PLNT*6160 Advanced Plant Breeding II

Winter 2021
Section(s): C01

Department of Plant Agriculture
Credit Weight: 0.50
Version 1.00 - January 05, 2021

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1 Course Details

1.1 Calendar Description

Fundamentals of quantitative genetics. Topics include gene and genotype frequencies means, variances, covariances and resemblance among relatives. Lecture topics are expanded through discussion of classic and current papers.

1.2 Course Description

This course is designed to familiarize graduate students with the theory and application of quantitative genetics in plant breeding. Students will learn methods to estimate genetic variation, inheritance, and selection response. Students will also learn to analyze genome-wide DNA polymorphism data both to identify loci that account for quantitative variation and to make genomic predictions. The course is intended to provide opportunities for continued learning, critical questioning and skill development. Emphasis is placed on gaining hands-on experience in R/tidyverse data analysis and visualization.

1.3 Timetable

TBD in consultation with students

1.4 Final Exam

There is no Final Exam

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2 Instructional Support

2.1 Instructional Support Team

Instructor: Lewis Lukens
Email: llukens@uoguelph.ca
Telephone: +1-519-824-4120 x52304
Office: CRSC 326
Office Hours: Online meetings by appointment

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3 Learning Resources

3.1 Recommended Resources

Recommended Texts (Textbook)

Readings will be assigned. The following texts are recommended:

Bernardo, R. 2002. Breeding for quantitative traits in plants. Stemma Press, Woodbury, MN

Falconer, D.S. and T.F.C. Mackay. 1996. Introduction to Quantitative Genetics. 4th edition Pearson Prantice Hall. Essex, England.

Wickham, H. and G. Grolemund. 2017. R for Data Science. Oreilly Inc. Sebastopol, California.

An introductory statistics book that uses R such as Statistics: An Introduction Using R, Crawley, M. Wiley. West Sussex, England.

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4 Learning Outcomes

4.1 Course Learning Outcomes

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

1. Have had hands-on experience with quantitative plant data manipulation, visualization, and analysis using R and R tidyverse.
2. Understand the fundamentals of quantitative genetics theory and understand how this theory applies to plant breeding situations.
3. Understand, with hands-on experience, the application of genomics data in the analysis of plant genetics data.

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5 Teaching and Learning Activities

5.1 Lecture

Topics: **Course overview and introduction to data exploration and visualization in tidyverse.**

Introduction.

Using tidyverse and ggplot to manage and visualize data.

Topics: **Estimating genotypic values and their importance and stability**

Using linear models to estimate the effects of factors that affect plant traits.

Best Linear Unbiased Estimators and Best Linear Unbiased Predictors.

Estimating genotypic values and variance component analyses.

Visualizing genotypic differences.

Genotype x environment interaction

Topics: **The components of genotypic variation**

Understanding additive, dominance, and epistatic components of genetic variances.

Estimating genetic variance components.

Defining and calculating narrow sense heritabilities.

Topics: **Selection**

Predicting how selection affects trait values and variability.

Explore the theoretical and empirical consequences of different selection schemes in plant breeding.

Topics: **Molecular bases and molecular prediction of trait variation**

Identifying loci that control trait variation in biparental and diverse populations.

Calculating genomic predictions and the consequences of genomic selection.

5.2 Lab

Topics: Labs

There is no lab for this course. Nonetheless, hands-on data analysis outside of class is key. Quizzes and assignments will encourage data analysis skill development.

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6 Assessments

6.1 Marking Schemes & Distributions

Name	Scheme A (%)
Quizzes (10x)	30
Assignments (4x)	55
Discussion and Participation	15
Total	100

6.2 Assessment Details

Quizzes (10x) (30%)
Due: weekly
Learning Outcome: 1, 2, 3
Quizzes are meant to reinforce concepts and coding given in lectures. The first quiz will be due in week 2.

Assignments (4x) (55%)
Due: 3 weeks after assigned
Learning Outcome: 1, 2, 3
17, 18 and 20 points.
Three assignments will given. Each will require students to do analyses and write a report. The report is due back in three weeks. Please send electronic reports saved as Word document to llukens@uoguelph.ca on or before the deadline by 12:00 (AM).

Assignment	Handed out	Due
I	Jan-22	Feb-12
II	Feb-12	Mar-12
III	Mar-26	Apr-16

Discussion and Participation (15%)
Due: N/A
Learning Outcome: 1, 2, 3

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7 Course Statements

7.1 Grading Policies

Assignments (55% of the final mark): Three assignments will be given. For each assignment, students will be supplied with a data set and questions. Students are asked to analyze the data and write a report, in which they will follow the format Introduction, Materials and Methods, Results (including tables and Figures as appropriate), Discussion, and References.

Students helping others is strongly encouraged. Nonetheless, each person must write their own code and report. Copying the work of others is academic dishonesty.

Class Participation (15 % of the final mark): Students are expected to actively participate in class learning. I may ask for students to present certain concepts to the class.

Quizzes (30 % of the final Mark): Students will write 10 Quizzes throughout the semester. These quizzes are open book and outside of class time. They are intended for students to practice data analysis and interpretation. Quizzes should be submitted via email.

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 book their exams at least 7 days in advance and not later than the 40th Class Day.

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 and academic schedules. Any such changes will be announced via CourseLink and/or class email. 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

The University will not normally require verification of illness (doctor's notes) for fall 2020 or winter 2021 semester courses. However, requests for Academic Consideration may still require medical documentation as appropriate.