Biostatistics (BIST)

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5099. Investigation of Special Topics

(Also offered as STAT 5099.) Variable (1-6) credits. Prerequisite: Open only to Biostatistics graduate students; instructor consent required. May be repeated for credit.

5125. Computing for Statistical Data Science

(Also offered as STAT 5125.) Three credits. Prerequisite: Instructor consent and introductory course in mathematical and applied statistics; introductory course in programming.

Principles and practice of statistical computing in data science: data structure, data programming, data visualization, simulation, resampling methods, distributed computing, and project management tools.

5215. Statistical Consulting

(Also offered as STAT 5215.) Three credits. Prerequisite: At least two of BIST/STAT 5315, 5505, or 5605; or instructor consent.

Applied inference for academia, government, and industry: ethical guidelines, observational studies, surveys, clinical trials, designed experiments, data management, aspects of verbal and written communication, case studies.

5225. Data Management and Programming in R and SAS

(Also offered as STAT 5225.) Three credits. Prerequisite: STAT 5505 and 5605; or instructor consent.

Creation and management of datasets for statistical analysis: software tools and databases, user-defined functions, importing/exporting/manipulation of data, conditional and iterative processing, generation of reports.

5361. Statistical Computing

(Also offered as STAT 5361.) Three credits. Prerequisite: Open only to Biostatistics graduate students; instructor consent required.

Use of computing for statistical problems; obtaining features of distributions, fitting models and implementing inference. Basic numerical methods, nonlinear statistical methods, numerical integration, modern simulation methods.

5505. Applied Statistics I

(Also offered as STAT 5505.) Three credits. Prerequisite: Open only to Biostatistics graduate students; instructor consent required.

Exploratory data analysis: stem-and leaf plots, Box-plots, symmetry plots, quantile plots, transformations, discrete and continuous distributions, goodness of fit tests, parametric and non-parametric inference for one sample and two sample problems, robust estimation, Monte Carlo inference, bootstrapping.

5515. Design of Experiments

(Also offered as STAT 5515.) Three credits. Prerequisite: STAT 5005 or graduate student in Biostatistics. Not open for credit to students who have passed STAT 3515Q.

One way analysis of variance, multiple comparison of means, randomized block designs, Latin and Graeco-Latin square designs, factorial designs, two-level factorial and fractional factorial designs, nested and hierarchical designs, split-plot designs.

5525. Sampling Theory

(Also offered as STAT 5525.) Three credits. Prerequisite: Open only to Biostatistics graduate students; instructor consent required.

Sampling and nonsampling error, bias, sampling design, simple random sampling, sampling with unequal probabilities, stratified sampling, optimum allocation, proportional allocation, ratio estimators, regression estimators, super population approaches, inference in finite populations.

5535. Nonparametric Methods

(Also offered as STAT 5535.) Three credits. Not open to students who have passed STAT 4875.

Theory and applications of statistical methods for analyzing ordinal, non-normal data: one and multiple sample hypothesis testing, empirical distribution functions and applications, order statistics, rank tests, efficiency, linear and nonlinear regression, classification.

5585. Mathematical Statistics I

(Also offered as STAT 5585.) Three credits. Prerequisite: Open only to Biostatistics graduate students; instructor consent required.

Introduction to probability theory, transformations and expectations, moment generating function, discrete and continuous distributions, joint and marginal distributions of random vectors, conditional distributions and independence, sums of random variables, order statistics, convergence of a sequence of random variables, the central limit theorem.

5605. Applied Statistics II

(Also offered as STAT 5605.) Three credits. Prerequisite: Open only to Biostatistics graduate students; instructor consent required.

Analysis of variance, regression and correlation, analysis of covariance, general liner models, robust regression procedures, and regression diagnostics.

5615. Categorical Data Analysis

(Also offered as STAT 5615.) Three credits. Prerequisite: STAT 5505 and 5605; or instructor consent.

Statistical analysis of data on a nominal scale: discrete distributions, contingency tables, odds ratios, interval estimates, goodness of fit tests, logistic/probit/complementary log-log regression, Poisson-related regression.

5625. Introduction to Biostatistics

(Also offered as STAT 5625.) Three credits. Prerequisite: Open only to Biostatistics graduate students; instructor consent required.

Rates and proportions, sensitivity, specificity, two-way tables, odds ratios, relative risk, ordered and non-ordered classifications, rends, case-control studies, elements of regression including logistic and Poisson, additivity and interaction, combination of studies and meta-analysis.

5635. Clinical Trials

(Also offered as STAT 5635.) Three credits. Prerequisites: Open only to Biostatistics graduate students; instructor consent required.

Basic concepts of clinical trial analysis; controls, randomization, blinding, surrogate endpoints, sample size calculations, sequential monitoring, side-effect evaluation and intention-to-treat analyses. Also, experimental designs including dose response study, multicenter trials, clinical trials for drug development, stratification, and cross-over trials.

5645. Concepts and Analysis of Survival Data

(Also offered as STAT 5645.) Three credits.

Survival models, censoring and truncation, nonparametric estimation of survival functions, comparison of treatment groups, mathematical and graphical methods for assessing goodness of fit, parametric and nonparametric regression models.

5655. Epidemiology

(Also offered as STAT 5655.) Three credits. Prerequisite: Open to graduate students in the Department of Statistics; others with consent.

The statistical study of health and illness in human and veterinary populations: epidemiological study designs, measures of disease frequency/effect/potential impact, selection and information biases, confounding, stratified analysis.

5665. Applied Multivariate Analysis

(Also offered as STAT 5665.) Three credits. Prerequisite: Open only to Biostatistics graduate students; instructor consent required.

Multivariate normal distributions, inference about a mean vector, comparison of several multivariate means, principal components, factor analysis, canonical correlation analysis, discrimination and classification, cluster analysis.

5675. Bayesian Data Analysis

(Also offered as STAT 5675.) Three credits. Prerequisite: STAT 5585 and 5685; or instructor consent.

Theory of statistical inference based on Bayes' Theorem: basic probability theory, linear/nonlinear, graphical, and hierarchical models, decision theory, Bayes estimation and hypothesis testing, prior elicitation, Gibbs sampling, the Metropolis-Hastings algorithm, Monte Carlo integration.

5685. Mathematical Statistics II

(Also offered as STAT 5685.) Three credits. Prerequisite: Open only to Biostatistics graduate students; instructor consent required.

The sufficiency principle, the likelihood principle, the invariance principle, point estimation, methods of evaluating point estimators, hypotheses testing, methods of evaluating tests, interval estimation, methods of evaluating interval estimators.

5705. Statistical Methods in Bioinformatics

(Also offered as STAT 5705.) Three credits. Prerequisite: STAT 5505 and 5585; or instructor consent.

Statistical methods and software tools for the analysis of biological data: sequencing methods; gene alignment methods; expression analysis; evolutionary models; analysis of proteomics, metabolomics, and methylation data; pathway analysis: gene network analysis.

5725. Linear Models I

(Also offered as STAT 5725.) Three credits. Prerequisite: Open only to Biostatistics graduate students; others with instructor consent.

Linear and matrix algebra concepts, generalized inverses of matrices, multivariate normal distribution, distributions of quadratic forms in normal random vectors, least squares estimation for full rank and less than full rank linear models, estimation under linear restrictions, testing linear hypotheses.

5735. Linear Models II

(Also offered as STAT 5735.) Three credits. Prerequisite: BIST/STAT 5505, 5605, and 5725; open to Ph.D. students who have passed the Ph.D. Qualifying Exam in Statistics; others with permission.

Multiple comparisons, fixed effects linear models, random-effects and mixed-effects models, generalized linear models, variable selections, regularization and sparsity, support vector machines, additive models and Bayesian linear models.

5815. Longitudinal Data Analysis

(Also offered as STAT 5815.) Three credits. Prerequisite: STAT 5505 and 5605; or instructor consent.

Statistical theory and methodology for data collected over time in a clustered manner: design of experiments, exploratory data analysis, linear models for continuous data, general linear models for discrete data, marginal and mixed models, treatment of missing data.

5825. Applied Time Series

(Also offered as STAT 5825.) Three credits. Prerequisite: Open only to Biostatistics graduate students; instructor consent required.

Introduction to prediction using time-series regression methods with non-seasonal and seasonal data. Smoothing methods for forecasting. Modeling and forecasting using univariate autoregressive moving average models.

5915. Statistical Data Science in Action

(Also offered as STAT 5915.) Three credits. Prerequisite: STAT 5405 or instructor consent.

Real-world statistical data science practice: problem formulation; integration of statistics, computing, and domain knowledge; collaboration; communication; reproducibility; project management.

6494. Seminar in Applied Statistics

(Also offered as STAT 6494.) Variable (1-6) credits. Prerequisite: Open only to Biostatistics graduate students, instructor consent required. May be repeated for credit.

6615. Statistical Learning and Optimization

(Also offered as STAT 6615.) Three credits. Prerequisite: Instructor consent and intermediate courses in mathematical and applied statistics.

Computationally intensive statistical learning methods with optimization techniques: classification, discriminant analysis, (generalized) additive models, boosting, regression trees, regularized regression, principal components, support vector machines, and (deep) neural networks.