STATISTICS

Contact Information

Statistics
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Department Chair
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Statistics coursework trains students in the role played in the modern world by probabilistic and statistical ideas and methods. Students grow familiar with both the theory and the application of techniques in common use as they are trained in statistical research.

At the undergraduate level, the department offers two undergraduate degrees: the Bachelor of Arts (BA) degree and the Bachelor of Science (BS) degree. The Bachelor of Arts (BA) degree is designed for those students interested in applied statistics while the Bachelor of Science (BS) degree is intended for students desiring to pursue research positions or graduate study in Statistics.

The graduate program has areas of specialization in applied probability, Bayesian methodology, bioinformatics, biomathematics, biostatistics, computational finance, data science, data visualization, environmental health, functional data analysis, graphical models, large and complex data, machine and statistical learning, networks, neuroscience, nonparametric function estimation, social sciences, statistical computing, spatial statistics, stochastic processes, systems biology, time series analysis, and urban analytics. Statistics is a cornerstone of campus wide data science efforts.

The Department of Statistics houses the Data Science (DSCI) (https://ga.rice.edu/programs-study/departments-programs/engineering/data-science/data-science-minor/) undergraduate minor and jointly oversees the Financial Computation and Modeling (FCAM) (https://ga.rice.edu/programs-study/departments-programs/engineering/financial-computation-modeling/#header) undergraduate minor, the Sport Analytics (https://ga.rice.edu/programs-study/departments-programs/social-sciences/sport-analytics/) major, and the Master of Computational Science and Engineering (MCSE) (https://ga.rice.edu/programs-study/departments-programs/engineering/computational-science-engineering/) degree program.

Bachelor's Programs

- Bachelor of Arts (BA) Degree with a Major in Statistics (https://ga.rice.edu/programs-study/departments-programs/engineering/statistics/statistics-ba/)
- Bachelor of Science (BS) Degree with a Major in Statistics (https://ga.rice.edu/programs-study/departments-programs/engineering/statistics/statistics-bs/)

Minor

- Minor in Statistics (https://ga.rice.edu/programs-study/departments-programs/engineering/statistics/statistics-minor/)

Coordinated Programs

- Bachelor of Arts (BA) Degree with a Major in Sport Analytics (https://ga.rice.edu/programs-study/departments-programs/social-sciences/sport-analytics/sport-analytics-ba/)*
- Minor in Data Science (https://ga.rice.edu/programs-study/departments-programs/engineering/data-science/data-science-minor/)**
- Minor in Financial Computation and Modeling (https://ga.rice.edu/programs-study/departments-programs/engineering/financial-computation-modeling/financial-computation-modeling-minor/)***

* *This degree is jointly managed by the Data to Knowledge (D2K) Lab, the Department of Sport Management, and the Department of Statistics. For more information, see* Sport Analytics *(*https://ga.rice.edu/programs-study/departments-programs/social-sciences/sport-analytics/*).*

** *This minor is jointly managed by the Data to Knowledge Lab (D2K) and the Department of Statistics. For more information, see* Data Science *(*https://ga.rice.edu/programs-study/departments-programs/engineering/data-science/*).*

*** *This minor is jointly managed by the Department of Economics and the Department of Statistics. For more information, see* Financial Computation and Modeling *(*https://ga.rice.edu/programs-study/departments-programs/engineering/financial-computation-modeling/*).*

Master's Programs

- Master of Arts (MA) Degree in the field of Statistics*
- Master of Statistics (MStat) Degree (https://ga.rice.edu/programs-study/departments-programs/engineering/statistics/statistics-mstat/)

Doctoral Program

- Doctor of Philosophy (PhD) Degree in the field of Statistics (https://ga.rice.edu/programs-study/departments-programs/engineering/statistics/statistics-phd/)

Coordinated Program

- Master of Computational Science and Engineering (MCSE) Degree (https://ga.rice.edu/programs-study/departments-programs/engineering/computational-science-engineering/computational-science-engineering-mcse/)**

* *Although students are not normally admitted to a Master of Arts (MA) degree program, graduate students may earn the MA as they work towards the PhD.*

** *This degree is jointly managed by the Department of Computational Applied Mathematics and Operations Research and the Department of Statistics. For more information, see* Computational Science and Engineering *(*https://ga.rice.edu/programs-study/departments-programs/engineering/computational-science-engineering/*).*

Department Chair

Huixia Judy Wang

Professors

Katherine Bennett Ensor
Rudy Guerra
Marek Kimmel
Marina Vannucci
Frederi Viens
Huixia Judy Wang

Associate Professors

Meng Li
Christine Peterson

Assistant Professors

Hengrui Luo
Xinyi Zhang

Professors Emeriti

Dennis Cox
David W. Scott

Associate Teaching Professors

Arko Barman
Elizabeth McGuffey

Assistant Teaching Professors

Xiujie Lan
Lorenzo Luzi

Research Professor

Erzsébet Merényi

Professor in the Practice

Loren Hopkins

Senior Lecturer

Roberto Bertolusso

Lecturers

Michael Jackson
Leif Peterson

Professors, Joint Appointments

Christopher M. Jermaine
Chad A. Shaw
Anshumali Shrivastava

Assistant Professors, Joint Appointments

Scott Powers
Santiago Segarra

Adjunct Faculty

Genevera I. Allen
Kim-Anh Do
Philip Ernst
Michele Guindani
Xuelin Huang
Anil Korkut
Matthew Koslovsky
Suprateek Kundu
Yisheng Li
Ziyi Li
Ruitao Lin
Tomasz Lipniacki
Suyu Liu
James Long
Marie Lynn Miranda
Jeffrey S. Morris
Yu Shen
Francesco Stingo
Ryan Sun
Wenyi Wang
Peng Wei
Ying Yuan
Wentao Zhao

Adjunct Professor in the Practice

Maxwell Lee

For Rice University degree-granting programs:
To view the list of official course offerings, please see Rice's Course Catalog (https://courses.rice.edu/admweb/!SWKSCAT.cat?p_action=cata).
To view the most recent semester's course schedule, please see Rice's Course Schedule (https://courses.rice.edu/admweb/!SWKSCAT.cat).

Statistics (STAT)

STAT 180 - AP/OTH CREDIT IN STATISTICS
Short Title: AP/OTH CREDIT IN STATISTICS
Department: Statistics
Grade Mode: Transfer Courses
Course Type: Transfer
Credit Hours: 4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Description: Provides transfer credit based on student performance on approved examinations in statistics, such as the AP Statistics exam. This credit counts toward the total credit hours required for graduation, but does not count for distribution. Equivalency: STAT 280.

STAT 238 - SPECIAL TOPICS
Short Title: SPECIAL TOPICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Internship/Practicum, Laboratory, Lecture, Seminar, Independent Study, Lecture/Laboratory
Credit Hours: 1-4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Description: Topics and credit hours may vary each semester. Contact department for current semester's topic(s). Repeatable for Credit.

STAT 280 - ELEMENTARY APPLIED STATISTICS
Short Title: ELEMENTARY APPLIED STATISTICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Distribution Group: Distribution Group III
Credit Hours: 4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Lower-Level
Description: Topics include basic probability, descriptive statistics, probability distributions, confidence intervals, significance testing, simple linear regression and correlation, association between categorized variables. Equivalency: STAT 180.

STAT 305 - INTRODUCTION TO STATISTICS FOR BIOSCIENCES
Short Title: INTRO TO STAT FOR BIOSCIENCES
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Distribution Group: Distribution Group III
Credit Hours: 4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): (MATH 101 or MATH 105 or MATH 112) and (MATH 102 or MATH 106)
Description: An introduction to statistics for Biosciences with emphasis on statistical models and data analysis techniques. Computer-assisted data analysis and examples, are explored in laboratory sessions. Topics include descriptive statistics, correlation and regression, categorical data analysis, statistical inference through confidence intervals and significance testing, rates, and proportions. Real-world examples are emphasized. Recommended Prerequisite(s): MATH 212 or MATH 222

STAT 310 - PROBABILITY AND STATISTICS
Short Title: PROBABILITY & STATISTICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group III
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): MATH 102 or MATH 106
Description: Probability and the central concepts and methods of statistics including probability, random variables, distributions of random variables, expectation, sampling distributions, estimation, confidence intervals, and hypothesis testing. Cross-list: ECON 307. Recommended prerequisite(s): MATH 212. Mutually Exclusive: Cannot register for STAT 310 if student has credit for DSCI 301/STAT 311/STAT 312/ STAT 315.

STAT 311 - HONORS PROBABILITY AND MATHEMATICAL STATISTICS
Short Title: HONORS STATISTICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group III
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): MATH 212 or MATH 222
Description: Probability and the central concepts and methods of statistics including probability, random variables, distributions of random variables, expectation, sampling distributions, estimation, confidence intervals, and hypothesis testing. Advanced topics (not covered in STAT 310 or STAT 315) include the modeling stochastic phenomena and asymptotic statistical theory. Intended for students wishing to understand more rigorous statistical theory and for those contemplating a BS degree in Statistics or graduate school in statistical science. Required prerequisite(s): MATH 212 (or equivalent). Mutually Exclusive: Cannot register for STAT 311 if student has credit for DSCI 301/ ECON 307/STAT 310/STAT 312/STAT 315.

STAT 312 - PROBABILITY & STATISTICS FOR ENGINEERS
Short Title: PROB & STAT FOR ENGINEERS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group III
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): MATH 102
Description: Probability and the central concepts and methods of statistics including probability, distributions of random variables, expectation, sampling distributions, estimation, confidence intervals, and hypothesis testing. Examples are predominantly from civil and environmental engineering. Recommended Prerequisite(s): MATH 212. Mutually Exclusive: Cannot register for STAT 312 if student has credit for DSCI 301/ECON 307/STAT 310/STAT 311/STAT 315.

STAT 313 - UNCERTAINTY AND RISK IN URBAN INFRASTRUCTURES
Short Title: RISK-BASED DEC UNDER UNCERT
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group III
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): STAT 312 or STAT 310 or STAT 315 or DSCI 301 or ECON 307 or ECON 382 or STAT 331 or ELEC 331
Description: This course explores methods for practical risk-based decision support, particularly for infrastructure systems. Uncertainty quantification (UQ) to external events including natural hazards is at the core of risk-informed design, operation, and mitigation actions. UQ also guides engineering practice and enables code developments. The course emphasizes decision theory, Bayesian approaches, risk analysis tools, and infrastructure safety. Cross-list: CEVE 313. Repeatable for Credit.

STAT 314 - COMPUTING FOR STATISTICAL ANALYSIS BRIDGE
Short Title: COMPUTING STAT BRIDGE
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hour: 1
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): STAT 310 (may be taken concurrently)
Description: This course provides a computational bridge for students who have completed STAT 310 to fulfill the requirements of the AI major. Students will implement statistical methodology using modern computational languages (such as Python), focusing on data structures, visualization, and simulation techniques essential for modern data science.

STAT 315 - PROBABILITY AND STATISTICS FOR DATA SCIENCE
Short Title: STATISTICS FOR DATA SCIENCE
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Distribution Group: Distribution Group III
Credit Hours: 4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): MATH 102 or MATH 106
Description: An introduction to mathematical statistics and computation for applications to data science. Topics include probability, random variables expectation, sampling distributions, estimation, confidence intervals, hypothesis testing and regression. A weekly lab will cover the statistical package, R, and data projects. Cross-list: DSCI 301. Recommended Prerequisite(s): MATH 212. Mutually Exclusive: Cannot register for STAT 315 if student has credit for ECON 307/STAT 310/ STAT 311/STAT 312.

STAT 376 - ECONOMETRICS
Short Title: ECONOMETRICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): ECON 209 and ECON 308
Description: Survey of estimation and forecasting models. Includes multiple regression time series analysis. A good understanding of linear algebra is highly desirable. Cross-list: ECON 310. Mutually Exclusive: Cannot register for STAT 376 if student has credit for ECON 409/STAT 400.

STAT 385 - METHODS OF DATA ANALYSIS AND SYSTEM OPTIMIZATION
Short Title: METHODS FOR DATA ANALYSIS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): STAT 180 or STAT 280 or STAT 305 or STAT 310 or ECON 307 or STAT 312 or STAT 315 or DSCI 301
Description: The three general areas covered in this methodology oriented course are (a) statistical methods, including regression, sampling, and experimental design; (b) simulation based methods in statistics, queuing and inventory problems; (c) an introduction to optimization methods. Excel serves as the basic computing software.

STAT 405 - R FOR DATA SCIENCE
Short Title: R FOR DATA SCIENCE
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Distribution Group: Distribution Group III
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): STAT 305 or STAT 312 or STAT 310 or ECON 307 or STAT 311 or STAT 385 or STAT 315 or DSCI 301
Description: This course introduces students to the statistical programming language, R, and how to use it in statistical and data science problems. The course traces the data science pipeline from importing data into R, exploring and visualizing data, applying a variety of statistical methods, and communicating results. Important computational tools for data science (e.g. databases, web scraping, and big data) and good programming practice are integrated throughout the course. No programming experience is required. Graduate/Undergraduate Equivalency: STAT 605. Mutually Exclusive: Cannot register for STAT 405 if student has credit for STAT 605.

STAT 406 - SAS STATISTICAL PROGRAMMING
Short Title: SAS STATISTICAL PROGRAMMING
Department: Statistics
Grade Mode: Standard Letter
Course Type: Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): STAT 305 or STAT 312 or STAT 311 or ECON 307 or ECON 382 or STAT 385 or STAT 310 or STAT 315 or DSCI 301
Description: Students will learn how to work within the statistical programming language SAS. The course covers from getting data into SAS, transforming and plotting it, to applying appropriate statistical analysis, and communicating the results. Important topics such as database managing with SQL, macro programming, interactive Matrix Language, and efficient programming in general are integrated throughout the course. Graduate/Undergraduate Equivalency: STAT 606. Mutually Exclusive: Cannot register for STAT 406 if student has credit for STAT 606.

STAT 410 - LINEAR REGRESSION
Short Title: LINEAR REGRESSION
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): STAT 310 or STAT 311 or STAT 312 or ECON 307 or STAT 315 or DSCI 301
Description: An introduction to linear regression and its applications. Topics include simple and multiple linear regression, least squares, analysis of variance, model selection, diagnostics, remedial measures. Applications to real data using statistical software are emphasized. Recommended Prerequisite(s): CMOR 302 or MATH 355.

STAT 411 - ADVANCED STATISTICAL METHODS
Short Title: ADVANCED STATISTICAL METHODS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): (STAT 310 or STAT 311 or STAT 312 or STAT 315 or DSCI 301 or ECON 307 or ECON 382) and (STAT 410 or STAT 615)
Description: Advanced topics in statistical applications such as sampling, experimental design and statistical process control. STAT 411 will have assignments and examinations focusing more on basic concepts than on theoretical methods. Graduate/Undergraduate Equivalency: STAT 616. Mutually Exclusive: Cannot register for STAT 411 if student has credit for STAT 616.

STAT 413 - INTRODUCTION TO STATISTICAL MACHINE LEARNING
Short Title: INTRO TO STAT MACHINE LEARNING
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): STAT 410 and (STAT 405 or CAAM 210 or CMOR 220 or COMP 140 or COMP 130)
Description: This course is an introduction to concepts, methods, and best practices in statistical machine learning. Topics covered include regularized regression, classification, kernels, dimension reduction, clustering, trees, and ensemble learning. Emphasis will be placed on applied data analysis and computation. Recommended Prerequisite(s): STAT 411 and CAAM 335 or CMOR 302 or MATH 354 or MATH 355. Mutually Exclusive: Cannot register for STAT 413 if student has credit for ELEC 478.

STAT 415 - DATA SCIENCE CONSULTING
Short Title: DATA SCIENCE CONSULTING
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): STAT 405 or COMP 140 or CAAM 210 or CMOR 220
Description: Students in this course will advise clients at Rice and beyond in a data science consulting clinic, learn best practices in consulting, and gain exposure to a variety of real data science problems. Instructor Permission Required. Graduate/Undergraduate Equivalency: STAT 515. Recommended Prerequisite(s): STAT 413 or COMP 440 or COMP 540 or COMP 330 or STAT 411. Mutually Exclusive: Cannot register for STAT 415 if student has credit for STAT 515. Repeatable for Credit.

STAT 418 - PROBABILITY
Short Title: PROBABILITY
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Description: Topics include random variables, distributions, transformations, moment generating functions, common families of distributions, independence, sampling distributions, and basic stochastic processes. STAT 418 will have assignments and examinations focusing more on basic concepts than on theoretical methods. Graduate/Undergraduate Equivalency: STAT 518. Mutually Exclusive: Cannot register for STAT 418 if student has credit for STAT 518.

STAT 419 - STATISTICAL INFERENCE
Short Title: STATISTICAL INFERENCE
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): (MATH 354 or MATH 355 or CAAM 334 or CAAM 335 or CMOR 302 or CMOR 303) and STAT 418
Description: Topics include principles of data reduction, point estimation, hypothesis testing, interval estimation, Bayesian inference, Decision Theory, inference foundations of analysis of variance and regression. STAT 419 will have assignments and examinations focusing more on basic concepts than on theoretical methods. Graduate/Undergraduate Equivalency: STAT 519. Mutually Exclusive: Cannot register for STAT 419 if student has credit for STAT 519.

STAT 420 - THE STATISTICAL FOUNDATION OF GENERATIVE ARTIFICIAL INTELLIGENCE
Short Title: STAT FOUNDATION GENERATIVE AI
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): (BIOE 439 or BUSI 395 or DSCI 301 or STAT 315 or ELEC 303 or PSYC 339 or SOCI 382 or SOSC 302 or STAT 280 or STAT 305 or STAT 310 or ECON 307 or STAT 311) and (CMOR 438 or COMP 341 or COMP 540 or DSCI 303 or ELEC 378 or ELEC 478 or STAT 413 or COMP 330 or DSCI 302)
Description: This course is an advanced machine learning course that focuses on the statistical foundations of generative AI in the Data Science (DSCI) Minor Program. In this course, students will study the fundamental concepts of statistics and understand the evolution of machine learning from discriminative to generative models. Specifically, students will learn two main foundation models: Transformers and diffusion models, via understanding their statistical foundations, comparing their advantages to classical models, and implementing the two models in real-world applications. Cross-list: DSCI 420. Graduate/Undergraduate Equivalency: STAT 626.

STAT 421 - APPLIED TIME SERIES AND FORECASTING
Short Title: APPLIED TIME SERIES/FORECASTNG
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): STAT 410 or ECON 310
Description: Applied time series modeling and forecasting, with applications to financial markets. STAT 621 is a graduate version of STAT 421 with advanced assignments. Graduate/Undergraduate Equivalency: STAT 621. Mutually Exclusive: Cannot register for STAT 421 if student has credit for STAT 621.

STAT 423 - PROBABILITY IN BIOINFORMATICS AND GENETICS
Short Title: PROB BIOINFORMATICS & GENETICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): STAT 310 or ECON 307 or STAT 311 or STAT 315 or DSCI 301 or STAT 312 or STAT 418
Description: Course introduces the student to modern biotechnology and genomic data. Statistical methods to analyze genomic data are covered, including probability models, basic stochastic processes, and statistical modeling. Biological topics include DNA sequence analysis, phylogenetic inference, gene finding, and molecular evolution. A weekly 1-hour lab on computational aspects of the course will cover software and practice of bioinformatics and computational biology, including modern data sets. Graduate/Undergraduate Equivalency: STAT 623. Mutually Exclusive: Cannot register for STAT 423 if student has credit for STAT 623.

STAT 425 - INTRODUCTION TO BAYESIAN INFERENCE
Short Title: INTRO TO BAYESIAN INFERENCE
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): STAT 410 and STAT 405 or COMP 210 or COMP 140 or COMP 130
Description: This course is an introduction to Bayesian inference, with emphasis on concepts and methods for analyzing data. We will consider a variety of models, including MCMC algorithms and methods for linear regression and hierarchical models. Computational methods will be emphasized. Recommended Prerequisite(s): STAT 411 or CAAM 335 or MATH 355.

STAT 435 - DATA SCIENCE PROJECTS
Short Title: DATA SCIENCE PROJECTS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Description: In this project-based course, student teams will complete semester-long data science research or analysis projects selected from a variety of disciplines and industries. Students will also learn best practices in data science. Instructor Permission Required. Graduate/Undergraduate Equivalency: STAT 535. Mutually Exclusive: Cannot register for STAT 435 if student has credit for STAT 535. Repeatable for Credit.

STAT 440 - STATISTICS FOR BIOENGINEERING
Short Title: STATISTICS FOR BIOENGINEERING
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hour: 1
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): BIOE 252 (may be taken concurrently)
Description: Course covers application of statistics to bioengineering. Topics include descriptive statistics, estimation, hypothesis testing, ANOVA, and regression. BIOE 252 may be taken concurrently with BIOE 440. BIOE 440/STAT 440 and BIOE 439 cannot both be taken for credit. Cross-list: BIOE 440. Mutually Exclusive: Cannot register for STAT 440 if student has credit for BIOE 439.

STAT 449 - QUANTITATIVE FINANCIAL RISK MANAGEMENT
Short Title: QUAN FINANCIAL RISK MANAGEMENT
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): MATH 211 and MATH 212 and (ECON 400 or STAT 400 or ECON 409 or STAT 410) and (STAT 310 or ECON 307 or STAT 311 or STAT 315 or DSCI 301 or STAT 312 or STAT 331 or ELEC 331)
Description: This course covers the use of financial securities and derivatives to take or hedge financial risk positions. Most commonly used instruments, from simple forwards and futures to exotic options and swaptions are covered. The pricing of derivatives securities will also be studied, but the emphasis will be on the mechanics and uses of financial engineering methods. STAT 449 is mutually exclusive to ECON 449. Credit cannot be given for both. Graduate/Undergraduate Equivalency: STAT 649. Mutually Exclusive: Cannot register for STAT 449 if student has credit for ECON 449.

STAT 450 - SENIOR CAPSTONE PROJECT
Short Title: SENIOR CAPSTONE PROJECT
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment limited to students with a class of Senior. Enrollment is limited to students with a major in Statistics. Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Description: Students engage in individual or team-oriented statistical projects to solve problems motivated by theory, computation, or application to real problems and data. Typical projects involve statistical modeling, data analysis, and computing to answer substantive questions in engineering or the physical, biological, or social sciences. Participants attend regular seminars addressing project development, research techniques and effective written and verbal communication skills in presenting statistical results. Repeatable for Credit.

STAT 453 - BIOSTATISTICS
Short Title: BIOSTATISTICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): STAT 410
Description: An overview of statistical methodologies useful in the practice of Biostatistics. Topics include epidemiology, rates, and proportions, categorical data analysis, regression, and logistic regression, retrospective studies, case-control studies, survival analysis. Real biomedical applications serve as context for evaluating assumptions of statistical methods and models. R serves as the computing software. Graduate/Undergraduate Equivalency: STAT 553. Mutually Exclusive: Cannot register for STAT 453 if student has credit for STAT 553.

STAT 477 - SPECIAL TOPICS
Short Title: SPECIAL TOPICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Internship/Practicum, Seminar, Lecture, Laboratory
Credit Hours: 1-4
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Description: Topics and credit hours may vary each semester. Contact department for current semester's topic(s). Repeatable for Credit.

STAT 482 - QUANTITATIVE FINANCIAL ANALYTICS
Short Title: QUANT FINANCIAL ANALYTICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Description: A modern approach to fundamental analytics of securities, the classic works of Graham and Dodd. Deconstructing the Efficient Market Hypothesis Financial Statement Analysis, Capital Market Theory, CAPM, APT, Fama-French Empirical Financial Forecasting. Graduate/Undergraduate Equivalency: STAT 682. Mutually Exclusive: Cannot register for STAT 482 if student has credit for STAT 682.

STAT 484 - ENVIRONMENTAL RISK ASSESSMENT & HUMAN HEALTH
Short Title: ENVIRON RISK ASSESS&HUMAN HLTH
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): STAT 180 or STAT 280 or STAT 305
Description: Learn and apply quantitative risk assessment methodology to estimate human health risk from environmental exposure to contamination in air, soil and water. Students will conduct a series of team projects focused on toxicology, risk based screening levels, exposure concentration estimation and risk characterization. Cross-list: CEVE 484. Graduate/Undergraduate Equivalency: STAT 684. Mutually Exclusive: Cannot register for STAT 484 if student has credit for STAT 684.

STAT 485 - ENVIRONMENTAL STATISTICS AND DECISION MAKING
Short Title: ENVIR STAT & DECISION MAKING
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): STAT 305 or STAT 385
Description: A project oriented computer intensive course focusing on statistical and mathematical solutions and investigations for the purpose of environmental decisions. This course is the undergraduate version of STAT 685 with reduced requirements. Graduate/Undergraduate Equivalency: STAT 685. Recommended Prerequisite(s): STAT 305 and STAT 385. Mutually Exclusive: Cannot register for STAT 485 if student has credit for STAT 685.

STAT 486 - MARKET MODELS
Short Title: MARKET MODELS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Prerequisite(s): STAT 310 or ECON 307 or STAT 311 or STAT 315 or DSCI 301 or ECON 382 or STAT 312
Description: This course takes the classical efficient market models and superimposes upon it models for other stochastic phenomena not generally accounted for in efficient market theory, showing how risk is lessened by portfolios and other mechanisms. This undergraduate course uses computer simulations as an alternative to closed form solutions. Graduate/Undergraduate Equivalency: STAT 686. Mutually Exclusive: Cannot register for STAT 486 if student has credit for STAT 686.

STAT 487 - COFES BLOCKCHAIN AND CRYPTOCURRENCIES
Short Title: COFES BLOCKCHAIN/CRYPTO
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Description: How will blockchains empower positive and radical change in our increasingly globalized and data-driven society? Students should be prepared for exposure to highly interdisciplinary discussions regarding applying new technology to rethink existing economic & social structures. No technical or engineering experience is required. Graduate/Undergraduate Equivalency: STAT 687.

STAT 490 - UNDERGRADUATE RESEARCH IN STATISTICS
Short Title: UNDERGRADUATE RESEARCH IN STAT
Department: Statistics
Grade Mode: Standard Letter
Course Type: Research
Credit Hours: 1-3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Description: This course provides 1-3 credit hours of credit for STAT majors who wish to pursue a research project of mutual interest to the student and a faculty member in a selected area of statistical specialization. The student will conduct independent research under the faculty member's direction. Repeatable for Credit.

STAT 491 - INDEPENDENT STUDY
Short Title: INDEPENDENT STUDY
Department: Statistics
Grade Mode: Standard Letter
Course Type: Independent Study
Credit Hours: 1-6
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Description: Repeatable for Credit.

STAT 492 - STATISTICS PRACTICUM
Short Title: STATISTICS PRACTICUM
Department: Statistics
Grade Mode: Satisfactory/Unsatisfactory
Course Type: Internship/Practicum
Credit Hour: 1
Restrictions: Enrollment is limited to students with a major in Statistics. Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Description: Designed for undergraduate statistics majors. The course is to provide experience in real world applications and practice in statistics. An off-campus internship is required. Instructor Permission Required. Repeatable for Credit.

STAT 496 - RTG CROSS-TRAINING IN DATA SCIENCE
Short Title: RTG CROSS-TRAINING IN DATA SCI
Department: Statistics
Grade Mode: Standard Letter
Course Type: Seminar
Credit Hour: 1
Restrictions: Enrollment is limited to students with a major in Computer Science or Statistics. Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Description: A seminar course to introduce students to topics in Data Science at the interface between Statistics and Computer Science. Students participate in the process of preparing, delivering and critiquing talks. Topics change each semester. Instructor Permission Required. Cross-list: COMP 496. Graduate/Undergraduate Equivalency: STAT 696. Mutually Exclusive: Cannot register for STAT 496 if student has credit for STAT 696. Repeatable for Credit.

STAT 499 - TOPICS IN STATISTICAL SCIENCES
Short Title: TOPICS IN STATISTICAL SCIENCES
Department: Statistics
Grade Mode: Standard Letter
Course Type: Seminar
Credit Hours: 1-3
Restrictions: Enrollment is limited to Undergraduate, Undergraduate Professional or Visiting Undergraduate level students.
Course Level: Undergraduate Upper-Level
Description: This course prepares a student for research in the statistical sciences. Topics may change each semester depending on instructor interest. Current topics include bioinformatics, computational finance, data science, Bayesian methods, mathematical tools for statistics, simulation, optimization, and dependent data, high-dimensional problems, and complex problems. Additional topics may be introduced. Contact the instructor for more information. Graduate/Undergraduate Equivalency: STAT 699. Repeatable for Credit.
Course URL: statistics.rice.edu (http://statistics.rice.edu)

STAT 502 - NEURAL MACHINE LEARNING I
Short Title: NEURAL MACHINE LEARNING I
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Review of major neural machine learning (Artificial Neural Network) paradigms. Analytical discussion of supervised and unsupervised neural learning algorithms and their relation to information theoretical methods. Practical applications to data analysis such as pattern recognition, clustering, classification, function approximation/ regression, non-linear PCA, projection pursuit, independent component analysis, with lots of examples from image and digital processings. Details are posted at www.ece.rice.edu/~erzsebet/ANNcourse.html. Cross-list: COMP 502, ELEC 502.
Course URL: www.ece.rice.edu/~erzsebet/ANNcourse.html (http://www.ece.rice.edu/~erzsebet/ANNcourse.html)

STAT 503 - TOPICS IN METHODS AND DATA ANALYSIS
Short Title: TOPICS METHODS&DATA ANALYSIS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Applications of least squares and general linear mode. Cross-list: POLI 503.

STAT 509 - ADVANCED PSYCHOLOGICAL STATISTICS I
Short Title: ADVANCED PSYC STATISTICS I
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 4
Restrictions: Enrollment is limited to students with a major in Human-Comp Inter & Humn Factrs, Industrial-Organizational Psyc or Psychology. Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Introduction to inferential statistics, with emphasis on analysis of variance. Students who do not meet registration requirements as Graduate and Psychology, MIOP (Master in Industrial-Organizational Psychology), or MHCIHF (Master in Human-Computer Interaction and Human Factors) Majors must receive instructor permission to register. Cross-list: PSYC 502.

STAT 510 - ADVANCED PSYCHOLOGICAL STATISTICS II
Short Title: ADVANCED PSYC STATISTICS II
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): PSYC 502 or STAT 509
Description: A continuation of PSYC 502, focusing on multiple regression. Other multivariate techniques and distribution-free statistics are also covered. Cross-list: PSYC 503.

STAT 514 - INTRODUCTION TO BIOSTATISTICS
Short Title: INTRODUCTION TO BIOSTATISTICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to students with a major in Bioengineering. Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Presents basic and advanced methods of statistics as applied to problems in bioengineering. Demonstrates techniques for data organization, exploration, and presentation. Foundations of statistical estimation, inference, and testing are reviewed. Optimal planning of experiments is explored. Advanced techniques include multiple regression, variable selection, logistic regression, analysis of variance, survival analysis, multiple measurements and measurements over time. Additional topics, such as Bayesian methods, will be discussed as time allows. Labs will use the statistical software JMP and/or R. Cross-list: BIOE 514.

STAT 515 - DATA SCIENCE CONSULTING
Short Title: DATA SCIENCE CONSULTING
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Students in this course will advise clients from across this Rice community in a data science consulting clinic, learn best practices in consulting, and gain exposure to a variety of real data science problems. Instructor Permission Required. Graduate/Undergraduate Equivalency: STAT 415. Recommended Prerequisite(s): STAT 413 or COMP 440 or COMP 540 or COMP 330 or STAT 411. Mutually Exclusive: Cannot register for STAT 515 if student has credit for STAT 415. Repeatable for Credit.

STAT 518 - PROBABILITY
Short Title: PROBABILITY
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Topics include random variables, distributions, transformations, moment generating functions, common families of distributions, independence, sampling distributions, and basic stochastic processes. STAT 518 will have more advanced assignments and examinations focusing on theoretical methods. Graduate/Undergraduate Equivalency: STAT 418. Mutually Exclusive: Cannot register for STAT 518 if student has credit for STAT 418.

STAT 519 - STATISTICAL INFERENCE
Short Title: STATISTICAL INFERENCE
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 518
Description: Topics include principles of data reduction, point estimation, hypothesis testing, interval estimation, Bayesian inference, Decision Theory, inference foundations of analysis of variance and regression. STAT 519 will have more advanced assignments and examinations focusing on theoretical methods. Graduate/Undergraduate Equivalency: STAT 419. Mutually Exclusive: Cannot register for STAT 519 if student has credit for STAT 419.

STAT 520 - APPLIED MULTIVARIATE STATISTICAL METHODS
Short Title: APPLIED MULTIVAR STATISTICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: This multidisciplinary course for non-STAT majors will address modern applied multivariate statistical methods used in business, economics, engineering, biomedicine, and the environmental and social sciences. Topics include covariance and correlation matrices, multivariate analysis of variance, unsupervised class discovery, cluster validity, supervised class prediction, classifier ensemble diversity. Recommended Prerequisite(s): Introductory statistics course, such STAT 280 or STAT 305 or STAT 310 or STAT 315.

STAT 525 - BAYESIAN STATISTICS
Short Title: BAYESIAN STATISTICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: This course covers Bayesian Inference and methods for analyzing data. The emphasis will be on applied data analysis rather than theoretical development. We will consider a variety of models, including linear regression, hierarchical models, and models for categorical data. Recommended Prerequisite(s): STAT 519 and STAT 615 and STAT 605.

STAT 530 - CAUSAL ANALYSIS
Short Title: CAUSAL ANALYSIS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Correlation is not causation, but what exactly is causation? In this course we will explore the framework statistical science has formalized to approach causation. We will examine the potential outcomes concept, counterfactual reasoning and directed acyclic graph (DAG) models. The course will cover key theorems and results in the field as well as practical estimation and inferential techniques. The course will address instrumental variables as well as exploratory use of causal methods for model building and design of studies. We will survey applications through case studies in various disciplines. After taking this course students will be able to construct causal models, estimate causal effects and distinguish what data are relevant and irrelevant for causal analysis. Students will also be introduced to software techniques using R. Recommended Prerequisite(s): The course is open to all graduate students, but students should be aware that this is a graduate level course in statistics. Students should be performing graduate level research in their respective fields and/or have a background in statistical inference and research methods.

STAT 532 - FOUNDATIONS OF STATISTICAL INFERENCE I
Short Title: FOUNDATIONS OF STAT INF I
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 519
Description: The first semester in a two-semester sequence in mathematical statistics: random variables, distributions, small and large sample theorems of decision theory and Bayesian methods, hypothesis testing, point estimation, and confidence intervals; topics such as exponential families, univariate and multivariate linear models, and nonparametric inference will also be discussed. Required for graduate students in statistics.

STAT 533 - FOUNDATIONS OF STATISTICAL INFERENCE II
Short Title: FOUNDATIONS OF STAT INF II
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 532
Description: A continuation of STAT 532. Required for Ph.D. students in statistics.

STAT 535 - DATA SCIENCE PROJECTS
Short Title: DATA SCIENCE PROJECTS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: In this project-based course, student teams will complete semester-long data science research or analysis projects selected from a variety of disciplines and industries. Students will also learn best practices in data science. Instructor Permission Required. Graduate/Undergraduate Equivalency: STAT 435. Mutually Exclusive: Cannot register for STAT 535 if student has credit for STAT 435. Repeatable for Credit.

STAT 540 - INTERNSHIP IN STATISTICAL MODELING
Short Title: PRACTICUM IN STAT & DATA SCI
Department: Statistics
Grade Mode: Standard Letter
Course Type: Internship/Practicum
Credit Hours: 1-3
Restrictions: Enrollment is limited to students with a major in Statistics. Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Designed for graduate students in statistics. This course introduces current theoretical and applied problems encountered in statistical practice through practical internships. Students will be required to complete a paid or unpaid off-campus internship. MSTAT students will be required to submit a written, 10-15 page report/document summarizing the statistical experience developed during the internship, as well documenting how the internship was instrumental to the Master's in Statistical course of study. Repeatable for Credit.

STAT 541 - MULTIVARIATE ANALYSIS
Short Title: MULTIVARIATE ANALYSIS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 410 or STAT 615
Description: Study of multivariate data analysis and theory. Topics include normal theory, principal components, factor analysis, discrimination, estimation and hypothesis testing, multivariate analysis of variance and regression clustering.

STAT 542 - SIMULATION
Short Title: SIMULATION
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 519 and (STAT 615 or STAT 410)
Description: Topics in stochastic simulation including; random number generators; Monte Carlo methods, resampling methods, Markov Chain Monte Carlo, importance sampling and simulation based estimation for stochastic processes.

STAT 545 - GLM & CATEGORICAL DATA ANALYSIS
Short Title: GLM & CATEG'L DATA ANALYSIS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 519 or STAT 615 or STAT 410
Description: Contingency tables, association parameters, chi-squared tests, general theory of generalized linear models, logistics regression, loglinear models, poisson regression.

STAT 547 - SURVIVAL ANALYSIS
Short Title: SURVIVAL ANALYSIS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 519 and STAT 615
Description: Lifetime tables, cumulative distribution theory, censored data, Kaplan-Meier survival curves, log-rank tests, Cox proportional hazards models, parametric and non parametric estimation, hypothesis testing.

STAT 549 - FUNCTIONAL DATA ANALYSIS
Short Title: FUNCTIONAL DATA ANALYSIS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 533 and STAT 581
Description: Statistical methods for functional data; spaces of functions; pre-processing of functional data; probability models for functional data; basis representations including spline functions, orthogonal bases such as wavelets, and functional principal components; methods of inference for functional data including both frequentist and Bayesian methods.

STAT 550 - NONPARAMETRIC FUNCTION ESTIMATION
Short Title: NONPARAMETRIC FUNCTION EST
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Survey of topics in data analysis including data visualization, multivariate density estimation, and nonparametric regression. Advanced applications will include clustering, discrimination, dimension reduction, and bump-hunting using nonparametric density procedures.

STAT 551 - ADVANCED TOPICS IN DEPENDENT DATA
Short Title: DEPENDENT DATA
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 552 or STAT 621 or STAT 622
Description: The course will cover current topics in both modeling and forecasting discrete and continuous time series. A brief coverage will also be given to spatial and spatial-temporal processes.

STAT 552 - APPLIED STOCHASTIC PROCESSES
Short Title: APPLIED STOCHASTIC PROCESSES
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 518 or CMOR 500
Description: This course covers the theory of some of the most frequently used stochastic processes in application: Poisson and renewal processes, discrete-time and continuous-time Markov chains, martingales, Brownian motion and diffusion processes. Cross-list: CMOR 554.

STAT 553 - BIOSTATISTICS
Short Title: BIOSTATISTICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 615
Description: Same as STAT 453 with advanced problem sets. Graduate/Undergraduate Equivalency: STAT 453. Mutually Exclusive: Cannot register for STAT 553 if student has credit for STAT 453.

STAT 555 - STATISTICAL CONSULTING AND COLLABORATION
Short Title: STATISTICAL CONSULTING
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 545 or STAT 553 or STAT 613 or STAT 615
Description: Students will gain experience by working on real collaborative projects commonly encountered in practice. The goal of the course is to introduce students to projects where statistics and science meet and interact to produce knowledge. Students will learn to work with domain experts and collaborators to elicit the scientific question of interest, design studies, identify appropriate statistical analysis tools, and communicate results effectively in both oral and written forms. The course also addresses important topics related to developing productive collaborations, including building trust and mutual respect, effective communication, participation in multidisciplinary teams, and reproducible research. This course is also offered at GSBS/MD Anderson Cancer Center as GS01 1723. Repeatable for Credit.
Course URL: statistics.rice.edu (http://statistics.rice.edu)

STAT 581 - MATHEMATICAL PROBABILITY I
Short Title: MATHEMATICAL PROBABILITY I
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Measure-theoretic foundations of probability. Open to qualified undergraduates. Required for PhD students in statistics. Cross-list: CMOR 552.

STAT 582 - MATHEMATICAL PROBABILITY II
Short Title: MATHEMATICAL PROBABILITY II
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 581
Description: Continuation of STAT 581.

STAT 583 - INTRODUCTION TO RANDOM PROCESSES AND APPLICATIONS
Short Title: INTRO RANDOM PROCESSES & APPL
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Review of basic probability; Sequences of random variables; Random vectors and estimation; Basic concepts of random processes; Random processes in linear systems, expansions of random processes; Wiener filtering; Spectral representation of random processes, and white-noise integrals. Cross-list: CMOR 553, ELEC 533.

STAT 590 - GRADUATE RESEARCH IN STATISTICS
Short Title: GRAD RESEARCH IN STATISTICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Research
Credit Hours: 1-15
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Research course for graduate level research in probability and statistics. This course provides 1-15 hours of credit for students who wish to pursue a statistical research project of mutual interest to the student and a faculty member. The student will conduct independent research under the faculty member's direction. Repeatable for Credit. Repeatable for Credit.

STAT 591 - INDEPENDENT STUDY
Short Title: INDEPENDENT STUDY
Department: Statistics
Grade Mode: Standard Letter
Course Type: Independent Study
Credit Hours: 1-15
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Independent study for graduate level research topics in statistics. It provides credit for independent study in a selected area of statistical specialization. It is intended for directed reading, for conducting independent research, and documentation of conclusions and application of practical internships. Repeatable for Credit.

STAT 600 - GRADUATE SEMINAR IN STATISTICS
Short Title: GRADUATE SEMINAR IN STATISTICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Seminar
Credit Hour: 1
Restrictions: Enrollment is limited to students with a major in Statistics. Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Students participate in the process of researching professional literature (journal articles, book chapters, dissertations), preparing, delivering and critiquing talks. Literature topics change each semester. Repeatable for Credit.

STAT 601 - STATISTICS COLLOQUIUM
Short Title: STATISTICS COLLOQUIUM
Department: Statistics
Grade Mode: Standard Letter
Course Type: Seminar
Credit Hour: 1
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Repeatable for Credit.

STAT 602 - NEURAL MACHINE LEARNING AND DATA MINING II
Short Title: NEURAL MACHINE LEARNING II
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ELEC 502 or COMP 502 or STAT 502
Description: Advanced topics in ANN theories, with a focus on learning high-dimensional complex manifolds with neural maps (Self-Organizing Maps, Learning Vector Quantizers and variants). Application to data mining, clustering, classification, dimension reduction, sparse representation. The course will be a mix of lectures and seminar discussions with active student participation, based on most recent research publications. Students will have access to professional software environment to implement theories. Cross-list: COMP 602, ELEC 602. Repeatable for Credit.
Course URL: www.ece.rice.edu/~erzsebet/NMLcourseII.html (http://www.ece.rice.edu/~erzsebet/NMLcourseII.html)

STAT 603 - GRAPH-THEORETICAL APPROACHES TO KNOWLEDGE DISCOVERY
Short Title: GRAPHS FOR KNOWLEDGE DISCOVERY
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: The course will focus on using the power of graph representation and related tools for knowledge discovery from data (structure analysis, pattern recognition, cluster (community) detection). We will review necessary graph theoretical foundations, relevant types of graphs; characterization of graphs by various properties and measures (such as randomness, connectedness, clustering coefficient, similarity.) Topics will include graph segmentation algorithms such as Leading Eigenvector (spectral clustering), Walktrap (Markov-chain random walk), or Infomap, for inferring clusters; and graph matching algorithms for model comparison. We will explore graph representations emerging from vector quantization machine learning processes (e.g, neural maps, K-means), which provide compressed, rich models of complex data relations and facilitate analysis of large data sets with relatively small graphs. We will exercise applications in homeworks and a class project utilizing available graph manipulation software packages. No previous knowledge of Graph Theory is assumed. Students will be assumed to have working knowledge of the following: • Linear algebra (such as in MATH 355, ELEC 301 or equivalent) • Multivariate calculus (such as in MATH 212, MATH 232, or equivalent) • Probability and statistics (such as in STAT 310, or ELEC/STAT 331 or equivalent) Please see additional information on recommended background in the syllabus and at the course web site. Recommended Prerequisite(s): No previous knowledge of Graph Theory is assumed. Students will be assumed to have working knowledge of the following: • Linear algebra (such as in MATH 355, ELEC 301 or equivalent) • Multivariate calculus (such as in MATH 212, MATH 232, or equivalent) • Probability and statistics (such as in STAT 310, or ELEC/STAT 331 or equivalent) If unsure, please check with the instructor. In addition, • If you have taken (ELEC 531 and (CMOR 553 / ELEC 533 / STAT 583)) or (STAT 615 and STAT 518) you automatically qualify. • Familiarity with simple information theoretical notions (ELEC 241 or equivalent) is an advantage. These will be briefly reviewed in the course as necessary. • Having taken machine learning type courses such as COMP/ELEC/STAT 502, ELEC/COMP 440, STAT 613 is an advantage.

STAT 604 - COMPUTATIONAL ECONOMICS
Short Title: COMPUTATIONAL ECONOMICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 501 and ECON 502 and ECON 505 and ECON 508 and ECON 510 and ECON 511 and MATH 321
Description: Numerical methods most commonly used in economics and their application to frontier research projects in economic modeling. Topics include optimization theory and numerical integration. Cross-list: ECON 504.

STAT 605 - R FOR DATA SCIENCE
Short Title: R FOR DATA SCIENCE
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: This course introduces students to the statistical programming language, R, and how to use it in statistical and data science problems. The course traces the data science pipeline from importing data into R, exploring and visualizing data, applying a variety of statistical methods, and communicating results. Important computational tools for data science (e.g. databases, web scraping, and big data) and good programming practice are integrated throughout the course. No programming experience is required. STAT 605 includes more advanced assignments and/or examinations than STAT 405. Graduate/Undergraduate Equivalency: STAT 405. Mutually Exclusive: Cannot register for STAT 605 if student has credit for STAT 405.

STAT 606 - SAS STATISTICAL PROGRAMMING
Short Title: SAS STATISTICAL PROGRAMMING
Department: Statistics
Grade Mode: Standard Letter
Course Type: Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Students will learn how to work within the statistical programming language SAS. The course covers from getting data into SAS, transforming and plotting it, to applying appropriate statistical analysis, and communicating the results. Important topics such as database managing with SQL, macro programming, interactive Matrix Language, and efficient programming in general are integrated throughout the course. Graduate/Undergraduate Equivalency: STAT 406. Mutually Exclusive: Cannot register for STAT 606 if student has credit for STAT 406.

STAT 607 - COMPUTATION FOR STATISTICAL RESEARCH
Short Title: STATISTICAL COMPUTING
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: This course will cover statistical computing beyond introductory programming, with a focus on essential tools for implementing statistical methods in research. Topics will include algorithms for model fitting, including optimization and MCMC sampling methods, as well as practical tools for statistical computing, including code profiling, debugging, cluster computing, source code management using GitHub, reproducible research tools, and the development of R packages and Shiny apps.

STAT 610 - ECONOMETRICS I
Short Title: ECONOMETRICS I
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Estimation and inference in single equation regression models, multicollinearity, autocorrelated and heteroskedastic disturbances, distributed lags, asymptotic theory, and maximum likelihood techniques. Emphasis is placed on critical analysis of the literature. Cross-list: ECON 510.

STAT 611 - ECONOMETRICS II
Short Title: ECONOMETRICS II
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): ECON 510 or STAT 610
Description: Topics in linear and nonlinear simultaneous equations estimation, including panel data, qualitative and categorical dependent variable models, duration analysis, simulation-based estimation, treatment effects, stochastic production frontier estimation. Cross-list: ECON 511.

STAT 613 - STATISTICAL MACHINE LEARNING
Short Title: STAT MACHINE LEARNING
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: This course is an advanced survey of statistical machine learning theory and methods. Emphasis will be placed methodological, theoretical, and computational aspects of tools such as regularized regression, classification, kernels, dimension reduction, clustering, graphical models, trees, and ensemble learning. Recommended Prerequisite(s): STAT 615 and STAT 605 and STAT 519. Mutually Exclusive: Cannot register for STAT 613 if student has credit for ELEC 478.

STAT 615 - REGRESSION AND LINEAR MODELS
Short Title: REGRESSION AND LINEAR MODELS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: A survey of regression, linear models, and experimental design. Topics include simple and multiple linear regression, single- and multi-factor studies, analysis of variance, analysis of covariance, model selection, diagnostics. Data analysis using statistical software is emphasized.
Course URL: ece.rice.edu/~erzsebet/STAT615.html (http://ece.rice.edu/~erzsebet/STAT615.html)

STAT 616 - ADVANCED STATISTICAL METHODS
Short Title: ADVANCED STATISTICAL METHODS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 615
Description: Advanced topics in statistical applications such as sampling, experimental design and statistical process control. STAT 616 will have more advanced assignments and examinations focusing on theoretical methods. Graduate/Undergraduate Equivalency: STAT 411. Mutually Exclusive: Cannot register for STAT 616 if student has credit for STAT 411.

STAT 620 - SPECIAL TOPICS IN STATISTICS
Short Title: SPECIAL TOPICS IN STAT
Department: Statistics
Grade Mode: Standard Letter
Course Type: Seminar
Credit Hours: 1-3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Seminar on advanced topics in Statistics. Repeatable for Credit.

STAT 621 - APPLIED TIME SERIES AND FORECASTING
Short Title: APPLIED TIME SERIES/FORECASTNG
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 615 (may be taken concurrently)
Description: Applied time series modeling and forecasting, with applications to financial markets with advanced problem sets. This is a graduate version of STAT 421 with advanced assignments. The courses STAT 615 and STAT 431 may be taken concurrently with STAT 621 if courses are not in history. Graduate/Undergraduate Equivalency: STAT 421. Mutually Exclusive: Cannot register for STAT 621 if student has credit for STAT 421.

STAT 623 - PROBABILITY IN BIOINFORMATICS AND GENETICS
Short Title: PROB BIOINFORMATICS & GENETICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 305 or STAT 310 or STAT 315 or DSCI 301 or STAT 331 or STAT 418 or STAT 518
Description: Course introduces the student to modern biotechnology and genomic data. Statistical methods to analyze genomic data are covered, including probability models, basic stochastic processes, and statistical modeling. Biological topics include DNA sequence analysis, phylogenetic inference, gene finding, and molecular evolution. A weekly 1-hour lab on computational aspects of the course will cover software and practice of bioinformatics and computational biology, including modern data sets. Graduate/Undergraduate Equivalency: STAT 423. Mutually Exclusive: Cannot register for STAT 623 if student has credit for STAT 423.

STAT 625 - ADVANCED BAYESIAN INFERENCE
Short Title: ADVANCED BAYESIAN INFERENCE
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 525
Description: This course focuses on the Bayesian inference with emphasis on theory and applications. In this course, we will cover advancements and challenges in modern Bayesian inference, and illustrate a variety of theoretical and computational methods, simulation techniques, and hierarchical models that are suitable to analyze complex data. Repeatable for Credit.

STAT 626 - THE STATISTICAL FOUNDATION OF GENERATIVE ARTIFICIAL INTELLIGENCE
Short Title: STAT FOUNDATION GENERATIVE AI
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 518 and STAT 615
Description: This course is an advanced machine learning course that focuses on the statistical foundations of generative AI in the Data Science (DSCI) Minor Program. In this course, students will study the fundamental concepts of statistics and understand the evolution of machine learning from discriminative to generative models. Specifically, students will learn two main foundation models: Transformers and diffusion models, via understanding their statistical foundations, comparing their advantages to classical models, and implementing the two models in real-world applications. Graduate/Undergraduate Equivalency: STAT 420.

STAT 630 - STATISTICAL DESIGNS FOR CLINICAL TRIALS
Short Title: DESIGNS FOR CLINICAL TRIALS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 519 and STAT 615
Description: This course provides a comprehensive introduction to statistical designs used in clinical trials. It covers key concepts relevant to a biostatistician's daily responsibilities in trial design, including different types of clinical trials (Phase I to Phase III), (adaptive) randomization methods, and sample size and power calculations. The course will also introduce commonly used design strategies in clinical trials, incorporating both frequentist and Bayesian approaches. Topics include adaptive dose-finding designs, group-sequential designs, sample size re-estimation, and sequential monitoring. Additionally, the course will cover advanced topics such as innovative designs for precision medicine, basket and platform trials, and trials utilizing complex endpoints. MD Anderson cancer trials will be used as motivating and illustrative examples throughout the course. By the end of the course, students are expected to be able to independently design standard clinical trials. No prior knowledge of biology or medicine is required, and basic Bayesian statistical concepts will be introduced.

STAT 635 - FOUNDATIONS OF STATISTICS
Short Title: FOUNDATIONS OF STATISTICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Statistical inference is the de facto tool in data science to carry out hypothesis testing and draw conclusions under uncertainty. With increasingly diverse stakeholders relying on inference as data-driven solutions, to study, decipher, and articulate its strength and limitation become more important than ever. In this course, we will discuss fundamental issues in statistical inference, partly in response to a range of daunting challenges posed by modern data science such as reproducibility and interpretability at large scales. A sample of topics includes the use of p-values vs. Bayes factors, frequentist properties of Bayesian procedures for both parametric and nonparametric models, Bernstein von-Mises phenomena, variable/feature selection, post-selection inference, false discovery control. Recommended Prerequisite(s): STAT 532/533 or equivalent courses on classical statistical inference, and STAT525 or equivalent courses on Bayesian inference.

STAT 648 - GRAPHICAL MODELS AND NETWORKS
Short Title: GRAPH MODELS & NETWORKS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 519
Description: Graphical models – aka Bayes networks, Markov networks, Gaussian networks, etc. – have been widely used to represent complex phenomena with dependence. The course aims to stimulate interest in graphical models and covers directed and undirected graphical models, exponential-family representations of graphical models, statistical inference, finite-sample and large-sample properties, and applications.

STAT 649 - QUANTITATIVE FINANCIAL RISK MANAGEMENT
Short Title: QUAN FINANCIAL RISK MANAGEMENT
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 519 or STAT 615
Description: This course covers the use of financial securities and derivatives to take or hedge financial risk positions. Most commonly used instruments, from simple forwards and futures to exotic options and swaptions are covered. The pricing of derivatives securities will also be studied, but the emphasis will be on the mechanics and uses of financial engineering methods. Students receiving graduate credit in STAT 649 will be expected to address additional homework and test questions targeting a graduate level understanding of the material. Graduate/Undergraduate Equivalency: STAT 449.

STAT 650 - STOCHASTIC DIFFERENTIAL EQUATIONS WITH APPLICATIONS TO FINANCE
Short Title: STOCH DIFF EQU WITH APP FINA
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 581 or CAAM 581 or CMOR 552
Description: This course will cover both theory and applications of stochastic differential equations. Topics include: the Langevin equation from physics, the Wiener process, white noise, the martingale theory, numerical methods and simulation, the Ito and Stratonovitch theories, applications in finance, signal processing, biology, and other fields.

STAT 666 - BAYESIAN OPTIMIZATION AND STATISTICAL REINFORCEMENT LEARNING
Short Title: BAYESIAN OPTIMIZATION
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 519 and STAT 525
Description: Bayesian optimization is a powerful machine learning technique for optimizing black-box functions with expensive evaluations. This course provides an in-depth introduction to Bayesian optimization, covering fundamental principles, mathematical foundations, and real-world applications. Students will explore experimental design, Gaussian processes, nonparametric methods, surrogate modeling, reinforcement learning, and bandit algorithms. The course will emphasize mathematical theoretical understanding in practical implementation, preparing students for research-level statistical reinforcement learning. Instructor Permission Required. Recommended Prerequisite(s): STAT 532/533 or STAT 581/582

STAT 677 - SPECIAL TOPICS
Short Title: SPECIAL TOPICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Internship/Practicum, Laboratory, Lecture, Seminar, Independent Study
Credit Hours: 1-4
Restrictions: Enrollment is limited to Graduate or Visiting Graduate level students.
Course Level: Graduate
Description: Topics and credit hours vary each semester. Contact department for current semester's topic(s). Repeatable for Credit.

STAT 682 - QUANTITATIVE FINANCIAL ANALYTICS
Short Title: QUANT FINANCIAL ANALYTICS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: A modern approach to fundamental analytics of securities, the classic works of Graham and Dodd. Deconstructing the Efficient Market Hypothesis Financial Statement Analysis, Capital Market Theory, CAPM, APT, Fama-French Empirical Financial Forecasting. Graduate/Undergraduate Equivalency: STAT 482. Mutually Exclusive: Cannot register for STAT 682 if student has credit for STAT 482.

STAT 684 - ENVIRONMENTAL RISK ASSESSMENT & HUMAN HEALTH
Short Title: ENVIRON RISK ASSESS&HUMAN HLTH
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 180 or STAT 280 or STAT 305
Description: Learn and apply quantitative risk assessment methodology to estimate human health risk from environmental exposure to contamination in air, soil and water. Students will conduct a series of team projects focused on toxicology, risk based screening levels, exposure concentration estimation and risk characterization. Cross-list: CEVE 684. Graduate/Undergraduate Equivalency: STAT 484. Mutually Exclusive: Cannot register for STAT 684 if student has credit for STAT 484.

STAT 685 - ENVIRONMENTAL STATISTICS AND DECISION MAKING
Short Title: ENVIR STAT & DECISION MAKING
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture/Laboratory
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 305 or STAT 385
Description: A project oriented computer intensive course focusing on statistical and mathematical solutions and investigations for the purpose of environmental decisions. This course is required for EADM students. Graduate/Undergraduate Equivalency: STAT 485. Mutually Exclusive: Cannot register for STAT 685 if student has credit for STAT 485.

STAT 686 - MARKET MODELS
Short Title: MARKET MODELS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Prerequisite(s): STAT 518 and (STAT 615 or STAT 410)
Description: This course takes the classical efficient market models and superimposes upon it models for other stochastic phenomena not generally accounted for in efficient market theory, showing how risk is lessened by portfolios and other mechanisms. This graduate course uses computer simulations as an alternative to closed form solutions with advanced problem sets. Graduate/Undergraduate Equivalency: STAT 486. Mutually Exclusive: Cannot register for STAT 686 if student has credit for STAT 486.

STAT 687 - COFES BLOCKCHAIN AND CRYPTOCURRENCIES
Short Title: COFES BLOCKCHAIN/CRYPTO
Department: Statistics
Grade Mode: Standard Letter
Course Type: Lecture
Credit Hours: 3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: How will blockchains empower positive and radical change in our increasingly globalized and data-driven society? Students should be prepared for exposure to highly interdisciplinary discussions regarding applying new technology to rethink existing economic & social structures. Graduate/Undergraduate Equivalency: STAT 487.

STAT 696 - RTG CROSS-TRAINING IN DATA SCIENCE
Short Title: RTG CROSS-TRAINING IN DATA SCI
Department: Statistics
Grade Mode: Standard Letter
Course Type: Seminar
Credit Hour: 1
Restrictions: Enrollment is limited to students with a major in Computer Science or Statistics. Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: A seminar course to introduce students to topics in Data Science at the interface between Statistics and Computer Science. Students participate in the process of preparing, delivering and critiquing talks. Topics change each semester. Instructor Permission Required. Cross-list: COMP 696. Graduate/Undergraduate Equivalency: STAT 496. Mutually Exclusive: Cannot register for STAT 696 if student has credit for STAT 496. Repeatable for Credit.

STAT 699 - TOPICS IN STATISTICAL SCIENCES
Short Title: TOPICS IN STATISTICAL SCIENCES
Department: Statistics
Grade Mode: Standard Letter
Course Type: Seminar
Credit Hours: 1-3
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: This course prepares a student for research in the statistical sciences. Topics may change each semester depending on instructor interest. Current topics include bioinformatics, computational finance, data science, Bayesian methods, mathematical tools for statistics, simulation, optimization, and dependent data, high-dimensional problems, and complex problems. Additional topics may be introduced. Contact the instructor for more information. Graduate/Undergraduate Equivalency: STAT 499. Repeatable for Credit.
Course URL: statistics.rice.edu (http://statistics.rice.edu)

STAT 800 - THESIS
Short Title: THESIS
Department: Statistics
Grade Mode: Standard Letter
Course Type: Research
Credit Hours: 1-15
Restrictions: Enrollment is limited to Graduate level students.
Course Level: Graduate
Description: Thesis for Graduate Students. Repeatable for credit. Repeatable for Credit.

Description and Code Legend

Note: *Internally, the university uses the following descriptions, codes, and abbreviations for this academic program. The following is a quick reference:*

Course Catalog/Schedule

- Course offerings/subject code: STAT

Home School Description and Code

- Engineering and Computing: EN

Home Department (or Program) Descriptions and Codes

- Statistics (BA-STAT, BS, MA, MSTAT, and PhD degrees, STAS minor): STAT
- Data Science (DSCI minor): DSCI
- Financial Computation and Modeling (FCAM minor): FCAM
- Sport Analytics (BA-SPCS degree): SPCS

Undergraduate Degree Descriptions and Codes

- Bachelor of Arts Degree: BA
- Bachelor of Science Degree: BS

Undergraduate Major Descriptions and Codes

- Major in Statistics (BA and BS degrees): STAT
- Major in Sport Analytics (BA degree): SPCS

Undergraduate Degree Program Option Descriptions and Codes*

- Degree Program Option (BA degree): BA-ENGI
- Degree Program Option (BS degree): BS-ENGI

Undergraduate Minor Descriptions and Codes

- Minor in Data Science: DSCI
- Minor in Financial Computation and Modeling: FCAM
- Minor in Statistics: STAS

Graduate Degree Descriptions and Codes

- Master of Arts degree: MA
- Master of Statistics degree: MStat
- Master of Computational Science and Engineering degree: MCSE
- Doctor of Philosophy degree: PhD

Graduate Degree Program Descriptions and Codes

- Degree Program in Computational Science and Engineering (MCSE degree): CSCE
- Degree Program in Statistics (MA, MStat, and PhD degrees): STAT

Graduate Degree Program Option Description and Code*

- Degree Program Option - Non-Thesis (MA degree): MA-NTHESIS

CIP Code and Description [1]

- **STAT** Major/Program: CIP Code/Title: *27.0501 - Statistics, General*
- **SPCS** Major/Program: CIP Code/Title: *30.7199 - Data Analytics, Other*
- **CSCE** Major/Program: CIP Code/Title: *30.3001 - Computational Science*
- **DSCI** Minor: CIP Code/Title: *30.7001 - Data Science, General*
- **FCAM** Minor: CIP Code/Title: *27.0305 - Financial Mathematics*
- **STAS** Minor: CIP Code/Title: *27.0501 - Statistics, General*

* *Systems Use Only: this information is used solely by internal offices at Rice University (such as OTR, GPS, etc.) and primarily within student information systems and support.*

[1] Classification of Instructional Programs (CIP) 2020 Codes and Descriptions from the National Center for Education Statistics: https://nces.ed.gov/ipeds/cipcode/.