Institution Name: University of Wisconsin-Madison
Course Subject, Number and Title: AGRONOMY/GENETICS/HORT 957 Seminar-Plant Breeding (Seminar)
Credits (#): 1
Canvas Course URL: https://canvas.wisc.edu/courses/81468 (probably not used)
Course Designations and Attributes: NA
Meeting Time and Location: Friday 3:30-4:30pm Moore/PISci 351
Instructional Mode: face-to-face
Specify how Credit Hours are met by the Course: One hour per week contact plus two hours outside preparing for in-class presentation.
Instructor Title and Name: Professor Brian Yandell & Professor Karl Broman
Instructor Availability: Yandell and Broman are available by appointment or email
Instructor Email/Preferred Contact: brian.yandell@wisc.edu, kbroman@biostat.wisc.edu
Teaching Assistant: NA

Course Description: The overarching topic for this semester is QTL Mapping in Experimental Populations. Students either sign up for a topic-based or research presentations. We particularly encourage those with QTL mapping as part of their research to consider focusing on some aspect of QTL analysis. Here is a list of suggested topics, roughly in the order that makes sense for presentation (although we will likely introduce R/qtl early):

Requisites: For graduate students in the Plant Breeding & Plant Genetics PhD Program.

Course Learning Outcomes
- **Knowledge and Skills**
  - Articulates research problems, potentials, and limits with respect to knowledge within the field of plant breeding and plant genetics.
  - Formulates ideas, concepts, designs, and/or techniques beyond the current boundaries of knowledge within the field of plant breeding and plant genetics.
  - Creates research that makes a substantive contribution.
  - Demonstrates breadth within their learning experiences.
  - Advances contributions of the field of plant breeding and plant genetics to society.
  - Communicates complex ideas in a clear and understandable manner.
- **Professional Conduct**
  - Fosters ethical and professional conduct.

Grading
Grading is based on attendance (10%), participation in discussion (20%) and quality of presentation and accompanying materials (70%).
**Suggested topics**
This seminar will work best if concepts are illustrated and grounded with data analysis and graphics. Sample data sets are indicated below;

- What is QTL mapping?
  - relation of genotype to phenotype across genome
  - genome scans
- How can we use R/qtl tools for QTL mapping?
  - linkage map diagnostics
  - model selection for multiple QTLs
  - estimating genetic effects and heritability
  - covariates and design considerations
- QTL mapping for multiparent experimental populations
  - What are the challenges and opportunities with?
  - How does R/qtl2 scale up to these larger crosses?
- Tour of available datasets (see Sample Datasets below)
- Tour of available packages
  - R/qtl: see brief or shorter tour under Tutorials
  - R/qtl2: see User Guide and Differences between R/qtl & R/qtl2
  - Kyazma/MapQTL/JoinMap
  - GeneNetwork & GeneNetwork2

**Sample Datasets**

- listeria sample dataset in R/qtl package
- grav2 & iron sample datasets in R/qtl2geno package
- DO mouse data (Dan Gatti)
- Example data in R/qtl2data
  - B6BTBR F2
  - DO from Gatti and Recla
  - Gough x WSB F2
- other data?

**Selected References**

- more QTL references
  - Overview: Tanksley (1993); Lander, Schork (1994); Basten, Weir, Zeng (1995); Paterson (1995); Doerge, Zeng, Weir (1997); Kearsley, Farquhar (1998); Broman (2001); Mackay (2001a,b); Mauricio (2001); Asins (2002); Boake et al. (2002); Phillips, Belknap (2002); Hackett (2003); FAO (2004); Collard et al. (2005); Swertz, Jansen (2007); Stein (2008); Xu, Crouch (2008)
The following are mostly about multiparental families

- **Magic Web talk (Broman 2013, MAGIC Workshop, Cambridge)**
- **Genetics.org Multiparental Populations site**
- **mouse**
  - The Diversity Outbred mouse population (Mamm Genome 2012)
  - High-resolution genetic mapping using the Mouse Diversity outbred population (Genetics 2012)
  - Quantitative trait locus mapping methods for diversity outbred mice (G3 2014)
- **plants**