

Genetic Prediction Course Syllabus

Fall 2017

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Prerequisites: Selection Index Theory and Application
Linear Models in Animal Breeding
or equivalent (equivalency granted via instructor's written/email approval)

Schedule and Credit

This on-line course will begin on Monday, September 25 and last 5 weeks. The ending date for the course is October 27 (final exam completion due the following week).

The content of the course is consistent with a one-credit graduate level course.

Course Goal

The goal of this module is to extend the concepts learned in Selection Index Theory and Application and Linear Models in Animal Breeding to increase student understanding of best linear unbiased prediction and to develop skills in genetic prediction.

A wide array of material will be covered with emphasis on real-world datasets designed to develop applied analytical skills relative in animal breeding. Topics will include data integrity diagnosis, contemporary grouping strategies, adjusting for known non-genetic effects, the AWK Programming Language, UNIX/Linux scripting, and use of the Animal Breeder's Toolkit to perform genetic evaluations. Students will develop procedures for the utilization of various sources of information for the calculations of predictions of genetic merit in the form of estimated breeding values.

Course Access

Access to course will be through the Colorado State University Canvas online learning system via the URL <http://info.canvas.colostate.edu/login.aspx>

Lectures and material presented via:

- Adobe Presenter
- Camtasia

Academic Integrity:

In this course students will be expected to abide by the honor code of Great Plains IDEA and Colorado State University as outlined below.

Colorado State University expects students to maintain standards of personal integrity that are in harmony with the educational goals of the institution; to observe national, state, and local laws, and University regulations; and to respect the rights, privileges, and property of other people (see Students' Responsibilities, Academic Integrity; <http://catalog.colostate.edu/general-catalog/policies/students-responsibilities/#academic-integrity>). The Great Plains IDEA (Ag*IDEA) integrity statement can be accessed at http://www.gpidea.org/policy-procedure/appendices/appendix_e13.pdf

We take academic integrity seriously. At a minimum, to achieve academic integrity no one will use another's work as his/her own. The CSU writing center defines plagiarism in this manner:

Plagiarism is the unauthorized or unacknowledged use of another person's academic or scholarly work. Done on purpose, it is cheating. Done accidentally, it is no less serious. Regardless of how it occurs, plagiarism is a theft of intellectual property and a violation of an ironclad rule demanding "credit be given where credit is due."

Source: (Writing Guides: Understanding Plagiarism.

<http://writing.colostate.edu/guides/researchsources/understandingplagiarism/plagiarismoverview.cfm>. Accessed, January 15, 2009)

Course Outline/Objectives:

- I. Introduction and Discussion of Course Goals
- II. Why genetic prediction?
 - a. Factors influencing rate of genetic change
 - b. EPD versus EBV
 - c. Properties of
 - i. Selection Index
 - ii. BLUP

Upon completion of this lesson, learners will be able to:

1. Identify the factors that influence the rate of genetic change
2. Recognize how genetic prediction impacts the rate of genetic change
3. Recognize the properties of selection index when used for genetic prediction
4. Recognize the properties of BLUP and why it is the preferred method for genetic prediction

III. Introduction to
a. Unix/Linux Commands
b. Animal Breeder's Tool Kit

Upon completion of this lesson, learners will be able to:

1. Use basic Unix/Linux commands to navigate and modify files
2. Use commands associated with the Animal Breeder's Tool Kit to manipulate large matrices

IV. Performing Genetic Prediction—The Issues and Procedures
a. Data sifting
b. Incidence matrices
c. Assembling the MME
d. Multi-component evaluation
i. Genetic covariances

Upon completion of this lesson, learners will be able to:

1. Recognize common deficiencies in field datasets
2. Use the ABTK to construct incidence matrices for large field data sets
3. Use basic Unix/Linux commands to navigate and modify files
4. Develop strategies to define contemporary groups
5. Recognize the impact of changing genetic and residual covariances on the direct and maternal components of a maternally influenced trait.

V. Considerations in Genetic Evaluation
a. Adjustments –pre-adjustment versus including in the model
b. Contemporary groups
c. Accuracy
d. Influence of heritability on the analysis

Upon completion of this lesson, learners will be able to:

1. Calculate accuracies from a genetic evaluation
2. Identify differences between various definitions of accuracy
3. Recognize the effect of heritability on accuracy

COURSE SCHEDULE

Course material will be made available on a weekly basis. This pacing is intended to maintain course continuity by engaging all students in the same material at the same time.

Week	Beginning Date	Activities	Assignments
Week One	September 25	<p>Introduction and Course Goals</p> <ul style="list-style-type: none"> • online audio presentation <p>Why Genetic Prediction?</p> <ul style="list-style-type: none"> • Online audio presentation 	<p>Listen to the two Audio-Presentations related to this week's topics by Fri., September 29</p> <p>Make a posting to the Discussions by Friday, Sept. 29 @ 10:00 p.m. MST</p> <p>Complete Quiz #1 by Tues., Oct. 3, 10:00 p.m. MST</p>
Week Two	Oct. 2	<p>Introduction to Linux</p> <ul style="list-style-type: none"> • online audio presentation <p>The AWK Programming Language</p> <ul style="list-style-type: none"> • online audio presentation <p>Performing the Genetic Prediction—Part 1</p> <ul style="list-style-type: none"> • online audio presentation <p>First Homework Assignment posted Friday, October 6</p>	<p>Listen to the three Audio-Presentations related to this week's topics and make Discussions posting by Fri., Oct. 6 @ 10pm, MST</p> <p>Complete Quiz #2 by Tues., Oct. 10, 10pm, MST</p>

Week	Beginning Date	Activities	Assignments
Week Three	Oct. 9	<p>Performing the Genetic Prediction—Part 2</p> <ul style="list-style-type: none"> • online audio presentation <p>Building NRM</p> <ul style="list-style-type: none"> • online audio presentation <p>Homework Assignment #2 Posted Oct 13</p>	<p>Listen to the two Audio-Presentations related to this week's topics and make a Discussions Posting by Fri., Oct. 13</p> <p>Submit first Homework Assignment by Friday, October 13, 10pm, MST</p>
Week Four	Oct. 16	<p>The Maternal Effects Model</p> <ul style="list-style-type: none"> • online audio presentations <p>Associating Dams with Progeny Observations</p> <ul style="list-style-type: none"> • online audio presentations 	<p>Listen to the two Audio-Presentations related to this week's topic and make a Discussions Posting by Fri., October 20</p> <p>Complete Quiz #3 by Tues., Oct. 24, 10pm, MST</p>
Week Five	Oct. 23	<p>Considerations in Genetic Evaluation</p> <ul style="list-style-type: none"> • online audio presentation 	<p>Listen to the single Audio-Presentations related to this week's topics and make a Discussions posting by Fri., October 27</p> <p>Submit second Homework Assignment by Friday, October 27, 10pm, MST</p> <p>Complete Final Exam by Friday, Nov. 3, 10pm, MST</p>

TEXTBOOK

No textbook is required for the course, although the following book is recommended as a useful reference:

Mrode, R. A. 2005. Linear Models for the Prediction of Animal Breeding Values, 2nd Edition. CAB International, Wallingford, Oxfordshire, UK (ISBN 0 85199 000 2) (*the most recently released version, will work as well*)

Appropriate refereed journal articles

TOOLS REQUIRED

You will need a current version of Flash Player installed on your computer to “see” the audio-presentations. You will also need Adobe Acrobat Reader to view Portable Document Files (PDF) contained within the course. You will also need to be able to create PDF files for homework assignments. This process can be accomplished within Microsoft Office software through the Print menu. If you choose a different software package to complete your homework assignment, you may need the full version of Adobe Acrobat to create a PDF of your work.

I will also be using audio-visual presentations in an mp4 format. As such you will need access to a mp4 viewer such as Quick Time.

There are also several other small pieces of software needed to gain access to one of the Colorado State University Center for Genetic Evaluation of Livestock’s computers. This makes the Animal Breeder’s Tool Kit available for completion of the homework. These will be outlined as needed.

FORM OF ASSESSMENT

Students will be evaluated based on their performance on:

- three *on-line quizzes* (worth in total 30% of grade);
- a weekly submission to the *Discussions* (worth 10% of the total grade);
- two *homework assignments* the first due at the end of week three of the course, and the second Thursday of week 5 (worth 30% of the total grade); and,
- and on-line *final exam* at the end of the module (worth 30% of grade).

Discussions. You are expected to make one posting to the Discussions each week. Each week’s activity is worth 2% of your grade.

The purpose of the Discussions is to provide for the interaction of students in the course as a means of enhancing your learning. These posting will be related to the learning objectives for each week.

Each week, questions will be posted by an Instructor on the course Discussions on Canvas. You should respond to these postings, and/or preferably begin your own discussion thread. You are not limited to a single posting per week on the Discussions and more interaction is encouraged.

You are expected to make one posting to the Discussions each week. Each week’s posting is worth 2% of your grade, and is due each Friday by 10:00 p.m. Mountain time.

On-line quizzes. One half hour will be allowed for each on-line quiz. These must be completed individually during the time period announced. These quizzes will focus on material presented that week. You may use your class notes for these quizzes. Each on-line quiz is worth 10% of your grade.

Each weeks' quiz will be available by 7:00 p.m. Mountain time on Thursday. The quiz must be taken by 10:00 p.m. Mountain time on the subsequent Tuesday.

Homework assignment. Your homework assignments will involve developing and running your own single trait BLUP model to calculate breeding values for a real Angus population with nearly 60 years of pedigree and performance data. You are permitted, even encouraged, to discuss your homework assignment with other students in the course. However, you must write and submit your own homework assignment. Instructions on how to submit your homework assignments online will be released with the homework assignment.

Final exam. Two hours will be allowed for the final exam, which will be taken on-line. The exam must be completed individually during the time period announced. The final exam will cover material from the entire module. You may use your class notes for this exam.

The final exam will be available by 5:00 p.m. Mountain time on Friday, October 27. The final must be taken by 10:00 p.m. Mountain time on Friday, Nov. 3.

STUDENT EVALUATION OF COURSE

There will be opportunities at the end of the course for you to evaluate the instruction, flow and content. These evaluations will be entirely anonymous

GRADING

Your final grade will be determined by the number of credits (expressed as percentages) you earn over the five-week course. You are assured of earning a final grade within a category shown below by earning the number of credits specified.

Credits	Grade category
90-100%	A
80-89%	B
70-79%	C
60-69%	D
< 60%	F

The professor reserves the right to curve the course based on overall class performance. The curve will never be more strict than that listed above.