

**Faculty of Science Course Syllabus
Department of Biology****BIOL BIOL3872.01 The Biologist's Toolkit**
Fall 2019-2020**Instructor:** Aaron MacNeil a.macneil@dal.ca LSC 7087/88**Lectures/Laboratories:** Time W 08:35-11:25 Location *MCCAIN ARTS&SS 2176***Course Description**

Best practices for scientific computing and data handling, theory of visualisation, and scripting, teaching students how to create, store, and manipulate data using the object-oriented programming language R. Examples and projects will be drawn from a wide variety of biological areas, covering typical problems encountered with computer use.

Course Prerequisites

BIOL 2030.03 or BIOL 2040.03 or BIOL 2060.03

Undergraduate course Objectives/Learning Outcomes

Students will be able to store, import, and manipulate data in R, as well as execute basic concepts in data and research reproducibility, webpage data scraping, and graphical representation.

Course Materials

- No textbooks
- Use of a personal laptop is encouraged
- Course website ASAPs

Course Assessment – undergraduate students

In-class quizzes: One per lecture (5% each, use best 10 of 11) total of 50% Every lecture

Assignments: Four take-home assignments (12.5% each) total of 50% See lecture schedule

Course Assessment – graduate students

In-class quizzes: One per lecture (3% each, use 11 of 11) total of 33% Every lecture

Assignments: Four take-home assignments (16.75% each) total of 67% See lecture schedule

Other course requirements

While attendance is not mandatory these are hands-on labs with in-class quizzes, attendance is strongly encouraged.

Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale

A+ (90-100) B+ (77-79) C+ (65-69) D (50-54)

A (85-89) B (73-76) C (60-64) F (<50)
 A- (80-84) B- (70-72) C- (55-59)

Assignment Grading Rubric

Criteria	Indicators
Format (30%)	Student follows assignment guidelines; code is reproducible and submitted via GitHub. Full marks given for code that matches all guideline requirements, is submitted onto GitHub, and can be run from another computer without error.
Clarity (20%)	Submitted code is human-readable and can be interpreted easily. Full marks are given for code that is clearly annotated on each line that contains a new procedure, whereby a code-reader can understand clearly what each code block does.
Parsimony (20%)	Submitted code uses a minimum number of steps and follows guidelines from lectures or innovates a better approach. Full marks are given for code that cannot be reduced in length by common conventions taught in class.
Accuracy (30%)	Submitted code accurately reflects underlying data, matching key summary statistics to expected values. Full marks are given for results that closely match those produced by the course instructor.

Course Policies

Late assignments will incur an exponential penalty, with grades scaled per late day (x) by $100 - 100^{**}(x/7)$ and assignments 7 days late will have no value. Adjustments to this penalty will be addressed on a case-by-case basis, with exceptions made for illness, bereavement etc. Students absent from lecture quizzes will be able to complete them the following day scaled to 75% of their score. Weather-related cancellations will result in content being posted online, with a rapid review in the following class.

Plagiarism, cheating, and other misconduct are serious violations of your contract as a Dalhousie student. You are expected to know and abide by [Dalhousie's policies regarding academic misconduct](#). Violations of these policies will be dealt with according to the Faculty [Discipline Process](#).

For this course, plagiarism is defined as code that is identical or eerily similar to that of other students - programmers develop code that reflect their individual styles and these conventions are easily recognised. You are absolutely encouraged to collaborate and consult online forums such as [Stack Overflow](#) for assignments, however submitted work must be your own effort, with **sources of borrowed code clearly indicated in script comments**.

Lecture schedule

- Week 1: Introduction to Jupyter and R - survey of programming languages

- Week 2: R programming - functions, loops, and logic
- Week 3: Code and data storage – Git, Excel from hell, csv files, databases, importation
- Week 4: Data handling - DataFrames, arrays, lists, data manipulation
 - *Data cleanup assignment*
- Week 5: Databasing – Database skills, merges, filters
- Week 6: Temporal data - manipulating dates and times
- Week 7: String manipulation - working with text, genetics, hacking webpages
 - *Webpage scraping assignment*
- Week 8: Reproducibility - theory and practice, fraud, scientific method
- Week 9: Living documents - LaTeX, bamer, knitr, markdown, dplyr
 - *Reproducible document assignment*
- Week 10: Plotting - looking at data, Base, ggplot, maps
- Week 11: Scientific graphics - Tufte, the data:ink ratio, small multiples
- Week 12: Scientific graphics - Colours, transparency, symbols, vector graphics
 - *Beautiful graphics assignment*

University Policies and Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and by Senate

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect (The Center for Academic Integrity, Duke University, 1999). As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity.

Information: https://www.dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (Canada and Nova Scotia).

Information: https://www.dal.ca/campus_life/academic-support/accessibility.html

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation. When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution.

Code: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

Diversity and Inclusion – Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive

community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness

Statement: <http://www.dal.ca/cultureofrespect.html>

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit or e-mail the Indigenous Student Centre (1321 Edward St) (elders@dal.ca).

Information: https://www.dal.ca/campus_life/communities/indigenous.html

Important Dates in the Academic Year (including add/drop dates)

https://www.dal.ca/academics/important_dates.html

University Grading Practices

https://www.dal.ca/dept/university_secretariat/policies/academic/grading-practices-policy.html

Missed or Late Academic Requirements due to Student Absence (policy)

https://www.dal.ca/dept/university_secretariat/policies/academic/missed-or-late-academic-requirements-due-to-student-absence.html

Student Resources and Support

Advising

General Advising https://www.dal.ca/campus_life/academic-support/advising.html

Science Program Advisors: <https://www.dal.ca/faculty/science/current-students/academic-advising.html>

Indigenous Student Centre: https://www.dal.ca/campus_life/communities/indigenous.html

Black Students Advising Centre: https://www.dal.ca/campus_life/communities/black-student-advising.html

International Centre: https://www.dal.ca/campus_life/international-centre/current-students.html

Academic supports

Library: <https://libraries.dal.ca/>

Writing Centre: https://www.dal.ca/campus_life/academic-support/writing-and-study-skills.html

Studying for Success: https://www.dal.ca/campus_life/academic-support/study-skills-and-tutoring.html

Copyright Office: <https://libraries.dal.ca/services/copyright-office.html>

Fair Dealing Guidelines <https://libraries.dal.ca/services/copyright-office/fair-dealing.html>

Other supports and services

Student Health & Wellness Centre: https://www.dal.ca/campus_life/health-and-wellness/services-support/student-health-and-wellness.html

Student Advocacy: <https://dsu.ca/dsas>

Ombudsperson: https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/where-to-get-help/ombudsperson.html

Safety

Biosafety: <https://www.dal.ca/dept/safety/programs-services/biosafety.html>



Chemical Safety: <https://www.dal.ca/dept/safety/programs-services/chemical-safety.html>

Radiation Safety: <https://www.dal.ca/dept/safety/programs-services/radiation-safety.html>

Scent-Free Program: <https://www.dal.ca/dept/safety/programs-services/occupational-safety/scent-free.html>