chapters and TYPING EVERYTHING OUT will prepare you for these short deadlines, which are essential to reinforce and build on what you have learned each week. Plan to devote 3-5 hours to learning the lecture material and up to 10 hours to complete the assignments.

You are expected to check the course website regularly (or use alerts) to keep track of deadlines. **Late assignments are scored as zero** (but see below regarding accommodations).

Any questions or concerns about the course should be raised in lecture or tutorial, or privately during weekly office hours (no appointment needed). Email is generally not an effective tool for course material, and questions that can be addressed in person will not receive an email response. However, email is encouraged for urgent issues (e.g., medical or other personal emergencies, broken/incorrect website links, and other time-sensitive issues).

For Interactions

You will have regular interactions with the teaching team (TAs, instructor) and with your classmates. In all interactions, you are expected to be respectful and always behave with integrity, both in face-to-face interactions and when engaging online.

This course will also involve group-based activities that may require communication outside the classroom. You are responsible for maintaining contact and collaborating with all members of your group in a respectful and timely manner. Remember that other members of your group may not have the same resources or privileges and may need some flexibility or accommodation. **Developing skills to collaborate effectively within a diverse group of peers is an important goal of this course**.

Technology Requirement

You must have a laptop computer with internet access to participate in this course. Be sure to charge the battery as plugs may not be available for all students. Before attending the first lecture, you should install the following software:

- The R programming environment (free): https://www.r-project.org/
- Positron (the successor to Rstudio): https://positron.posit.co/
- tidyverse and positpal are two R packages we use in this course. Open Positron and run the following lines in the terminal and press enter after each. It may take several minutes to install. Be sure to type each line EXACTLY:

```
install.packages("tidyverse")
library(tidyverse)
install.packages("remotes")
remotes::install_url("https://quantitative.bio/downloads/positpal.tar.gz")
library(positpal)
```

Generative AI

Generative AI programs like Chat-GPT, Microsoft Copilot, GitHub Copilot, and similar tools may be used in this course, but only in specific ways. The final exam is hand-written and designed to assess learning of R code programming concepts taught through weekly readings and coding challenges. Improper use of AI to complete your work for you will only undermine your learning and your grade on the final exam.

As discussed in the introduction of the *R Crash Course for Biologists*, professional biologists are already starting to use Large Language Models (LLMs) and other forms of generative AI to help debug code. Learning to use these tools effectively – and ethically – can be a valuable skill. However, over-reliance on AI can hinder your learning.

In this course, everyone has access to an LLM that has been customized specifically for this course. It is designed to point you to relevant chapters in the textbook and guide you through troubleshooting bugs and errors. No other LLMs or generative AI are permitted for coding.

Suggested Time Commitment

Each week, you should commit 3 to 6 hours working through the assigned readings (self-tutorials), and ~ 2 hours completing assignments, with additional time to practice writing code, as your schedule permits. It is strongly recommended that you budget at least 10 hours per week reviewing and practicing the code in the assigned readings so that you are prepared to complete the associated assignment during scheduled class time.

Support for Success

The workload in this course is **demanding by design**, because frequent and regular practice is essential to develop competence as a data scientist. However, we have incorporated “Universal Design for Learning” and other best practices to support your success.

- Parallel content is presented in both video and written form on the course website.
- Content is taught primarily through self-guided tutorials, outside of the time limitations of class, allowing you to work at your own pace.
- A grace period is added to the assignment deadline in case you need a bit more time.
- Mistakes are encouraged in readings and in-class coding because learning to identify and deal with coding errors is a very important skill that you will learn in this class.

- Regular coding challenges provide frequent feedback opportunities to help you identify strength and bridge knowledge gaps.
- Assignments are done in different formats with opportunities to ask questions and discuss ideas with peers.
- Assignments are structured to allow application of concepts and skills in realistic case studies.

Learning Tips

Coding involves a lot of trial-and-error that can be frustrating for students new to the discipline. First, know that this is completely normal, even to seasoned data scientists. A very common and effective approach to solving errors or other problems is to search Google or Stack Overflow. Often, simply copying and pasting an error into an online search will produce a helpful link. **Very often you can just type 'How do I X in R' (or the R package name like ggplot2, dplyr) into a search engine and look for links to similar questions answered on the Stack Overflow website**.

In addition, we (instructor and TAs) will generally leave ample time at the end of lectures and tutorials. You are strongly encouraged to ask the question in lecture or tutorial so that all students can benefit from the answer. Any private questions or issues can be discussed during weekly scheduled office hours (no appointment necessary). Email is not an effective mode of communication in this course, except for time-sensitive issues

Topics

	PART I: Introduction to Coding for Data Science
Week 01	Introduction to coding for data science
Week 02	Basic visualizations
Week 03	R markdown and version control with GitHub
Week 04	Advanced R: data science with dplyr, tidyr, lubridate and flow control
Week 05	Advanced Visualizations
	PART II: Data Analysis
Week 06	Samples, distributions, probability and central moments
Week 07	Basic linear models
Week 08	Model QA/QC and model comparisons
Week 09	Advanced linear models
Week 10	Generalized Linear Models (GLM) and experimental design
Week 11	Linear Mixed Models (LMM)
Week 12	Final presentations

Course Learning Outcomes

Learning in this course is cumulative, meaning that content from early weeks is still relevant in later weeks. Therefore, assessments of the course are scaffolded to help you achieve the learning outcomes.

All students may opt to remove the two lowest assignment scores before calculating the final grade. This includes incomplete or late assignments that receive a 0 mark. However, due to the cumulative nature of this course, the information on incomplete assignments should be reviewed as they will be relevant to future assignments and the final exam.

On successful completion of this course, students will be able to:

1. Identify different data types to enable coding for visualization and analysis.
2. Translate real-world observations into appropriate data types to produce visualization and analysis.
3. Reflect on how positionality may bias one's experimental design and data interpretation by exploring historical and contemporary biases on scientific progress.
4. Contrast the use of fixed vs random effects and linear vs generalized linear models to ensure appropriate interpretation of statistical output for real-world questions.
5. Simulate data relevant to sustainable development goals to explore assumptions of statistical models.
6. Develop a robust strategy for quality assurance and quality control to assess the reliability of statistical models.
7. Write clean and coherent code in R markdown to create reports with professional formatting and an analysis that is **OPEN** and **REPRODUCIBLE.**
8. Apply appropriate statistical models to test biological hypotheses related to sustainable development goals.

Important University Dates

Please visit the Faculty of Arts and Sciences Sessional Dates website for all academic deadlines.

Inclusion

Land Acknowledgement

As a descendant of uninvited colonists, I feel tremendously privileged to live, learn, work, and play on these lands. As Queen's University is situated on traditional lands of the Anishinaabe and Haudenosaunee, I invite you all to be mindful with me about the many lessons we learn while on these lands, and how we might apply our newfound skills and knowledge for the benefit of all.

Even as a well-established scientist, I admit I have much to learn from the teachings and traditions of the Anishinaabe and Haudenosaunee, who have lived on these lands since time immemorial. While researching some of this history, I was moved to learn about the Seven Grandfathers in the Anishinaabe tradition, which, as I understand, demonstrate principles for living a "good" life. These include Dabaadendiziwin (humility/compassion/patience), Gwayakwaadiziwin (bravery to be honest), Minaadendamowin (respect for all creation), Nibwaakaawin (wisdom/knowledge to help people) and Zaagi'idiwin (unconditional love given and received). It is worth reflecting on how well these principles resonate with other cultures and traditions around the world, suggesting a deep truth.

This is especially important for those of us who analyze and interpret data to inform decision-making. Reflecting on the way that cultural biases influence the questions we ask, and the answers we provide, can only improve our contributions as scientists and community members.

Moreover, it can be difficult and even overwhelming as a student to struggle through the stresses and demands of a university degree and life more generally. When you feel this way, I encourage you to learn or return to these Indigenous teachings, and/or teachings from your own cultural traditions, to recall what really matters in life, and to let these insights guide you through difficult decisions.

Equity, Diversity, and Inclusivity Statement

Equity and diversity are central to our educational mission and standards of excellence in this course and at Queen's University. It is critical that we work together to dismantle direct, indirect, and systemic discrimination that still exists within our institutional structures, policies and practices -- and in our community. These take many forms and work to differentially advantage and disadvantage persons across social identities defined by race, ethnicity, disability, gender identity, sexual orientation, faith and socioeconomic status, among other factors. As students and educators, we all have important roles to play to identify and address systemic discrimination for the benefit of science and society.

Building a Classroom Community

University is a place to share, question, and challenge ideas. Each student brings a different set of lived experiences. You can help to create a safer, more respectful classroom community for learners by following these guidelines:

- Make a personal commitment to learn about, understand, and support your peers.
- Assume the best of others and expect the best of them.
- Recognize and value the experiences, abilities, and knowledge each person brings to the course.
- Acknowledge the impact of oppression on other people's lives and make sure your words and tone are respectful and inclusive.
- Encourage others to develop and share their ideas.
- Pay close attention to what your peers say/write before you respond. Think through and re-read what you have written before you post online or send your comments to others.
- Be open to having your ideas challenged and challenge others with the intent of facilitating growth.
- Look for opportunities to agree with one another, building on and intentionally referencing peers' thoughts and ideas; disagree with ideas without making personal attacks, demeaning, or embarrassing others.

Fostering Accessibility

All of us have a shared responsibility for fostering accessibility and promoting meaningful inclusion of those with disabilities. The Accessibility Hub at Queen's University's Human Rights & Equity Office offer a host of tutorials that provide us all with practical tips for:

- creating accessible documents, e.g., to submit to your teaching team or share with peers in peer feedback activities/in a presentation,
- emails, e.g., while communicating with group members or your teaching team, and
- meeting practices (e.g., in tutorials/labs/seminars or virtual meetings.

Name/Pronoun

If, for whatever reason, you wish to change how your name appears in onQ and/or on class lists, please follow these steps. You may also use this process to add your pronouns to the appearance of your name.

1. Log into SOLUS.
2. Click on Personal Information tab.
3. Click on the Names tab
4. Click on the Add New Name tab
5. Choose Preferred from the Name Type drop down menu
6. Enter the name you would like to appear in onQ and/or on class lists.
7. Click Save.

Please allow 24 to 48 hours for your name to be registered within the system. If you have further questions or concerns, please contact ITS at Queen's University.

Course Materials & Technologies

Material costs

Required Course Textbooks

Course Textbooks	Edition(s)	Publisher	For Purchase	Cost	At Queen's Library?
R Crash Course for Biologists	2nd	DP Press	Provided free via OnQ (printed copies available for purchase)	0	Yes
R STATS Crash Course for Biologists	1st	DP Press	Provided free via OnQ (printed copies available for purchase)	0	Yes

Other Required Materials

Resource	Resource Type	Access	Cost	Further Information
Laptop	Other	Borrow or purchase new or used	$0-$1000	Must be capable of running Windows, MacOS, or Linux
R	Other	Free online download	$0	https://cran.r-project.org/

Positron	Other	Free online download	$0	https://positron.posit.co/downloads/
Positpal	Other	Free online download	$0	In the R Console, type: install.packages("remotes") remotes::install_url("https://quantitative.bio/downloads/positpal.tar.gz") library(positpal)

Supplemental Materials – All other material available through the course website via OnQ

Educational Technologies, Help, Privacy, and Accessibility

This course makes use of the following website(s), program(s), and/or application(s) for specific educational use/purposes.

Privacy: Be aware that your independent use of the website(s), programs, and/or application(s) used in this course*, beyond what is required,* is subject to their terms of use and privacy policy. You are encouraged to review the applicable privacy statements before using the site. Please see below.

Accessibility: Queen's University is committed to developing courses that are accessible. For further information on accessibility compliance of the website(s), program(s) application(s) used in the course, please consult the links below.

Software	Use	Support	Privacy	Accessibility
onQ	Accessible learning			
Perusall	Accessible learning			

Notice of Recording

Synchronous (live) classes will be delivered in this course through Zoom and/or Teams, video conferencing platforms supported by the University. Steps have been taken by the University to configure these platforms in a secure manner. Classes will be recorded with video and audio (and, in some cases, transcription) and will be made available to students in the course for the duration of the term. The recordings may capture your name, image or voice through the video and audio recordings. By attending these live classes, you are consenting to the collection of this information for the purposes of administering the class and associated coursework. If you are concerned about the collection of your name and other personal information in the class, please contact the course instructor to identify possible alternatives.

To learn more about how your personal information is collected, used and disclosed by Queen's University, please see the Notice of Collection, Use and Disclosure of Personal Information.

Copyright of Course Material

Course materials created by the course instructor, including all slides, presentations, handouts, tests, exams, and other similar course materials, are the intellectual property of the instructor. It is a

departure from academic integrity to distribute, publicly post, sell or otherwise disseminate an instructor's course materials or to provide an instructor's course materials to anyone else for distribution, posting, sale or other means of dissemination, without the instructor's express consent. A student who engages in such conduct may be subject to penalty for a departure from academic integrity and may also face adverse legal consequences for infringement of intellectual property rights.

Communication

Questions about the Course and Contacting the Teaching Team

Questions about the course can be addressed in person during weekly lectures and tutorials. Of the 4.5 scheduled hours every week, a minimum of 2.5 hours per week is typically allocated to help sessions and office hours.

Queen's Email

The university communicates with students via Queen's email. Please check your email regularly to ensure you do not miss important information related to your course.

Course Feedback

At various points during the course, you may be asked to take part in a variety of feedback activities, such as surveys and questionnaires. This feedback enables the teaching team to improve the course. All surveys are anonymous and are directly related to activities, assessments, and other course material.

Assessments

Weighting and Alignment with Course Learning Outcomes (CLOs)

Assessment	Alignment with CLOs	Weighting
Weekly Coding Challenges	1,2,4-8	20%
Mid-term Coding Challenge	1,2,7	10%
Final Project	4-8	15%
Self-Reflections	2,3,8	10%
Participation	6,7	10%
Final Exam	1-8	35%
Total		100%

All students may opt to remove the two lowest assignment scores before calculating the final grade. This includes incomplete or late assignments that receive a 0 mark. However, due to the cumulative nature of this course, the information on incomplete assignments should be reviewed as they will be relevant to future assignments and the final exam.

Assessment Flexibility

The coding challenges are mini-assignments are designed to reinforce learning and provide you with ample practice coding and applying the concepts covered in the self-tutorials. To build in flexibility for all students, only your best 5 out of 11 assignment marks will count towards your grade.

Descriptions of Learning Activities and Assessments

Coding Challenges (20%)

- 9 short coding challenges are assigned throughout the 12-week course. You start it in class during the lecture session and submit it online, usually within 48 to 72 hours.
- Each challenge reinforces the coding and analysis skills from that week's self-tutorial. The final exam draws directly from these challenges, so completing them yourself is the best possible exam preparation.
- The challenges in Weeks 1 to 4 use the growing class dataset that you help design in Week 1 and build from your own observations, so you will be importing, cleaning, and visualizing data whose quirks you already understand. Later challenges use datasets from published studies and from your instructors' own research.
- You may discuss challenges with classmates during class, but the code and log you submit must be your own. Students who are absent may complete the challenge outside class (see Class Attendance).
- Each coding challenge is worth 2.5% of your final grade, calculated on your highest 8 of 9 challenges. The high weight per challenge reflects how central this weekly practice is to the course. Students with accommodations or extenuating circumstances that prevent submission with their group may instead submit individual assignments up to 3 days late.
- Longer extensions are discouraged because of the cumulative nature of the course. Delays will prevent learning of new content and the weekly rhythm can quickly become overwhelming when deadlines overlap. For students who have the need for longer extensions, please submit a request through the Academic Considerations Portal (see below).

Mid-term coding challenge (10%)

- This short assignment incorporates concepts used in the first part of the course and applies them to analyze an original dataset. This both reinforces the concepts taught in prior weeks but also helps to set expectations for analysis of the final project.

Final Project (15%)

- A group statistical-analysis project covering Part II of the course (Weeks 6 to 11), built on the class dataset: your group combines the observations that every student collected in Weeks 1 to 4 into a single relational dataset, cleans it (the same kinds of errors you practiced finding in the Midterm Project, this time for real), joins the observation and observer tables with tidyverse tools, visualizes the results with ggplot2, and poses and tests a biological question related to a UN Sustainable Development Goal using an appropriate statistical model, with QA/QC.
- Groups and detailed instructions are posted in Week 9, and the project is due in Week 12, when your group will also give a short presentation of your analysis during the final lecture session.
- The deliverable is one reproducible R Markdown report per group, graded together with the presentation. In addition, each group member submits their own coding log showing their contribution to the analysis; a member whose log shows no genuine contribution may receive a reduced grade.
- You may divide the work within your group, but the code each member contributes must be their own, and the same generative AI rules apply as for the Midterm Project.

Self-Reflections (2 x 5%)

- Two short self-reflection exercises are completed INDIVIDUALLY and anonymously — Part 1: Positionality in Week 4, and Part 2: Confirmation Bias in Week 11.
- Part 1 asks you to choose a UN Sustainable Development Goal that resonates with you personally and to reflect on how your learning in biology can contribute to it. You may choose from the goals introduced in Week 1 or from the full list of 17.

- Part 2 follows an assigned reading on bias in science, and asks where biases come from, how they surface in statistical models through the collection, interpretation, and presentation of data, and what you can do to minimize them in your own practice. • Both are graded on completion and the clarity of the reflection, not against a correctness standard, and your name is not visible to the grading TA. A submission that does not meet the requirements may be returned for revision rather than given a low mark.
- You may submit in whichever format suits you: a half-page written journal entry, an audio recording of roughly three minutes, or a concept map or graphic.

Participation (10%)

- The participation grade is designed to motivate attendance and active engagement in lectures and tutorials, where the coding challenges are worked on.
- Participation is based engagement with assigned readings through Perusall and a coding log you upload each week.
- The teaching team also uses these logs to see where the class is struggling so that we can address common problems in lecture, and to give you individual feedback and advice during tutorials.
- If you are unable to use the coding-log tool for accessibility or technical reasons, contact the instructor in Week 1 and an equivalent participation record will be arranged.

Final Exam (35%)

- The format of the exam includes two parts. The first part asks short questions about the code and concepts in the self-tutorials. The second part draws directly from the weekly coding challenges: shorter, focused tasks of the same kind, rather than comprehensive reports.
- To succeed on the final exam, you will need to work through the self-tutorials and coding challenges yourself (unless otherwise directed by your instructor or TA). This will help you develop the knowledge and skills needed for the final exam without the need for additional work.

Proctored Exams

Timing of Final Examinations

Once the exam schedule has been finalized, the exam date will be posted on your SOLUS account. The exam dates for each term are listed on the Faculty of Arts and Science webpage under "Important Dates." Student exam schedules for the Fall Term are posted on SOLUS immediately prior to Thanksgiving and on the Friday before Reading Week for the Winter Term. Students should **delay finalizing any travel plans until after the examination schedule has been posted**. Exams will **not be moved or deferred** to accommodate employment, travel/holiday plans or flight reservations. For information regarding what is considered extenuating circumstances and qualifications for Academic Consideration, please visit the Faculty of Arts and Science's Academic Consideration webpage.

If you are unable to attend an exam and receive approval for a deferred proctored exam, a further deferral of that exam will not be accommodated.

Assignment Submission Policy

Late assignments are assigned a score of zero. However, each assignment will have a grace period; your assignments are due on the due date posted but will be accepted, without penalty. Short-term academic consideration is therefore built into all assignment due dates and will not be extended past this grace period for students without long-term academic consideration or accommodations for disabilities. Please see the Academic Considerations for Students with Extenuating Circumstances and Accommodations for Disabilities sections of the syllabus for more information.

Policy Review of Graded Work

Requests for assignment regrading may be made to your TA during the lecture or tutorial help sessions in the week following your assignment submission. Requests made more than 5 days after grading will not be considered. Be sure to read your TA's feedback carefully before you submit a review of graded work. To request that your assignment be reviewed, please be sure to communicate the following:

- Your name, student number, and assignment number.
- The TA responsible for grading the assignment (you can ask the help-session TA if you are not sure)
- For group projects, the name of all group members and confirmation that all agree to the review.
- A clear explanation of your reason for the request:
    - The specific aspects of your assignment that you believe were not sufficiently awarded, referring to the categories of the rubric.
    - Why you believe that your assignment meets the criteria for a higher mark for each of the categories of the rubric that you indicated above. Please make explicit reference to the detailed descriptions of each category provided in the rubric.

After communicating your request in-person with the TA, email the above information to the grading TA and the instructor. An alternate TA will then grade the assignment.

If a review of graded work results in only a slightly different final grade, the original grade will stand. Should we find an error where marks were not assigned when they should have been or were missed in adding up the total score or were added up incorrectly resulting in a higher score than earned, the grade will be changed so that it is accurate. Grades would only increase or decrease if there was evidence of an error in marking, not simply because the TA interprets or applies the rubric slightly differently than the original grader.

Policies

Class Attendance

Your presence and participation in class contributes to the knowledge and skills that you will develop throughout this course. I expect that you attend class regularly, participate in class conversations and learning activities. These types of activities provide active engagement, promote a deeper understanding of the course content, and contribute to your success in this course.

You are expected to bring a laptop capable of running Windows, MacOS, or Linux programs, and you must be able to access Queen's wireless network during lecture and tutorial sessions (see also "Technology Requirements").

Academic Support

All undergraduate students face new learning and writing challenges as they progress through university: essays and reports become more complex; effectively incorporating research into writing becomes more important; the types of assignments become more diverse; managing your time and

developing the skills you need to read and think critically gets more challenging. I encourage students to contact Student Academic Success Services (SASS). SASS offers many different ways to receive support:

- Free online or in-person appointments to get personalized support on writing and academic skills from expert staff and trained peers.
- Workshops and drop-in programs. SASS' Events Calendar lists events coming soon.
- Online resources that provide strategies for academic skills and writing development at university.
- If English is not your first language, SASS has specific resources for English as Additional Language students, including weekly programs and EAL academic skills appointments. You can meet on an ongoing basis with an EAL consultant to work on your academic writing, speaking, listening, and reading skills.

Accommodations for Disabilities

Queen's University is committed to working with students with disabilities to remove barriers to their academic goals. Queen's Student Accessibility Services (QSAS), students with disabilities, instructors, and faculty staff work together to provide and implement academic accommodations designed to allow students with disabilities equitable access to all course material (including in-class as well as exams). If you are a student currently experiencing barriers to your academics due to disability related reasons, and you would like to understand whether academic accommodations could support the removal of those barriers, please visit the QSAS website to learn more about academic accommodations or start the registration process with QSAS by clicking ***Access Ventus*** button at **Ventus | Accessibility Services | Queen's (queensu.ca)**

VENTUS is an online portal that connects students, instructors, Queen's Student Accessibility Services, the Exam's Office and other support services in the process to request, assess, and implement academic accommodations.

To learn more go to: https://www.queensu.ca/ventus-support/students/visual-guide-ventus-students

Academic Consideration for Students in Extenuating Circumstances

Please note that specific accommodations are available for this course, namely:

1. Weekly assignments can be completed individually instead of in groups, with a deadline extension of up to 48 hours. However, it is strongly recommended that students complete assignments as soon as possible as each week builds on the assignments covered in previous weeks.
2. Up to 5 missing assignments can be dropped before calculating the final grade (top 5 of 10).
3. Supplementary videos are provided via the OnQ course website. These act as guided coding tutorials that cover most of the key content in the written self-tutorials.

Academic Consideration is a process for the University community to provide a compassionate response to assist students experiencing unforeseen, short-term extenuating circumstances that may impact or impede a student's ability to complete their academics. This may include but is not limited to any extenuating circumstance (illness, bereavement, traumatic event, injury, family emergency, etc.) which

is short-lived, begins within the term, and will not last longer than 12 weeks - see Academic Consideration webpage for details (https://www.queensu.ca/artsci/undergraduate/student-services/academic-consideration)

> Each Faculty has developed a protocol to provide a consistent and equitable approach in dealing with requests for academic consideration for students facing extenuating circumstances. For more information, undergraduate students in the Faculty of Arts and Sciences should consult the Faculty's webpage on Academic Consideration in Extenuating Circumstances and submit a request via the Academic Consideration Request Portal. Students in other Faculties and Schools who are enrolled in this course should refer to the protocol for their home Faculty.

Students are encouraged to submit requests as soon as the need becomes apparent and to contact their instructor and/or course coordinator as soon as possible once academic consideration has been granted. Any delay in contact may limit the options available for academic consideration. While we encourage instructors to accommodate, each instructor has discretion in deciding whether or how to apply the Academic Consideration. For more information on the Academic Consideration process, what is and is not an extenuating circumstance, and to submit an Academic Consideration request, please see the Faculty of Arts and Science's Academic Consideration website. ASO courses include links to information on **Academic Consideration** on your **Course Homepage** in onQ.

Please see the Teaching Team page for contact information for your instructor and TA(s), where relevant.

For more information, please see the Senate Policy on Academic Consideration for Students in Extenuating Circumstances.

Queen's Policy Statement on Academic Integrity

Queen's University is dedicated to creating a scholarly community free to explore a range of ideas, to build and advance knowledge and to share the ideas and knowledge that emerge from a range of intellectual pursuits. Each core value of academic integrity, as defined in the Senate Academic Integrity Policy, gives rise to and supports the next.

Honesty appears in presenting one's own academic work, whether in the context of an examination, written assignment, laboratory or seminar presentation. It is in researching one's own work for course assignments, acknowledging dependence on the ideas or words of another and in distinguishing one's own ideas and thoughts from other sources. It is also present in faithfully reporting laboratory results even when they do not conform to an original hypothesis. Further, honesty is present in truthfully communicating in written and/or oral exchanges with instructors, peers and other individuals (e.g. teaching assistants, proctors, university staff and/or university administrators).

Trust exists in an environment in which one's own ideas can be expressed without fear of ridicule or fear that someone else will take credit for them.

Fairness appears in the proper and full acknowledgement of the contributions of collaborators in group projects and in the full participation of partners in collaborative projects.

Respect, in a general sense, is part of an intellectual community that recognizes the participatory nature of the learning process and honours and respects a wide range of opinions and ideas. However, "respect" appears in a very particular sense when students attend class, pay attention, contribute to discussion and submit papers on time; instructors "show respect by taking students' ideas seriously, by recognizing them as individuals, helping them develop their ideas, providing full and honest feedback on their work, and valuing their perspectives and their goals" ("The Fundamental Values of Academic Integrity", 3rd Edition, p. 8).

Ultimately, responsibility is both personal and collective and engages students, administrators, faculty and staff in creating and maintaining a learning environment supported by and supporting academic integrity.

Courage differs from the preceding values by being more a quality or capacity of character – "the capacity to act in accordance with one's values despite fear" ("The Fundamental Values of Academic Integrity", 3rd edition, p. 10). Courage is displayed by students who make choices and integrous decisions that are followed by action, even in the face of peer pressure to cheat, copy another's material, provide their own work to others to facilitate cheating, or otherwise represent themselves dishonestly. Students also display courage by acknowledging prior wrongdoing and taking proactive measures to rectify any associated negative impact.

All of these values are not merely abstract but are expressed in and reinforced by the University's policies and practices.

Syllabus statements for Generative Artificial Intelligence (AI) Tools

- **Not permitted**: There is an LLM built specifically for this course. Using any other generative AI writing tools such as ChatGPT in your submitted work is not permitted in this class. This type of use constitutes a departure from academic integrity. Original work, completed wholly by you, is expected to be submitted in this course. Any other use constitutes a Departure from Academic Integrity.

Queen's Student Academic Success Services (SASS) offers a self-directed, online academic integrity module which we encourage all students to take which will help with:

- Understanding the nature of the academic integrity departure
- Understanding the expectations of and role of sources in scholarly writing
- Integrating sources into your writing (paraphrasing, quoting, summarizing)
- Understanding when and how to cite your sources
- Managing your time effectively to avoid the need for shortcuts
- Taking effective notes to ensure accuracy of source material and correct attribution

Turnitin Statement

This course makes use of Turnitin, a third-party application that helps maintain standards of excellence in academic integrity. Normally, students will be required to submit their course assignments through onQ to Turnitin. In doing so, students' work will be included as source documents in the Turnitin

reference database, where they will be used solely for the purpose of detecting plagiarized text in this course. Data from submissions is also collected and analyzed by Turnitin for detecting Artificial Intelligence (AI)-generated text. These results are not reported to your instructor at this time but could be in the future.

Turnitin is a suite of tools that provide instructors with information about the authenticity of submitted work and facilitates the process of grading. The similarity report generated after an assignment file is submitted produces a similarity score for each assignment. A similarity score is the percentage of writing that is similar to content found on the internet or the Turnitin extensive database of content. Turnitin does not determine if an instance of plagiarism has occurred. Instead, it gives instructors the information they need to determine the authenticity of work as a part of a larger process.

Please read Turnitin's Privacy Policy, Acceptable Use Policy and End-User License Agreement, which govern users' relationship with Turnitin. Also, please note that Turnitin uses cookies and other tracking technologies; however, in its service contract with Queen's Turnitin has agreed that neither Turnitin nor its third-party partners will use data collected through cookies or other tracking technologies for marketing or advertising purposes.

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