STA 6178 Genetic Data Analysis

Syllabus Spring 2000 Syllabus
(3 Credits)

Instructor
Rongling Wu
Department of Statistics
533 McCarty Hall C
University of Florida
Gainesville, FL 32611

Phone: (352)392-3806
Fax: (352)392-8555
Email: rwu@stat.ufl.edu

Times and Locations
11:45 am – 12:35 pm Tuesday 230 FLO
12:50 pm – 1:40 pm Tuesday 230 FLO
12:50 pm – 1:40 pm Thursday 242 LEI

Textbook

(1) Lecture Notes

(2) Well, J. I., 2001 Quantitative Trait Loci Analysis in Animals, CABI Publishing (recommended).

Scope
This is a graduate course at the Master's level in the Department of Statistics. It is also appropriate for graduate students in agricultural, biological, medical and veterinary sciences with mathematical and statistical background (e.g., STA 6327). By taking this course, students in statistical sciences will find it interesting to apply their statistical expertise to solve genetic problems, whereas students in biological sciences will find a useful statistical tool to enhance their genetic research. Students with a diversity of scientific interests will find that they are virtually close enough to promote sciences and technologies at the University of Florida or anywhere else.

Topics of this course include: (1) Basic genetics for statisticians, (2) Basic statistics for geneticists, (3) Linkage analysis and genetic map construction using molecular markers, (4) Genetic mapping of complex traits by the EM algorithm, (5) Mapping QTL with different experimental designs, (6) Microarray data analysis, and (7) The future direction of statistical genetics/genomics.

1 **Basic Genetics**
Genes, genotypes, and phenotypes
Mendel's laws
Chromosomes and linkage
Experimental designs
Molecular markers
Genetic maps
QTL mapping

2 **Basic Statistics**
Data structure
Experimental designs
Chi-square tests
Mixture model
Regression analysis
EM algorithm
Bayesian statistics

3 **Segregation, Linkage and Map**
Testing Mendelian segregation
Linkage anlysis
Map functions
Construction of a linkage map

4 **Mixture Model in QTL Mapping**
Structures of a mixture model
Mixture proportions–Gene segregation
Mixture normals–Genetic model
Parameter estimation

5 **Regression Mapping Approach**
One-QTL model
Two-QTL model

6 **Maximum Likelihood Mapping Approach**
Genetic model
Maximum likelihood analysis
EM algorithm
Likelihood ratio test statistic
Threshold determination
Permutation test

7 **Composite Mapping Approach**
The formulation of problems
A composite model of regression and ML
Propositions
Marker selection
Advantages and disadvanrages

8 **Bayesian Mapping Approach**
Will not teach in this course

9 **QTL Mapping in Natural Populations**
Population strcucture
Linkage disequilibrium
A combined linkage and linkage disequilibrium analysis

10 **Special Issues of Genome Mapping**
(a focus of our research projects, but not a focus of this course)
Distorted markers
Full-sib family mapping
High-resolution mapping
Multi-family mapping
Multi-trait mapping
Genotype × environment interaction mapping
Epistasis mapping
Endosperm mapping
Megagametophyte mapping
Polyploid mapping
Genome mapping based on biological laws

11 **Microarray Data Analysis**

12 **Future Direction**