

Course Title: M 21-621 Computational Statistical Genetics

Coursemaster: Michael A Province, Ph.D.

Dates & time(s): Spring 2020 (Jan 14-May 5); Tues and Thurs (9:00-10:30am)

Place: Lectures in Room 502, Division of Biostatistics, Becker Library (*Computer Labs in Room 501)

Objectives: Learn statistical computational techniques in Statistical Genetics/Genetic Epidemiology, emphasizing statistical models, algorithms and programming. How to develop/implement your own algorithm.

Format: Lectures, labs, work through practical term projects programming (in SAS, R, etc.).

Recommended Text (NOT required): Kenneth Lange *Mathematical and Statistical Methods for Genetic Analysis Second Edition*, Springer, New York, 2002

Recommended CD/Web (NOT required): Henry Stewart Talks on Web

<http://www.hstalks.com/access> (Login/Password given in Class)

Grade Criteria: Numerical score based on: Term Projects (75%); Homework (25%), **[NO Final Exam]**

Contacts: Primary Faculty: Michael Province mprovince@wustl.edu; Warwick Daw warwick.daw@wustl.edu; Jason Anema: jasona@wustl.edu; (TA Christy Hoffman: cmhoffmann@wustl.edu)

Topic	Instructor(s)	Tues	Thurs
Overview of Course & "Historical Origin of P<0.05 Significance"	Michael Province	Jan 14	
*Computer Lab: Description & Assignment of Term Project Problems	Province/Daw/Anema		Jan 16
Linkage vs. Association: What's the Difference?	Michael Province	Jan 21	
Maximum Likelihood (ML) Theory	Michael Province		Jan 23
ML: Newton-Raphson maximization & E-M Algorithm	Michael Province	Jan 28	
ML: Generalized Linear Association Models	Michael Province		Jan 30
ML: Permutation, Randomization Tests	Michael Province	Feb 4	
ML: Rare-Variant Association Score & Burden Tests	Michael Province		Feb 6
Epigenetic Analysis Methods	Bo Zhang	Feb 11	
*Computer Lab: Work on Term Projects	Province/Daw/Anema		Feb 13
ML: Pedigree Likelihoods, Commingling, Segregation, Linkage Models	Michael Province	Feb 18	
Power and Monte Carlo Simulations	Michael Province		Feb 20
Missing Data, Imputation, Ascertainment Bias	Michael Province	Feb 25	
Multiple Comparisons Corrections	Michael Province		Feb 27
*Computer Lab: Work on Term Projects	Christy Hoffman (TA)	Mar 3	
Meta Analysis Methods	Michael Province		Mar 5
Spring Break (NO CLASS)		Mar 10	Mar 12
Information Theory, Relation to Likelihood Theory, and Model Selection	Michael Province	Mar 17	
Bayesian and MCMC Methods	Warwick Daw		Mar 19
Coalescent Theory	Warwick Daw	Mar 24	
*Computer Lab: Work on Term Projects	Province/Daw/Anema		Mar 26
Decision Trees, Random Forests, Neural Nets	Jason Anema	Mar 31	
Hidden Markov Models	Warwick Daw		Apr 2
Graphical Models	Jason Anema	Apr 7	
*Computer Lab: Work on Term Projects	Province/Daw/Anema		Apr 9
Cancer Genomics and Somatic Mutations	Chris Miller/Li Ding	Apr 14	
Haplotyping Algorithms	Warwick Daw		Apr 16
*Computer Lab: Work on Term Projects	Province/Daw/Anema	Apr 21	
*Computer Lab: Work on Term Projects	Province/Daw/Anema		Apr 23
Final Term Project Presentations (NO Final Exam)	Michael Province/ Warwick Daw/ Jason Anema	Apr 28 May 5	Apr 30

*Labs are in Room 501