



# Statistics—BS/MS Integrated Program

Statistics is a scientific discipline by which statisticians assist other scientists and researchers in making informed decisions in the face of uncertainty. Statisticians use skills in a variety of areas to solve problems. The application of statistics is the embodiment of the scientific method.

The Statistics BS/MS Integrated Program prepares outstanding students for successful and productive careers. The graduate curriculum is designed to equip students with decision-making skills necessary for successful careers as professional statisticians. Although a firm foundation in theoretical statistics is provided, most of the courses are applied in nature, offering approaches to the solution of important real-world problems.

The Statistics BS/MS Integrated program allows well-prepared students to complete both degree programs efficiently and at lower tuition cost.

## Admission Requirements

Applicants must be on track to receive their Bachelor's degree in Statistics from BYU in the Statistics or Biostatistics emphasis with a minimum 3.3 GPA.

Students must complete Stat 336 and University Core requirements before applying. The Statistics BS/MS Integrated Program is best for students who have only six courses left until completion of a Bachelor's degree. Math 214 is recommended. Acceptance into the Integrated Track is required before students can enroll in graduate courses.

## Profile of MS Students Admitted Fall 2009

Mean GPA: 3.75

Mean GRE: Q-765, V-535, A-4.5

## Bachelor's Degree Requirements

- Introductory Statistics
- Stat 336, 337
- Math 112, 113, 214, 343
- 31 credit hours from Statistics or Biostatistics emphasis

## Master's Degree Requirements

- Thesis or Project (including final oral examination)
- Required courses: Stat 535, 536, 624, 641, 642 and 9 hours of 600-level Statistics courses
- Comprehensive written examination covering Stat 535, 536, 641, and 642
- C+ or better in each class with a cumulative 3.0 GPA in all MS degree classes

## 100% Post-graduation Placement\*

### 78% Employment (median starting salary \$60,000) at

Battelle—Columbus  
First National Bank of Omaha  
Monsanto Co.  
Pacific Northwest National Laboratory  
Alliant Techsystems (ATK)  
Overstock.com  
LDS Church  
Edison Media Research  
Hallmark  
University of Utah School of Medicine  
Quintiles  
TiVo

### 22% Pursue Doctoral Degree at

Harvard  
Carnegie Mellon  
Duke  
Iowa State  
Texas A&M  
UNC-Chapel Hill  
North Carolina State  
U.C. Santa Cruz  
Ohio State (College of Medicine, MD)

\*Last 5 years

## To Apply

Students must submit the Department Application for Integrated Program by February 1 of their third or junior year at BYU. The Department Application includes a proposed study list demonstrating feasibility, GRE scores, and three references. The university application fee will be deferred until the student's fourth year of study, at which point they must submit an Application for Graduate Study in Apply Yourself by February 1.

Integrated students must also sign and submit Graduate Studies Form "Notice of Integrated or Joint Program Status" (GS Form 5) concurrent with the Apply Yourself Application.

## Financial Assistance

The department has limited funds to supplement students' financial resources. All admitted students receive teaching or research assistantships. Some students will receive graduate tuition awards.

## Graduate Program Courses

### Required Courses:

#### STAT 535 Applied Linear Models

Analysis of full-rank model, over-parameterized model, cell means model, unequal subclass frequencies, and missing and fused cells. Estimability issues, diagnostics.

#### STAT 536 Modern Regression Methods

Weighted least squares, measurement error models, robust regression, nonlinear regression, local regression, generalized additive models, tree-structured regression.

#### STAT 624 Statistical Computation

Fundamental numerical methods used by statisticians, programming concepts, efficient use of software available for statisticians, simulation studies.

#### STAT 641 Probability Theory & Mathematical Statistics 1

Axioms of probability; combinatorics; random variables, densities and distributions; expectation; independence; joint distributions; conditional probability; inequalities; derived random variables; generating functions; limit theorems; convergence results.

#### STAT 642 Probability Theory & Mathematical Statistics 2

Introduction to statistical theory, principles of sufficiency and likelihood; point and interval estimation, maximum likelihood, Bayesian inference, hypothesis testing, Neyman-Pearson lemma, likelihood ratio tests, asymptotic results including delta method, exponential family.

### Graduate Electives:

#### STAT 537 Generalized Linear Models

Generalized linear models framework, binary data, polytomous data, log-linear models.

#### STAT 538 Survival Analysis

Basic concepts of survival analysis, hazard functions, types of censoring, Kaplan-Meier estimates, Logrank tests, proportional hazard models, examples drawn from clinical and epidemiological literature.

#### STAT 545 Stochastic Processes

Conditional expectation and probabilities; Markov chains; solutions using time reversible chains; modeling using hidden Markov chains; exponential waiting times; Poisson processes; Brownian motion with approximations.

#### STAT 631 Advanced Experimental Design

Response surface methods; mixture designs; optimal designs; fractions of two-level, three level, and mixed-level factorials; analysis of experiments with complex aliasing; robust parameter designs.

#### STAT 635 Mixed Model Methods

Fixed effects, random effects, repeated measures, non-independent data, general covariance structures, estimation methods.

#### STAT 643 Theory of Linear Models

Random vectors, multivariate normal distribution, quadratic forms distribution, full-rank and non-full-rank linear models, hypothesis testing, random predictors, estimability, Bayesian topics, mixed and/or generalized linear models.

#### STAT 651 Bayesian Methods

Basic Bayesian inference, conjugate and non-conjugate analyses, Markov Chain Monte Carlo Methods, hierarchical modeling, convergence diagnostics.

#### STAT 666 Multivariate Statistical Methods

Inference about mean vectors and covariance matrices, multivariate analysis of variance and regression, canonical correlation, discriminant analysis, cluster analysis, principal component analysis, factor analysis.

## Department Research

Research emphases include Bayesian methods, environmental and spatial statistics, reliability of industrial and computing processes, statistical genetics and bioinformatics, mixed models and longitudinal data, data mining, chemometrics, actuarial methods, design and analysis of experiments, and statistical computation. In addition to these general areas, more specific research interests for individual faculty are listed on their web pages.

### Graduate Committee Chairs

Blades, Natalie J, *Assistant Professor*. PhD, Johns Hopkins University, 2003. Statistical Genetics, Epidemiology.

Christensen, William F, *Professor*. PhD, Iowa State University, 1999. Environmental and Spatial Statistics, Multivariate Analysis.

Collings, Bruce J, *Professor*. PhD, University of North Carolina, 1981. Combinatorics, Actuarial Science, Biostatistics.

Engler, David L, *Assistant Professor*. PhD, Harvard University, 2007. High-dimensional Data Analysis, Variable Selection, Biomedical Applications.

Fellingham, Gilbert W, *Professor*. PhD, University of Washington, 1990. Application of Bayesian models to health and human performance; Biostatistics.

Grimshaw, Scott D, *Professor*. PhD, Texas A&M University, 1989. Data Mining, Statistical Computing.

Johnson, W. Evan, *Assistant Professor*. PhD, Harvard University, 2007. Statistical Genomics, Computational Biology, Bioinformatics.

Neeley, E. Shannon, *Assistant Professor*. PhD, Rice University, 2007. Microarrays, Biostatistics, Statistical application in medicine, health, and wildlife.

Lawson, John S, *Professor*. PhD, Polytechnic Institute of New York, 1984. Reliability, Industrial Statistics, Experimental Design, Record Linkage.

Reese, C. Shane, *Professor*. PhD, Texas A&M University, 1999. Bayesian Methods, Reliability, Information Combination, Experimental Design.

Schaalje, G. Bruce, *Professor*. PhD, North Carolina State University, 1988. Mixed Models, Experimental Design, Biostatistics.

Scott, Del T, *Professor*, PhD, Pennsylvania State University, 1977. Statistical Computing, Categorical Data Analysis, Linear Models.

Tolley, H. Dennis, *Professor*. PhD, University of North Carolina, 1974. Actuarial methods in health. Methods for chemical transport.

Whiting, David G, *Associate Professor*. PhD, Texas A&M University, 1995. Proteomics; Bioinformatics; Statistical Computing; Spatial Statistics.