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BIOL 343
Advanced Data Analysis for Biologists

Winter Term (2018-19)

CALENDAR DESCRIPTION

Advanced topics in using R for data management, exploratory data analysis, data visualization, and statistical analysis using the general linear model, with particular focus on statistical literacy and biological examples from both laboratory and field research.

LEARNING HOURS 120 (36L;12T;12O;60P)
PREREQUISITE BIOL 243/3.0 or PSYC 202/3.0 or STAT 269/3.0.

SCHEDULE
Lectures: Tuesday11:30am -12:30pm, Wednesday 1:30-2:30pm, Friday 12:30-1:30pm. BIOSCI 1120 .
Tutorials: Thursday 230-330pm, 430-530pm. BIOSCI 2306.

Instructor	Chris Eckert
Instructor Contact	chris.eckert@queensu.ca, hone: 613-533-6158
Office Hours	Wednesdays 230-430pm Biosci rm. 4447
TA:	TBA
TA Contact Information	Through the OnQ discussion forum
TA Office Hours	In the weekly tutorials

Learning Objectives

The goals of Biology 343 are to provide students with practical experience in the application of the general linear model to the analysis of biological data using R, and to develop general skills in the application and reporting of statistical analysis.

Learning Hours

Teaching method		Average hours per week	Number of weeks	Total hours
In-class hours	Lecture	3	12	36
	Seminar			
	Laboratory			
	Tutorial	1	12	12
	Practicum			
	Group learning			
	Individual instruction			
Other	Online activity	1	12	12
	Off-campus activity			
	Private study	5	12	60
Total hours on task				120

Course Outline

The main topics to be covered in this course are data management & visualization and the practical application of general linear models to biological data using R statistical software environment. This course builds on the foundation provided in BIOL-243 (and equivalent courses) to give students considerable practical experience in data analysis and presentation. Students who are successful in BIOL-343 should be well prepared for the sorts of data analysis required in field courses, honours theses and graduate research.

Proposed weekly schedule
week 1   Intro to R and data management (using dplyr)
week 2   Intro to data visualization (using ggplot and R Markdown)
week 3   Statistical inference: the population, the sample & the sampling distribution
week 4   Comparing samples and intro to linear models
week 5   Regression and diagnosing assumptions
week 6   Multiple regression and model selection
week 7   Polynomial regression, likelihood and information theory
week 8   Simple and factorial analysis of variance
week 9   Making up data to design better experiments
week 10   Analysis of covariance and model II regression
week 11   Mixed-effects linear models
week 12   Logistic regression and generalized linear models

Textbooks/Readings

Motulsky H 2016 Essential Biostatistics. A Nonmathematical Approach. Oxford University Press

Grading Scheme

Component	Weight (%)	Date
Weekly assignments (10 x 7%)	70	About weekly
Two in-class midterm exams (2x 15%)	30	One in early October, another in mid November, Dates TBA

Grading Method

All assignments and exams will be graded using letter grades as per the Faculty of Arts and Science Letter Grade Input Scheme (see below).

Academic Integrity and Queen's Code of Conduct

Students are responsible for familiarizing themselves with the regulations concerning academic integrity and for ensuring that their assignments and conduct conform to the principles of academic integrity. Information is available in the Arts and Science Calendar (see Academic Regulation 1 - http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations, on the Arts and Science website (see http://www.queensu.ca/artsci/academics/undergraduate/academic-integrity), and at Biology's website (http://www.queensu.ca/biology/undergrad/integrity.html) and from the instructor of this course. Departures from academic integrity include plagiarism, use of unauthorized materials, facilitation, forgery and falsification, and are antithetical to the development of an academic community at Queen's. Given the seriousness of these matters, actions which contravene the regulations on academic integrity

carry sanctions that can range from a warning or the loss of grades on an assignment to the failure of a course to a requirement to withdraw from the university.

Arts & Science Letter Grade Input Scheme

Assignment mark	Numerical value for calculation of final mark
A+	93
A	87
A-	82
B+	78
B	75
B-	72
C+	68
C	65
C-	62
D+	58
D	55
D-	52
F48 (F+)	48
F24 (F)	24
F0 (0)	0

Your course average will then be converted to a final letter grade according to Queen's Official Grade Conversion Scale:

Queen's Official Grade Conversion Scale

Grade	Numerical Course Average (Range)
A+	90-100
A	85-89
A-	80-84
B+	77-79
B	73-76
B-	70-72
C+	67-69
C	63-66
C-	60-62
D+	57-59
D	53-56
D-	50-52
F	49 and below

Accommodation Policy, Exam Conflicts, and Other Conflicts

Students who feel they need accommodations for disabilities or extenuating circumstances, or have a conflict between exams or other commitments should consult the Biology Department's website for details about how to proceed (http://www.queensu.ca/biology/undergrad/integrity.html). In general, the earlier a course coordinator is apprised of an extenuating circumstance, the more likely an accommodation can be made. Students are encouraged to be proactive in anticipating difficulties, when it is possible to do so.

Students may apply to write a make-up or deferred exam if they have an exam conflict as defined in the Academic Regulations of the Faculty (See Arts and Science Calendar Regulation 8 - http://www.queensu.ca/artsci/academic-calendars/regulations/academic-regulations). In this case, the student should report to the Exams Office first to verify that there is a genuine exam conflict. Biology professors will not consider your situation to be a conflict unless it meets the criteria set out by the Faculty of Arts and Sciences.

Students may request a make-up or deferred exam if they have an exam conflict with off-campus travel associated with a field course (e.g BIOL-307/3.0 or 407/3.0) that is held during the fall or winter terms.

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Accommodation of Disabilities

Queen's University is committed to achieving full accessibility for persons with disabilities. Part of this commitment includes arranging academic accommodations for students with disabilities to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a disability and think you may need accommodations, you are strongly encouraged to contact the Disability Services Office (DSO) and register as early as possible. For more information, including important deadlines, please visit the DSO website at: http://www.queensu.ca/hcds/ds/