Linear Models in Animal Breeding
Course Syllabus

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Lecture Hours: Tue. 10-11:45am   Lab Hours: Tue. 1-3pm
Office: 1223-146   Class Room: 5128-217
Office Hours: Mon. 3-4pm   Project week: Nov. 30 - Dec. 6

Course Description

The goal of this course is to introduce the students the principles of linear models in animal breeding, with focus on various statistical models and methods for estimation of variance components and genetic/genomic prediction. In particular, this course will acquaint the students with the hands-on data analyzing skills using R and the prepared data sets, which can help to understand the logic behind the algorithms.

Remember that your personal computer will be your main tool of learning and exercise during our course. In order to start our course with everyone's computers ready to get our hands on the programming, make sure to have R or RStudio installed and running. Both are free.

Download R: https://cran.r-project.org
Download RStudio: https://posit.co/download/rstudio-desktop/

Absalon

Course information, slides/notes (available before the class), exercises, and solution (available after the class) files will be on the Github: https://github.com/hongdinggao/LMAB2024

Reference book: Raphael A. Mrode (2013). Linear models for the prediction of animal breeding values. 3rd edition. CABI international. Some of the exercises are from this book.

Prerequisites

A basic introduction on Quantitative Genetics.

Lecture Outline

1. Matrix algebra and R basics

2. Introduction to breeding value estimation

3. Relationship matrix and its inverse

4. Best linear unbiased prediction

5. Animal model, single-trait model, repeated observations

6. Multi-trait models, maternal effects model

7. Genomic selection in animal breeding

8. SNP-BLUP model, Genomic-BLUP

9. Single-step GBLUP model

10. Industrial presentation, analysis of a real data set

11. Estimation of variance components

Final exam

The exam is a combination of written and oral exam. The written part is the project report and should be handed in and accepted one week before the oral exam. The oral exam is a discussion based on the project report. The student presents the project report in 5 minutes and the examiner and censor asks questions. The exam is expected to take 30 minutes per student. All exams are individual.

Intended learning outcomes

After completing the course, we hope you will have achieved the following learning goals:

- Explain how breeding value estimation is applied in animal breeding

- Familiar with the common data stucture present in animal genetic prediction

- Set up the mixed model equations using R code for small data sets

- Identify tradeoffs when using various methods/models for genetic prediction

- Interpret the differences between traditional pedigree-based genetic prediction and genomic prediction

- Apply and modify R code to analyze their own data