Department of Mathematics, Physics, and Statistics

Mission Statement
The Department of Mathematics, Physics, and Statistics (http://www.apu.edu/clas/mathphysics) at Azusa Pacific University:

1. Offers undergraduate programs in mathematics, applied mathematics, physics, and statistics, as well as a single subject waiver for a teaching credential in mathematics;
2. Provides General Education (http://catalog.apu.edu/undergraduate/academic-programs/general-education-program) mathematics and science courses consistent with the outcomes of a liberal arts education;
3. Prepares students for graduate study or success in their chosen careers; and


MATH 199, Calculus Fundamentals for Statistics, 1 Unit
This course introduces fundamental topics in calculus required for understanding statistical theory and methods, including the interpretation of derivatives and integrals, rules for single-variable differentiation and integration, applications to optimization, moments and areas, and basic multivariable differentiation and integration.
Prerequisite: Acceptance into M.S. in Applied Statistics and Analytics program.

MATH 299, Linear Algebra Fundamentals for Statistics, 1 Unit
This course introduces fundamental topics in linear algebra required for statistical courses, including linear and generalized linear models, vectors and matrices, basic matrix operations, methods to solve linear systems, LU/QR decomposition, singular value decomposition, and computation of eigenvalues and eigenvectors.
Prerequisite: Acceptance into M.S. in Applied Statistics and Analytics program.

STAT 501, Introduction to Modeling with Probability, 3 Units
This course is an introduction to probability models used in statistics and data analysis. Topics include basic axioms of probability, random variables, probability distributions, expected values, and probability distribution theory.
Prerequisite: Calculus (multivariable preferred) and linear algebra. Students who are lacking in one area or the other may satisfy the prerequisite by earning a B- or higher in APU’s MATH 199 and/or MATH 299.

STAT 502, Mathematical Statistics, 3 Units
This course offers an introduction to descriptive and inferential statistics used in data analysis. Topics include random sampling, parameter estimation, hypothesis testing and goodness of fit, summarizing data, and comparing samples.
Prerequisite: STAT 501

STAT 511, Applied Regression Analysis, 3 Units
This course is an introduction to simple and multiple linear regression models. Topics include parameter estimation, diagnostics, model selection, prediction, and models with categorical predictors.
Prerequisite: STAT 501;
Corequisite: STAT 502

STAT 512, Analysis of Variance and Design of Experiments, 3 Units
This course offers an introduction to designing and analyzing data using experiments. Basic experimental designs are covered, including block, factorial, and fractional factorial. ANOVA models and their assumptions, estimation, and interpretation are introduced. Statistical software is used for all analysis.
Prerequisite: STAT 501;
Corequisite: STAT 502

STAT 521, Statistical Computing and Programming, 3 Units
Students in this course gain basic familiarity with SAS and R programming for data management and analysis. The course takes place in a computer lab, enabling students to implement the lecture material as it is presented. Assignments require using SAS and R to perform data management techniques, generate descriptive statistics and graphical representations of data, and apply statistical methods available in software.
Prerequisite: MATH 361 or equivalent
STAT 541, Epidemiology Research Methods, 3 Units
The purpose of this course is to equip students with the basic concepts and principles of epidemiology, a discipline that identifies the determinants of disease in human populations and assesses the magnitude of public health problems and the success of interventions designed to control them. Students learn about various epidemiologic study designs and their strengths and limitations, the basic mathematical tools needed in epidemiology, the collection of epidemiologic data, and the criteria of causality. Also, the course addresses the biases that may invalidate epidemiologic studies, and considers ethical concerns in epidemiology from a Christian faith perspective.

STAT 542, Applied Logistic Regression and Survival Analysis, 3 Units
This course offers an introduction to methods for analyzing binary outcome and time-to-event data, with the primary focus on how to analyze such data using methods available in standard statistical software packages. Topics include logistic regression estimation, interpretation, and assessment. For time-to-event data, summary statistics for censored data, nonparametric methods (specifically Kaplan-Meier), and semiparametric regression methods centered on the Cox model are introduced.
**Prerequisite:** STAT 511 and STAT 521 or equivalent

STAT 543, Applied Longitudinal Data Analysis, 3 Units
This course focuses on classical and modern approaches to analyzing continuous and discrete longitudinal data. Topics include exploratory analysis of correlated data, random effect and growth curve models, random effects models, Generalized Estimating Equations (GEE), and analysis of discrete longitudinal data. Emphasis is on estimation using statistical software and model interpretation.
**Prerequisite:** STAT 511 and STAT 521

STAT 551, Data Visualization, 3 Units
This course introduces students to the field of data visualization. Students learn basic visualization design and evaluation principles, including methods to evaluate visualizations. They also learn how to acquire, parse, and analyze data sets using various data visualization software tools. Data types included in the course include multivariate, temporal, text-based, geospatial, and network/graph-based.

STAT 552, Time Series Analysis and Forecasting, 3 Units
In this course, students develop a working knowledge of time series analysis and forecasting methods, with a focus on applications. Topics include descriptive analysis, probability models for time series, fitting and forecasting for time series models, bootstrapping, models for nonstationary series, and an introduction to spectral analysis.
**Prerequisite:** STAT 502 and STAT 521

STAT 553, Data Mining, 3 Units
Data mining focuses on algorithms and computational paradigms that allow computers to find patterns and regularities in data in order to perform prediction or find structure and relationships to help improve decision making. This course covers basic methodology, major software tools, and applications in data mining. Students learn conceptual underpinnings of methods in data mining while focusing more on usage of existing software packages than developing the algorithms. In particular, the course covers the methodology, motivation, assumptions, strengths, and weaknesses of the most widely applicable methods in the field.
**Prerequisite:** STAT 511 and STAT 521

STAT 571, Applied Multivariate Analysis, 3 Units
This course introduces a variety of standard statistical methods used to analyze multivariate data, emphasizing the implementation and interpretations of the methods. Topics covered include matrix computation of summary statistics, graphical techniques, the geometry of sample data, the multivariate normal distribution, principal components analysis, factor analysis, classification and discrimination, and cluster analysis.
**Prerequisite:** STAT 511 and STAT 521

STAT 572, Applied Bayesian Analysis, 3 Units
This course provides a practical introduction to Bayesian data analysis. Students are exposed to a variety of Bayesian models, including the Bayesian linear model and Bayesian hierarchical modeling as a strategy for modeling complex processes and as a means of assimilating a variety of sources of data. Models are fit for various types of data using modern simulation techniques in statistical software. The focus of the course is modeling, assessing model appropriateness, and interpretation.
**Prerequisite:** STAT 511 and STAT 521

STAT 573, Applied Nonparametric Statistics, 3 Units
This course provides an overview of nonparametric statistics, helping students learn the difference between parametric and nonparametric statistics and when each is appropriate. This course includes the basic theory and computing tools to perform traditional rank-based nonparametric tests, and advanced topics include nonparametric density estimation, nonparametric regression, and the bootstrap.
**Prerequisite:** STAT 511 and STAT 521

STAT 574, Discrete Data Analysis, 3 Units
This course covers basic methods for analysis of discrete data, including methods for analyzing and describing discrete data in contingency tables, and statistical models for discrete outcomes that are binary, counts, nominal, and ordinal. Emphasis is on using statistical software to fit models to data, assessing the appropriateness, and interpreting the results in context.
**Prerequisite:** STAT 511 and STAT 521
STAT 575, Applied Survey Sampling, 3 Units
This course covers sampling design and analysis methods useful for research and management in many fields. Students learn about the basic methods of sampling and estimation and then explore selected designs and recent developments. Topics include simple random sampling with associated estimation and confidence interval methods, selecting sample sizes, estimating proportions, unequal probability sampling, ratio and regression estimation, stratified sampling, cluster, systematic sampling, multistage designs, and double sampling.
Prerequisite: STAT 502 and STAT 521

STAT 592, Ethics in Data Analytics, 2 Units
The availability and use of data has led to tremendous opportunities. Businesses mine data to gain a competitive advantage, and healthcare organizations use it to help improve medical decision making. The use of data, however, has led to potential abuses. This course explores ethical issues in big data analytics, including issues surrounding collection, use, and reporting of data, and considers them from a Christian worldview.

STAT 595, Special Topics in Applied Statistics, 3 Units
This course presents coverage of topics in applied statistics.
Prerequisite: Based upon the topic offered.

STAT 597, Statistical Consulting Practicum, 2 Units
Students in this course investigate the role of the statistician as consultant and collaborator. Topics include problem solving and communication skills (oral and written), structuring working engagements with nonstatisticians and collaborators, and skills specific to statistical consulting. Case studies or ongoing projects are used to provide hands-on consulting experience. Students identify, and produce their proposal for, their culminating project during this course.
Prerequisite: STAT 511 and STAT 521

STAT 598, Culminating Project, 2 Units
This is the capstone course of the Master of Science in Applied Statistics and Analytics program. It is open to second-year students in good standing. Students provide an oral presentation and a written report of the project.
Prerequisite: STAT 597

STAT 599, Independent Study, 1-3 Units

Faculty

Department Chair
Bradley McCoy (http://www.apu.edu/faculty/bmccoy), Ph.D.

Program Director, M.S. in Applied Statistics and Analytics
Soeun Kim, Ph.D.

Assistant Professors
Soeun Kim, Ph.D.
Yi Millie Mao, Ph.D.

Affiliated Faculty
Chong Ho (Alex) Yu (http://www.apu.edu/faculty/cyu), Ph.D.