AGR*3200 Computing for Bioscientists

Winter 2023
Section(s): C01

Department of Animal Biosciences
Credit Weight: 0.50
Version 1.00 - January 09, 2023

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1 Course Details

1.1 Calendar Description

This course focuses on computational aspects of analytical techniques for biological data. Topics covered include, how to operate a computer efficiently when using biological data, types of biological data used in animal biosciences, how to prepare biological data for analysis, programming skills for bio-data organization, manipulation and problem solving, bio-data visualization, and computational aspects of data modelling.

Pre-Requisites:	9.50 credits
Restrictions:	Restricted to students in BSCH.ABIO, BSAG.AGRS, BSAG.ANSC, BBRM.EQM.

1.2 Course Description

This course focuses on computational aspects of analytical techniques for biological data. Topics covered include, how to operate a computer efficiently when using biological data, types of biological data used in animal biosciences, how to prepare biological data for analysis, programming skills for bio-data organization, manipulation and problem solving, bio-data visualization, and computational aspects of data modelling.

Note: While the course is currently offered in-person, due to the continuously volatile Covid-19 situation, the course might have to move online (synchronously).

1.3 Timetable

Timetable is subject to change. Please see WebAdvisor for the latest information.

Current timetable:

Lectures: Tuesdays and Thursdays from 11:30 AM to 12:50 PM, ANNU 101

Labs: Mondays from 9:30 AM to 11:20 AM, ANNU 002

First class: Tuesday, January 9, 2023

1.4 Final Exam

There is a take-home final exam (mini project) for this course.

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2 Instructional Support

2.1 Instructional Support Team

Instructor: Dan Tulpan
Email: dtulpan@uoguelph.ca
Telephone: +1-519-824-4120 x52482
Office: By appointment: in-person or online (Zoom, WebEx)

2.2 More info

The instructor will facilitate discussions, present lecture notes in an interactive and hands-on fashion, provide feedback to students, and oversee/prepare the lab activities.

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3 Learning Resources

3.1 Recommended Resources

S. Alesina, M. Wilmes. Computing Skills for Biologists, Princeton University Press, 2019, ISBN: 9780691182759 (Textbook) (Textbook)
https://press.princeton.edu/books/paperback/9780691182759/computing-skills-for-biologists

R. Libeskind-Hadas, E. Bush. Computing for Biologists, Cambridge University Press, 2014, ISBN: 9781107337510 (Textbook) (Textbook)
https://www.cambridge.org/highereducation/books/computing-for-biologists/5B08EEEE2AE8A602113A8F225E89F5FD#overview

3.2 Complementary resources

Course notes will be used during the course and available via the CourseLink course's webpage.

Extra pertinent information, such as websites, papers, chapters of books, etc. will be accordingly recommended.

Students are advised to take their own notes during lectures.

Potentially useful/interesting Python programming resources:

Online book: How to Code in Python:

- *https://assets.digitalocean.com/books/python/how-to-code-in-python.pdf*

Online book: Introduction to Scientific Programming with Python:

- *https://library.oapen.org/bitstream/handle/20.500.12657/39979/2020_Book_IntroductionToScientificPr*

Online Python course:

- *https://python-course.eu/*

Online R tutorial:

- *https://www.r-tutor.com/r-introduction*

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4 Learning Outcomes

4.1 Course Learning Outcomes

By the end of this course, you should be able to:

1. Perform and understand basic computer operations.
2. Understand bio-data formats and standards used in bio sciences and be able to manipulate them using basic computer programming.
3. Be able to organize information in data files and visualize their content using appropriate visualization methods and graphs with the help of software.
4. Be able to perform basic statistical analyses of biological data using R.
5. Be able to operate a research computer running the Linux operating system and perform basic tasks such as creating, modifying and removing files, listing directory contents, searching in files, high throughput operations involving multiple files, etc.
6. Be able to create well-organized/structured data sets.

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5 Teaching and Learning Activities

5.1 Topics covered in lectures and labs

This course will provide you with solid notions of data wrangling and basic computing using 3 special tools: Linux OS, Python and R. The following topics will be covered:

- Introduction to data and computing (week 1)
- The Linux operating system (weeks 1-2): basic commands, file and directory structure, working with data
- The Python programming language (weeks 3-6): variables, data types, operations, input/output, decisions, loops, functions, special libraries
- The R language (weeks 7-9): variables, data types, operations, input/output, decisions, loops, functions, basic stats
- Working with bio data - use cases (weeks 10-11): tabular data, RFID data, Body Weight + Milk Yield + Dry Matter Intake data
- Bonus topic (week 12): Artificial Intelligence and Machine Learning (intelligent computing) or other interesting topic

5.2 Technical details

Each lecture is followed by a lab, which will offer students the opportunity to practice the theoretical notions covered in the lecture using Python programs executed on a Linux platform or on https://replit.com/, and R programs executed with on Linux or on individual laptops/computers using R (https://www.r-project.org/) and RStudio Desktop (https://www.rstudio.com/), which must be installed prior to class.

Please bring you own computer and make sure that you have applications that support SSH (Secure Shell) and SFTP/SCP (Secure File Transfer Protocol/Secure Copy) installed on it. SSH allows connections to remote Linux/Unix servers, while SFTP/SCP allows file transfers to and from the Linux/Unix servers to your own computer.

Windows users

- SSH: **Putty** -- https://www.chiark.greenend.org.uk/~sgtatham/putty/latest.html
- SFTP/SCP: **WinScp** -- https://winscp.net/eng/download.php

Mac OS X (Apple) users

- SSH and SCP are typically pre-installed on Mac OS X and can be accessed via the *Terminal* application (Applications --> Utilities --> **Terminal.app**).
- FTP/SFTP/SCP: **FileZilla** (https://filezilla-project.org/download.php?platform=osx)

- ***Note: For Mac users it is important to have XCode (from App Store) and the Homebrew package***

manager (https://brew.sh/) installed as well.

Linux users

- SSH and SCP are typically pre-installed on a Linux OS and can be accessed using a *terminal.*

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6 Assessments

The following information represents a list of assessment items for this course. The deadlines are approximate and may change based on the assimilation / teaching speed, content and situations.

6.1 Marking Schemes & Distributions

Assessment	Number	Total weight (%)
Quizzes	5	10
Assignments	5	45
Take-home exam	1	45

6.2 Assessment Details

Assignment 1 (9%)
Date: Week 2
Learning Outcome: 1, 5

Assignment 2 (9%)
Date: Week 4
Learning Outcome: 1, 3, 5, 6

Assignment 3 (9%)
Date: Week 6
Learning Outcome: 1, 3, 6

Assignment 4 (9%)
Date: Week 8
Learning Outcome: 1, 4, 6

Assignment 5 (9%)

Date: Week 10
Learning Outcome: 1, 2, 3, 4

Quiz 1 (2%)
Date: Week 2
Learning Outcome: 5

Quiz 2 (2%)
Date: Week 3
Learning Outcome: 1, 2

Quiz 3 (2%)
Date: Week 5
Learning Outcome: 1, 2, 6

Quiz 4 (2%)
Date: Week 6
Learning Outcome: 1, 2, 3, 6

Quiz 5 (2%)
Date: Week 8
Learning Outcome: 1, 3, 4

Take-home exam (45%)
Date: Week 12
Learning Outcome: 1, 2, 3, 4, 5, 6
The take-home exams will be written individually and the estimated due date is April 19, 2023, subject to change at the discretion of the instructor.

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7 Course Statements

7.1 Grading policies

All assignments, quizzes and take-home exams must be submitted before 11:59 pm (EST) of the due date. Late assignments will receive zero (0) marks. The submissions will be performed using the Dropbox functionality on CourseLink unless otherwise specified by the instructor.

7.2 Netiquette Expectations

Online Behaviour:

Inappropriate online behaviour will not be tolerated. Examples of inappropriate online behaviour include:

- Posting inflammatory messages about your instructor or fellow students
- Using obscene or offensive language online

· Copying or presenting someone else's work as your own

· Adapting information from the Internet without using proper citations or references

· Buying or selling term papers or assignments

· Posting or selling course materials to course notes websites

· Having someone else complete your quiz/assignment/exam or completing a quiz/assignment/exam for/with another student

· Stating false claims about lost quiz/assignment/exam answers or other assignment submissions

· Threatening or harassing a student or instructor online

· Discriminating against fellow students, instructors and/or TAs

· Using the course website to promote profit-driven products or services

· Attempting to compromise the security or functionality of the learning management system

· Sharing your user name and password

· Recording lectures and/or labs without the permission of the instructor

8 University Statements

8.1 Email Communication

As per university regulations, all students are required to check their e-mail account regularly: e-mail is the official route of communication between the University and its students.

8.2 When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. The grounds for Academic Consideration are detailed in the Undergraduate and Graduate Calendars.

Undergraduate Calendar - Academic Consideration and Appeals
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-ac.shtml

Graduate Calendar - Grounds for Academic Consideration
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

Associate Diploma Calendar - Academic Consideration, Appeals and Petitions

https://www.uoguelph.ca/registrar/calendars/diploma/current/index.shtml

8.3 Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all students (undergraduate, graduate and diploma) except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in their respective Academic Calendars.

Undergraduate Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-drop.shtml

Graduate Calendar - Registration Changes
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/genreg-reg-regchg.shtml

Associate Diploma Calendar - Dropping Courses
https://www.uoguelph.ca/registrar/calendars/diploma/current/c08/c08-drop.shtml

8.4 Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

8.5 Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability.

Use of the SAS Exam Centre requires students to make a booking at least 14 days in advance, and no later than November 1 (fall), March 1 (winter) or July 1 (summer). Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time.

For Guelph students, information can be found on the SAS website
https://www.uoguelph.ca/sas

For Ridgetown students, information can be found on the Ridgetown SAS website
https://www.ridgetownc.com/services/accessibilityservices.cfm

8.6 Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity, and it is the responsibility of all members of the University community-faculty, staff, and students-to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff, and students have the responsibility of supporting an environment that encourages academic integrity. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

Undergraduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/undergraduate/current/c08/c08-amisconduct.shtml

Graduate Calendar - Academic Misconduct
https://www.uoguelph.ca/registrar/calendars/graduate/current/genreg/index.shtml

8.7 Recording of Materials

Presentations that are made in relation to course work - including lectures - cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

8.8 Resources

The Academic Calendars are the source of information about the University of Guelph’s procedures, policies, and regulations that apply to undergraduate, graduate, and diploma programs.

Academic Calendars
https://www.uoguelph.ca/academics/calendars

8.9 Disclaimer

Please note that the ongoing COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via CourseLink and/or class email.

This includes on-campus scheduling during the semester, mid-terms and final examination

schedules. All University-wide decisions will be posted on the COVID-19 website (https://news.uoguelph.ca/2019-novel-coronavirus-information/) and circulated by email.

8.10 Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g.. final exam or major assignment).

8.11 Covid-19 Safety Protocols

For information on current safety protocols, follow these links:

- https://news.uoguelph.ca/return-to-campuses/how-u-of-g-is-preparing-for-your-safe-return/
- https://news.uoguelph.ca/return-to-campuses/spaces/#ClassroomSpaces

Please note, these guidelines may be updated as required in response to evolving University, Public Health or government directives.
