BST-Biostatistics

BST 601. Biostatistics. 4 Hours.
Logic and language of scientific methods in life science research; use of basic statistics in testing hypotheses and setting confidence limits. Simple and multiple regression and elementary experimental designs. BST 601 is a 4-credit course for MPH students. There are no formal prerequisites for this course; however, familiarity and comfort with basic mathematical concepts is essential. The minimum technical skills required include the ability to use Adobe Acrobat, Word, Excel, and PowerPoint. If you are deficient in any of these areas, it is your responsibility to improve your skills before starting the course.

BST 603. Introductory Biostatistics for Graduate Biomedical Sciences. 3 Hours.
This course will utilize current statistical techniques to assess and analyze health science related data.

BST 611. Intermediate Statistical Analysis I. 3 Hours.
Students will gain a thorough understanding of basic analysis methods, elementary concepts, statistical models and applications of probability, commonly used sampling distributions, parametric and non-parametric one and two sample tests, confidence intervals, applications of analysis of two-way contingency table data, simple linear regression, and simple analysis of variance. Students are taught to conduct the relevant analysis using current software such as the Statistical Analysis System (SAS).

BST 612. Intermediate Statistical Analysis II. 3 Hours.
This course will introduce students to the basic principles of tools of simple and multiple regression. A major goals is to establish a firm foundation in the discipline upon which the applications of statistical and epidemiologic inference will be built. If prerequisite is not met, permission of instructor is required.
Prerequisites: BST 611 [Min Grade: C]

BST 613. Intermediate Statistical Analysis III. 3 Hours.
This course will introduce students to additional general concepts in biostatistics beyond an introductory level to include study design, power and sample size estimation, mixed-models, survival analysis, survey design and interpretation of research results. Prerequisites: BST 601 or 611 and 612, or prior statistics/biostatistics course that included hypothesis testing for proportions and means, ANOVA, correlation, simple and multiple linear regression, and logistic regression (with approval of the instructor).
Prerequisites: (BST 601 [Min Grade: C] or BST 601Q [Min Grade: C] or BST 611 [Min Grade: C] or BST 611Q [Min Grade: C]) and (BST 612 [Min Grade: C] or BST 612Q [Min Grade: C])

BST 619. Data Collection and Management. 3 Hours.
Basic concepts of study design, forms design, quality control, data entry, data management and data analysis. Hands-on experience with data entry systems, e.g., DBASE, and data analysis software, e.g., PC-SAS. Exposure to other software packages as time permits. Previous computer experience or workshop on microcomputers highly recommended. NOTE: If space permits, non-degree graduate students will be permitted to enroll. All students registered for the course must attend 1st class to remain enrolled. Previous computer experience or workshop on microcomputers highly recommended.
Prerequisites: BST 601 [Min Grade: C] or BST 601Q [Min Grade: C] or BST 611 [Min Grade: C] or BST 611Q [Min Grade: C] or BST 621 [Min Grade: C]

BST 620. Applied Matrix Analysis. 3 Hours.
Vector and matrix definitions and fundamental concepts; matrix factorization and application. Eigen-values and eigen-vectors, functions of matrices, singular and ill-conditioned problems.
Prerequisites: BST 622 [Min Grade: C]

BST 621. Statistical Methods I. 3 Hours.
Mathematically rigorous coverage of applications of statistical techniques designed for Biostatistics majors and others with sufficient mathematical background. Statistical models and applications of probability; commonly used sampling distributions; parametric and nonparametric one and two sample tests and confidence intervals; analysis of two-way contingency table data; simple linear regression; simple analysis of variance designs with equal or proportional subclass members; use of contrasts and multiple comparisons procedures; introduction to survival analysis; multivariate methods. Interested students must have a year of calculus sequence before enrolling in BST 621.

BST 622. Statistical Methods II. 3 Hours.
Mathematically rigorous coverage of applications of statistical techniques designed for Biostatistics majors and others with sufficient mathematical background. Statistical models and applications of probability; commonly used sampling distributions; parametric and nonparametric one and two sample tests and confidence intervals; analysis of contingency tables; simple linear regression; simple analysis of variance designs with equal or proportional subclass members; use of contrasts and multiple comparisons procedures; introduction to survival analysis; multivariate methods.
Prerequisites: BST 621 [Min Grade: B](Can be taken Concurrently)

BST 623. General Linear Models. 3 Hours.
Simple and multiple regression using matrix approach; weighted and non-linear regression; variable selection methods; modeling techniques; regression diagnostics and model validation; systems of linear equations; factorial designs; blocking; an introduction to repeated measures designs; Coding schemes.
Prerequisites: BST 622 [Min Grade: B]

BST 624. Experimental Design. 3 Hours.
BST 624 provides intermediate level training for the design of experiments in biomedical research. It will cover classical experimental designs including factorial and nested (hierarchical) designs, Latin squares, incomplete block designs, and fractional factorials. It will use a matrix approach to analysis. In addition, it will emphasize statistical methodology and communication of procedures, results, and conclusions. Students are expected to have prior coursework in calculus and matrix algebra. Additional prerequisites include successful completion (B or higher) in either the BST 621/622 sequence or the BST 611/612 sequence.
Prerequisites: (BST 621 [Min Grade: B] and BST 622 [Min Grade: B]) or (BST 611 [Min Grade: B] and BST 612 [Min Grade: B])

BST 625. Design/Conduct Clinical Trials. 3 Hours.
Concepts of clinical trials; purpose, design, implementation and evaluation. Examples and controversies presented.
Prerequisites: (BST 611 [Min Grade: B] and BST 612 [Min Grade: B]) or (BST 611Q [Min Grade: B] and BST 612Q [Min Grade: B]) or (BST 621 [Min Grade: B] and BST 622 [Min Grade: B])

BST 626. Data Management and Reporting with SAS. 3 Hours.
This course is designed to provide an introduction to data management and reporting using the SAS system.

BST 630. Estimation & Inference. 3 Hours.
This course is an introduction to probability concepts and statistical inference. Topics include counting techniques, discrete and continuous univariate and multivariate random variables & common distributions, probability, expectation, variance, confidence intervals, the Central Limit Theorem, and hypothesis testing. Restricted to MSPH and DrPH students. Preq: Calculus II.

BST 631. Statistical Theory I. 4 Hours.
Fundamentals of probability; independence; distribution and density functions; random variables; moments and moment generating functions; discrete and continuous distributions; exponential families, marginal and conditional distributions; transformation and change of variables; convergence concepts, sampling distributions. Point and interval estimation; hypothesis and significance testing; sufficiency and completeness; ancillary statistics; maximum likelihood and moment estimators; asymptotic properties of estimators and tests; introduction to Bayesian inference. Prerequisites: Proficiency in Algebra and calculus is required.

BST 632. Statistical Theory II. 4 Hours.
Fundamentals of probability; independence; distribution and density functions; random variables; moments and moment generating functions; discrete and continuous distributions; exponential families, marginal and conditional distributions; transformation and change of variables; convergence concepts, sampling distributions. Point interval estimation; hypothesis and significance testing; sufficiency and completeness; ancillary statistics; maximum likelihood and moment estimators; asymptotic properties of estimators and tests; introduction to Bayesian inference.
Prerequisites: BST 631 [Min Grade: B]

BST 640. Nonparametric Methods. 3 Hours.
Properties of statistical tests; order statistics and theory of extremes; median tests; goodness of fit; tests based on ranks; location and scale parameter estimation; confidence intervals; association analysis; power and efficiency.
Prerequisites: BST 621 [Min Grade: C] and BST 631 [Min Grade: C]

BST 655. Categorical Data Analysis. 3 Hours.
Intermediate level course with emphasis on understanding the discrete probability distributions and the correct application of methods to analyze data generated by discrete probability distributions. The course covers contingency tables, Mantel-Haenszel test, measures of association and of agreement, logistic regression models; regression diagnostics; proportional odds; ordinal and polytomous logistic regression; Poison regression; log linear models; analysis of matched pairs; and repeated categorical data.
Prerequisites: BST 621 [Min Grade: B] and BST 622 [Min Grade: B]

BST 660. Applied Multivariate Analysis. 3 Hours.
Analysis and interpretation of multivariate general linear models including multivariate regression, multivariate analysis of variance/covariance, discriminant analysis, multivariate analysis of repeated measures, canonical correlation, and longitudinal data analysis for general and generalized linear models. Extensive use of SAS, SPSS, and other statistical software.
Prerequisites: BST 623 [Min Grade: B]

BST 661. Structural Equation Modelling. 3 Hours.
Basic principles of measurements; factor analysis and latent variable models; multivariate predictive models including mediation mechanisms and moderators effects;path analysis;intergrative mutivariate covariance models, methods of llongitudinal analysis.
Prerequisites: BST 623 [Min Grade: C]

BST 665. Survival Analysis. 3 Hours.
Kaplan-Meier estimation; Parametric survival models; Cox proportional hazards regression models; sample size calculation for survival models; competing risks models; multiple events models.
Prerequisites: BST 622 [Min Grade: B](Can be taken Concurrently)

BST 670. Sampling Methods. 3 Hours.
Simple random, stratified, cluster, ratio regression and systematic sampling; sampling with equal or unequal probabilities of selection; optimization; properties of estimators; non-sampling errors; sampling schemes used in population research; methods of implementation and analyses associated with various schemes.
Prerequisites: BST 631 [Min Grade: C]

BST 671. Meta-Analysis. 3 Hours.
Statistical methods and inference through meta analysis.
Prerequisites: BST 622 [Min Grade: C] and BST 632 [Min Grade: C]

BST 675. Introduction to Statistical Genetics. 3 Hours.
This class wil introduce students to population genetics, genetic epidemiology, microarray and proteomics analysis, Mendelian laws, inheritance, heritability, test cross linkage analysis, QTL analysis, human linkage and human association methods for discrete and quatitative traits.
Prerequisites: BST 611 [Min Grade: C] or BST 621 [Min Grade: C]

BST 676. Genomic Data Analysis. 3 Hours.
The purpose of this class is to teach graduate students practical skills and statistics concepts and methods that underlie the analysis of high-dimensional genomic big data generated by high throughput technologies, as well as issues in the experimental design and implementation of these technologies. Lectures contents will be delivered often with live demonstrations. Afterwards, students will be immersed by practical problem solving sessions. The R language will be used for programming throughout the course.
Prerequisites: BST 611 [Min Grade: B] or BST 621 [Min Grade: B]

BST 680. Statistical Computing with R. 3 Hours.
This course is mainly focused on R and how to use R to conduct basic statistical computing. The course contains three themes: R programming, introduction to high performance computing, and basics of statistical computing.
Prerequisites: BST 621 [Min Grade: C] and BST 622 [Min Grade: C] and BST 626 [Min Grade: C]

BST 685. Training in Biostatistics Teaching. 3 Hours.
Acquire skills for teaching in higher education, including syllabus design, communication skills for the classroom and office hours, creating assignments and rubrics, preparing and giving lectures, preparing nondidactic content, and effective grading. Prerequisites: Must have completed the course that you will be the TA, or similar course, in a prior semester with a grade of B or higher. Completed the Biostatistics Qualifying Exam at the applicable level, have an overall GPA of 3.0 or higher (be a student in good standing with the UAB Graduate School). Receive an invitation from the applicable faculty member to register for this course.

BST 690. Biostatistical Consulting and Applied Problems. 3 Hours.
Students will work individually to address, analyze and present the results of an applied problem or grant design each week. The presentation of approaches, solutions and designs will be conducted in a round table format. Students will be evaluated on the quality of solution and by their presentation and class participation.
Prerequisites: BST 621 [Min Grade: C] and BST 622 [Min Grade: C]

BST 691. Pre-Doctoral Seminar Series. 1 Hour.
Biostatistics Seminar Series. This course is restricted to Biostatistics in Public Health majors only. This course provides an opportunity for students to learn about ongoing research in the field of biostatistics, clinical trials, and statistical genetics.

BST 695. Special Topics. 1-3 Hour.
Special topics in Biostatistics not covered in regular 600 level courses, but suited for Masters students in Biostatistics and doctoral students in other related disciplines.

BST 698. Non Thesis Research. 1-12 Hour.
Independent non-thesis research with guidance of appropriate faculty. Restricted to Biostatistics Majors only or permission of instructor / department.

BST 703. Methods in Evidence-Based Public Health. 3 Hours.
This course introduces students to the Evidence-Based Public Health (EBPH) framework. The Evidence-Based Public Health framework will be used to collaborate with the Jefferson County Department of Health (JCDH) on; 1) identifying critical public health needs in our local area; 2) suggesting appropriate evidence-based policies and interventions to address these needs; 3) proposing an evaluation plan to assess the impact of the suggested policy or intervention.

BST 723. Theory of Linear Models. 3 Hours.
Multivariate normal distributions and quadratic forms; least square estimation; nested models; weighted least squares, testing contrasts; multiple comparison; polynomial regression; maximum likelihood theory of log linear models will be studied.
Prerequisites: BST 632 [Min Grade: B]

BST 724. Experimental Design. 3 Hours.
This course provides training for the design of experiments in biomedical research. BST 724 extends the intermediate training to delve into more theoretical justification and advanced applications. The course will cover classical experimental designs including factorial and nested (hierarchical) designs, Latin squares, incomplete block designs, fractional factorials, and mixture designs. It will use a matrix approach to analysis. In addition, it will emphasize statistical methodology and communication of procedures, results, and conclusions. BST 724 is intended for advanced graduate students in the Department of Biostatistics who have completed BST 621/622, 623, and 631/632.
Prerequisites: BST 621 [Min Grade: B] and BST 622 [Min Grade: B] and BST 623 [Min Grade: B] and BST 631 [Min Grade: B] and BST 632 [Min Grade: B]

BST 725. Advances Clinical Trails. 3 Hours.
This course will provide students with the tools to develp a basic understanding of the fundamental statistical principles involved in the design and conduct of clinical trials.
Prerequisites: BST 611 [Min Grade: C] and BST 612 [Min Grade: C] or BST 621 [Min Grade: C] and BST 622 [Min Grade: C] and BST 625 [Min Grade: C]

BST 726. Advanced Clinical Trials II. 1 Hour.
This course builds on the knowledge gained in BST 725 in order to develop a more thorough understanding of the basic methodology behind important statistical concepts used in the design and analysis of large, randomized clinical trials. The class will involve discussions of publications dealing with current topics of interest in clinical trials.
Prerequisites: BST 621 [Min Grade: C] and BST 622 [Min Grade: C] and BST 625 [Min Grade: C] and BST 631 [Min Grade: C] and BST 632 [Min Grade: C] and BST 725 [Min Grade: C]

BST 735. Advanced Inference. 4 Hours.
Stochastic convergence and fundamental inequalities; weak convergence and the central limit theorems; large sample behavior of the empirical distribution and order statistics; asymptotic behavior of estimators and tests with particular attention to LR, score and Wald tests.
Prerequisites: BST 631 [Min Grade: B] and BST 632 [Min Grade: B]

BST 740. Bayesian Analysis. 3 Hours.
To introduce the student to the basic principles and tools of Bayesian Statistics and most importantly to Bayesian data analysis techniques. A major goal is to establish a firm foundation in the discipline upon which the applications of statistical and epidemiologic inference will be built.
Prerequisites: BST 632 [Min Grade: C]

BST 741. Advanced Bayesian Analysis II. 3 Hours.
This course is intended to illustrate advanced Bayesian modeling and computation for variety of models and problems.
Prerequisites: BST 631 [Min Grade: B] and BST 632 [Min Grade: B]

BST 750. Stochastic Modeling. 3 Hours.
Poisson processes; random walks; simple diffusion and branching processes; recurrent events; Markov chains in discrete and continuous time; birth and death process; queuing systems; applications to survival and other biomedical models will be studied.
Prerequisites: BST 632 [Min Grade: C]

BST 760. Generalized Linear and Mixed Models. 3 Hours.
Generalized linear models; mixed models; and generalized estimating equations.
Prerequisites: BST 723 [Min Grade: B]

BST 765. Advanced Computational Methods. 3 Hours.
Numerical algorithms useful in biostatistics including likelihood maximization using the Newton-Raphson method, EM algorithm, numerical integration using quadratic and Monte-Carlo methods, interpolation using splines, random variate generation methods, data augmentation algorithm, and MCMC and Metropolis-Hastings algorithm; randomization tests; resampling plans including bootstrap and jackknife will be studied.
Prerequisites: BST 632 [Min Grade: B]

BST 775. Statistical Methods for Genetic Analysis I. 3 Hours.
This course will provide a staistical basis for describing variation in qualitative (disease) and quantitative traits. This will include decomposition of trait variation into components representing genes, environment and gene-environment interaction. Resemblance between relative and heritability will be described. Important topics of discussion will include oligogenic and polygenic traits, complex segregations analysis, methods of mapping and characterizing simple and complex trait loci. NOTE: It is assumed that students are comfortable with regression theory, covariance, correlation, and likelihood theory. Interested students are urged to contact the instructors with concerns regarding assumed knowledge.
Prerequisites: BST 623 [Min Grade: C] and BST 632 [Min Grade: C] and BST 675 [Min Grade: C]

BST 776. Statistical Methods for Genetic Anlaysis II. 3 Hours.
This course builds on the knowledge gained in BST 775 with rigorous mathematical & statistical treatment of methods for localizing genes and environmental effects involved in the etiology of complex trits using case-control and pedigree data. NOTE: Knowledge of SAS and programming languages such as C++, and basic knoledge of multivariate methods and Markov chain theory is highly recommended.
Prerequisites: BST 775 [Min Grade: C]

BST 790. DrPH Applied Practice Experience. 3-6 Hours.
All DrPH students will complete an applied practice experience (Practicum) in which the student will complete at least one project that is meaningful for a public health organization and to advanced public health practice.

BST 793. Post-doc Seminar Series. 3 Hours.
BST seminar series. Permission of instructor / department required.

BST 795. Advanced Special Topics. 1-6 Hour.
This course is designed to cover advanced special topics in Biostatistics that are not covered in regular 700 level courses, but suited for doctoral students in Biostatistics.
Prerequisites: BST 622 [Min Grade: B] and BST 632 [Min Grade: B]

BST 798. Non-Dissertation Research. 1-12 Hour.
Non-dissertation research with the guidance of appropriate faculty. Research conducted before admission to candidacy for the doctoral degree. Biostatistics majors only or permission of instructor / department required.

BST 799. Dissertation Research. 1-12 Hour.
Doctoral Level Dissertation Research under the direction of the dissertation research committee. Reserved for Biostatistics only or permission of instructor /department. Admission to Candidacy required.
Prerequisites: GAC Z