

STATISTICS (STAT)

STAT 103 The Development of Statistics (3 credits)

A survey of traditional and contemporary statistical topics developed within a historical framework and designed to develop an appreciation for the role and universality of statistics as a cultural force in our society. Not for majors in the College of Science and Mathematics. Equivalent course MATH 103 effective through Spring 2020. Meets Gen Ed - Mathematics.

STAT 109 Statistics (3 credits)

Introduction to the use of statistics in the real world. Topics include: analysis and presentation of data, variability and uncertainty in data, techniques of statistical inference and decision-making. Computer centered model includes online lectures, textbook and homework, lab sessions with on-demand tutoring support, small group active learning sessions as well as optional individual tutoring in the Mathematics Computer Laboratory. Not for majors in Mathematics, Mathematics with Applied Math concentration, Mathematics-Teacher Education or Biology. Equivalent course MATH 109 effective through Spring 2020. Special fee. Meets Gen Ed - Mathematics.

STAT 110 Statistics for the Biological Sciences (4 credits)

Introduction to the use of statistics in the real world with an emphasis on biological data. Topics include: analysis and presentation of data, variability and uncertainty in data, techniques of statistical inference and decision-making. This course is intended for Biology majors. Statistical software such as JMP will be used. Not for mathematics majors. Equivalent course MATH 110 effective through Spring 2020. Meets Gen Ed - Mathematics.

STAT 230 Data Science and Statistics (3 credits)

Prerequisite(s): MATH 111 with a grade of C- or higher or placement through the Montclair State University Placement Test (MSUPT) or MATH 122 with a grade of C- or higher or AMAT 120 with a grade of C- or higher. Introduction to the general methodology of statistical data science in the context of the purpose, planning, analysis, and conclusions associated with a variety of field-specific research studies. Topics include Exploratory Data Analysis (EDA), summary measures, the normal distribution, linear regression, correlation, sampling distributions, statistical estimation and inference including the t test and Chi-square test. Understanding data is the primary focus of this course with emphasis on statistical techniques for gathering, analyzing, summarizing and communicating the results of these analyses. Statistical software is used. Equivalent course STAT 401 effective through Spring 2020.

STAT 231 Data Science and Biostatistics (1 credit)

Prerequisite(s): MATH 111 with a grade of C- or higher or placement through the Montclair State University Placement Test (MSUPT), or AMAT 120 or MATH 122 or any higher level undergraduate AMAT course or MATH course with a grade of C- or higher; and STAT 230 may be taken as prerequisite or corequisite. Introduction to the general methodology of statistical data science in the context of the purpose, planning, analysis, and conclusions associated with biological data and research studies. Statistical software is used. Topics include the analysis and presentation of data, techniques of statistical inference and decision-making with an emphasis on bivariate and multivariate data.

STAT 330 Fundamentals of Modern Statistics I (4 credits)

Prerequisite(s): STAT 230 and AMAT 120. Displaying, describing and modeling data. Methods for drawing conclusions from data: probability, significance testing, confidence interval estimation, linear regression, analysis of variance, and categorical data analysis. Examples from many disciplines including the social and natural sciences. Statistical software is used.

STAT 341 Statistical Computing (3 credits)

Prerequisite(s): STAT 230 or equivalent with departmental approval. This course is designed to acquaint students with the use of the statistical software in solving statistical problems, and to develop an intermediate level statistical methodology. Statistical computing packages will be utilized. Equivalent course STAT 441 effective through Spring 2020.

STAT 442 Fundamentals of Modern Statistics II (3 credits)

Prerequisite(s): STAT 330; or equivalent with departmental approval. Continuation of STAT 330. Principles of statistical inference; categorical data analysis; one and two-way anova; multiple linear regression; nonparametric methods; bootstrap methods. Examples from a wide variety of disciplines. Statistical software is used.

STAT 443 Theory of Statistics (3 credits)

Prerequisite(s): STAT 330 and AMAT 345 or equivalent with departmental approval. Develops statistical methods from probability theory. Topics include discrete and continuous probability distributions, estimation methods, sampling distributions, confidence intervals, hypothesis testing, and the impact on statistical analysis methods.

STAT 471 Time Series Analysis (3 credits)

Prerequisite(s): STAT 330; or equivalent with departmental approval. The Box-Jenkins approach to the stochastic modeling of time series data. The concepts of stationarity, model identification and estimation, and forecasting and diagnostics, are discussed in the context of the ARIMA class of time domain models. Emphasis of the course is on the application of this methodology to real time series. Spectral analysis, transfer function and statespace models will be introduced. Statistical software is used.

STAT 472 Missing Data Analysis (3 credits)

Prerequisite(s): STAT 330; or equivalent with departmental approval. Missing data can occur in research studies due to attrition, nonresponse, censoring, or simply incorrect data entries. This can become particularly problematic in surveys since the default in statistical packages is to exclude all "cases" with missing values for any variable. In this course, methods for handling missing data are considered. MCAR and MAR mechanisms are introduced, complete case versus available case methods are compared, and the multiple imputation approach is applied to real datasets using statistical software.

STAT 481 Introduction to Statistical Data Mining (3 credits)

Prerequisite(s): STAT 330; or equivalent with departmental approval. Introduction to the concepts and applications of a variety of data mining methods. Data mining is the process of selecting, exploring, and modeling large amounts of data to uncover previously unknown patterns in the data. Statistical techniques covered include classification and regression trees, predictive modeling, and unsupervised learning. Hands-on applications to data sets from diverse fields. Statistical software is used.

STAT 486 Multivariate Analysis (3 credits)

Prerequisite(s): STAT 330; or equivalent with departmental approval; and STAT 443 may be taken as prerequisite or corequisite. Analysis of multiple response variables simultaneously. Covariance and the multivariate normal distribution, MANOVA, principal components. Hands-on applications to data sets from diverse fields. Statistical software is used.

STAT 487 Statistical Genomics (3 credits)

Prerequisite(s): BIOL 380 and STAT 330; or equivalent with departmental approval. Analysis of discrete data, illustrated with genetic data on morphological characters, allozymes, restriction fragment length polymorphisms and DNA sequences. Maximum likelihood and Bayesian estimation, including iterative procedures. Numerical resampling and bootstrapping. Development of statistical techniques for characterizing genetic disequilibrium and diversity. Locating genes with markers. Mutually Exclusive with BIOL 487.

STAT 490 Seminar (1 credit)

Prerequisite(s): STAT 330. Attendance at the Applied Mathemats and Statistics Colloquium. May be repeated for a maximum of 3 credits.

STAT 495 Special Topics in Statistical Science (3 credits)

Prerequisite(s): STAT 330; or equivalent with departmental approval. Guided study of selected topics in statistical science such as exploratory data analysis, applied multivariate methods, statistical quality control, design of experiments. May be repeated for a maximum of 6 credits.

STAT 497 Statistical Science Research I (1-3 credits)

Prerequisite(s): Departmental approval. Individual research in an area of Statistical Science agreed upon by the student and the instructor. Prerequisite: Instructor approval. Students must not accumulate more than six (6) credits total in courses AMAT 497, AMAT 498, STAT 495, STAT 497, STAT 498.

STAT 498 Statistical Science Research II (1-3 credits)

Prerequisite(s): Departmental approval. Individual research in an area of Statistical Science agreed upon by the student and the instructor. Students must not accumulate more than six (6) credits total in courses AMAT 497, AMAT 498, STAT 495, STAT 497, STAT 498.

STAT 499 Co-Op in Statistics (3 credits)

Prerequisite(s): STAT 341 and department approval. Application of conceptual ideas from Statistics in a real work environment. The Co-Op experience is a semester of full- or part-time work under the guidance of a workplace supervisor and a faculty advisor.

STAT 500 Biostatistical Methods for Research Workers I (3 credits)

Prerequisite(s): Permission of graduate program coordinator. Planning effective observational and experimental research, data collection and summarization, significance testing and p-values, t-test, chi-square, regression and correlation, use of statistical software, reading statistical results in the literature. Required course for the MPH degree.

STAT 532 Fundamentals of Statistics (3 credits)

Prerequisite(s): STAT 330 or equivalent with departmental approval. Principles of statistical inference; categorical data analysis; one and two-way anova; multiple linear regression; nonparametric methods; resampling methods. Examples from a variety of disciplines. Statistical software is used. Equivalent course STAT 541 effective through Spring 2019.

STAT 534 Statistical Computing (3 credits)

Prerequisite(s): STAT 330 or equivalent with departmental approval. This course is designed to acquaint students with the computational aspects associated with statistical problems, with particular emphasis on data analytics using the comprehensive statistical software packages SAS and R. The programming environments will be covered in detail: data import and data manipulation techniques, working with multiple datasets, statistical summary procedures, using public domain add-on packages, statistical graphics, and debugging. Equivalent course STAT 544 effective through Spring 2019.

STAT 536 Statistical Theory (3 credits)

Prerequisite(s): STAT 532. Discrete and continuous probability distributions, multivariate distributions, sampling theory, transformations, Chi-squared, 'F' and 't' distributions. Point estimation, properties of estimators, sufficiency, exponential families, interval estimation, hypothesis testing, power, Neyman-Pearson lemma, likelihood ratio tests. The impact of the above theory on areas such as regression analysis, analysis of variance and analysis of discrete data. Equivalent course STAT 542 effective through Spring 2019.

STAT 537 Design and Analysis of Experiments (3 credits)

Prerequisite(s): STAT 532 and STAT 534. Fundamental principles of design. Fixed, random, and mixed effects models. Restricted randomization and block designs. Split-plot designs, confounding and fractional factorial designs. Experimental and sampling errors. Equivalent course STAT 547 effective through Spring 2019.

STAT 538 Regression Methods (3 credits)

Prerequisite(s): STAT 532 and STAT 534. Multiple linear regression, matrices, partial correlation, and residual diagnostics. Subset selection and regression model building techniques. Statistical properties of the regression parameter estimates. Incorporating qualitative factors and the general linear model. Polynomial and response surface regression. Introduction to non-linear regression. Equivalent course STAT 548 effective through Spring 2019.

STAT 543 Special Topics in Statistical Theory (3 credits)

Prerequisite(s): STAT 536 and permission of graduate program coordinator. Discrete and continuous probability distributions, multivariate distributions, sampling theory, transformations, Chi-squared, 'F' and 't' distributions. Point estimation, properties of estimators, sufficiency, exponential families, interval estimation, hypothesis testing, power, Neyman-Pearson Lemma, likelihood ratio tests. The impact of the above theory on areas such as regression analysis, analysis of variance and analysis of discrete data.

STAT 545 Practicum in Statistics I (3 credits)

Prerequisite(s): STAT 532 and STAT 534; and STAT 537 or STAT 538; and permission of graduate program coordinator. An applied experience in which students work with practitioners in industry, government or research organizations utilizing statistical techniques in a research setting. Students will work with statisticians on projects involving experimental design and data collection as well as the analysis and interpretation of the data. May be repeated once.

STAT 546 Non-Parametric Statistics (3 credits)

Prerequisite(s): STAT 330 and permission of graduate program coordinator. Selected distribution-free tests and estimation techniques including sign, Kolmogorov-Smirnov, Wilcoxon signed rank, Mann-Whitney, Chi-square, rank correlation, Kendall's Tau, Kruskal-Wallis, Friedman, McNemar, and others.

STAT 549 Sampling Techniques (3 credits)

Prerequisite(s): STAT 330 or STAT 443, and permission of graduate program coordinator. Sampling and survey methodology; basic sampling theory; simple, stratified, random, cluster, systematic and area sampling. Sampling errors and estimation procedures.

STAT 552 Intermediate Statistics Methods (3 credits)

Prerequisite(s): STAT 330, permission of graduate program coordinator. Follow up to introductory statistical methods course. Principles of statistical inference; categorical data analysis; one and two-way anova; multiple linear regression; nonparametric methods; bootstrap methods. Examples from a wide variety of disciplines. Statistical software is used.

STAT 561 Statistical Data Mining I (3 credits)

Prerequisite(s): STAT 532 or STAT 538 or equivalent, permission of graduate program coordinator. Introduction to the concepts and applications of a variety of data mining methods. Data mining is the process of selecting, exploring, and modeling large amounts of data to uncover previously unknown patterns in the data. Statistical methods covered include classification and regression trees, predictive modeling, and unsupervised learning. Hands-on applications to data sets from diverse fields. Statistical software is used.

STAT 562 Statistical Data Mining II (3 credits)

Prerequisite(s): STAT 548 and STAT 561, permission of graduate program coordinator. Continuation of STAT 561. An in-depth approach to the topics of STAT 561 including logistic regression, decision trees, classifier theory, predictive modeling and unsupervised learning methods. Mathematical details of these techniques as well as the computational methods for their implementation. Hands-on applications to data sets from diverse fields. Statistical software is used.

STAT 570 Statistical Consulting (3 credits)

Prerequisite(s): STAT 532 or equivalent, permission of graduate program coordinator. An introduction to the statistical and interpersonal issues that arise in statistical consulting. Topics include communicating with scientists in other disciplines, technical writing and presentation, and statistical tools for consulting. Lectures center around real case studies presented by the instructor and invited speakers. Statistical software is used. Emphasis of the course is on the scientific, statistical, computational, and communication skills that a statistical consultant needs for interacting effectively with researchers from a wide range of disciplines.

STAT 571 Time Series Analysis (3 credits)

Prerequisite(s): STAT 538. The Box-Jenkins approach to the stochastic modeling of time series data. The concepts of stationarity, model identification and estimation, forecasting and diagnostics, are discussed in the context of the ARIMA class of time domain models. Emphasis of the course is on the application of this methodology to real time series. Spectral analysis, transfer function and statespace models will be introduced. Statistical software is used.

STAT 572 Missing Data Analysis (3 credits)

Prerequisite(s): STAT 532. Missing data can occur in research studies due to attrition, nonresponse, censoring, or simply incorrect data entries. This can become particularly problematic in surveys since the default in statistical packages is to exclude all "cases" with missing values for any variable. In this course, methods for handling missing data are considered. MCAR and MAR mechanisms are introduced, complete case versus available case methods are compared, and the multiple imputation approach is applied to real datasets using statistical software.

STAT 577 Applied Longitudinal Data Analysis (3 credits)

Prerequisite(s): STAT 538 and STAT 536. This course introduces students to statistical models and methods for longitudinal and clustered data. Methods include analyzing the mean response profiles, modeling the mean parametric curves, modeling covariance, linear mixed effects models, generalized estimating equation models, generalized linear mixed effects models.

STAT 583 Fundamentals of Data Analysis (3 credits)

Prerequisite(s): STAT 330 and permission of the Graduate Program Coordinator. Theory and application of statistical methods for data analysis in professional industrial areas such as business, manufacturing, biomedical and marketing. Exploratory data analysis; principles of statistical inference; design and analysis of observational studies and experiments; linear regression. Additional topics based on real examples from other disciplines would include biostatistical methods, multivariate analysis, time series analysis, and data mining. Statistical software is used.

STAT 595 Special Topics in Statistics (3 credits)

Prerequisite(s): Permission of graduate program coordinator. Topics such as exploratory data analysis, statistical graphics, statistical quality control and statistical quality assurance, Bayesian methods and Markov chain Monte Carlo studies. May be repeated twice for a total of 9 credits.

STAT 597 Research Methods in Statistical Science (3 credits)

Prerequisite(s): STAT 552 or equivalent and departmental approval. Preparation for research in statistical science. Application of mathematics and computing science to the development, modeling, validation and evaluation of statistical research methods. Identification of statistical issues in real world problems and novel applications of statistical methods to these problems. Development of research proposals in statistical science.

STAT 600 Statistical Methods for Research Workers I (3 credits)

Restriction(s): Doctoral status, permission of graduate program coordinator. Planning effective observational and experimental research, data collection and summarization, significance testing and p-values, t-test, chi-square, regression and correlation, use of statistical software, reading statistical results in the literature.

STAT 601 Statistical Methods for Research Workers II (3 credits)

Prerequisite(s): STAT 600 or equivalent, permission of graduate program coordinator. Principles and practices of experimental design. Randomized comparative designs, randomized block designs, factorial designs, dealing with concomitant variables, repeated measurements. Predictive modeling and analysis of designed studies. Topics from multivariate analysis, time series analysis, categorical data analysis. Students analyze data from research projects.

STAT 610 Statistical Methods For Scientific Research (3 credits)

Prerequisite(s): Departmental approval. This course aims to provide an introduction to the types of statistical analyses used in scientific research. Topics include EDA analysis, inference procedures, modeling and estimation, generalized linear models, multivariate analysis, time series and design of experiments. The course focuses on applications in areas including ecology, environmental health and environmental sciences and public health.

STAT 640 Biostatistics: Categorical Data Analysis (3 credits)

Prerequisite(s): STAT 537 and STAT 538. Fundamental statistical concepts and methods used by statistical scientists in the health, biological, medical, and biopharmaceutical industries. Two way table analysis, three way table analysis, logistic regression, generalized linear models, loglinear models, matched pairs.

STAT 641 Biostatistics: Clinical Trials and Survival Analysis (3 credits)

Prerequisite(s): STAT 537 and STAT 538. Fundamental statistical concepts and methods used by statistical scientists in the health, biological, medical, and biopharmaceutical industries. Survival analysis, and designs for clinical trials.

STAT 642 Introduction to Stochastic Processes (3 credits)

Prerequisite(s): MATH 540 and permission of graduate program coordinator. Generating functions, convolutions, recurrent events, random walk models, gambler's ruin problems, Markov chains and processes, time dependent stochastic processes, queuing theory and epidemic models.

STAT 645 Special Topics in Advanced Statistics (3 credits)

Prerequisite(s): Permission of graduate program coordinator. Recent developments in statistical science. Topics such as data mining, statistical genomics, computationally intensive data-analytic methods, statistical consulting, dynamic statistical graphics and visualization, applied time series analysis. May be repeated with no limit as long as the topic is different.

STAT 646 Multivariate Analysis (3 credits)

Prerequisite(s): STAT 532, STAT 538 and permission of graduate program coordinator. Analysis of multiple response variables simultaneously; covariance and the multivariate normal distribution; manova, discriminant functions; principle components and canonical correlations.

STAT 647 Practicum in Statistics II (3 credits)

Prerequisite(s): STAT 536, STAT 545, at least one 600-level course, and permission of graduate program coordinator. An applied experience in which students work with practitioners in industry, government or research organizations utilizing advanced statistical techniques in a research setting. Students will be expected to exhibit the ability to work independently on projects involving advanced techniques in experimental design, analysis and interpretation of data. May be repeated once.

STAT 648 Advanced Statistical Methods (3 credits)

Prerequisite(s): STAT 534, STAT 537, STAT 538, and permission of graduate program coordinator. Advanced statistical concepts and methods used by statistical scientists in the analysis of designed experiments and observational studies. Response surface methodology, analysis of covariance, the general linear model, the cell means model and the analysis of variance of unbalanced or messy data.

STAT 649 Independent Study in Statistics (3 credits)

Prerequisite(s): Permission of graduate program coordinator and departmental approval. Independent study under the direction of a faculty member, offering the opportunity to pursue topics in statistics which may be outside the scope of regular curricular offerings or may be an extension of an existing course or courses. Approval must be obtained from the graduate coordinator and faculty advisor. May be repeated once for a maximum of 6 credits during the graduate program.

STAT 656 Functional Analysis (3 credits)

Prerequisite(s): STAT 537 and STAT 538. Advanced statistical concepts and methods used by statistical scientists in the analysis of functional data. Methods include analysis of covariance, functional principal components analysis, smoothing splines, and functional regression models.

STAT 657 Advanced Design and Analysis of Experiments (3 credits)

Prerequisite(s): STAT 537 and STAT 538. Principles of design, incomplete block design, fractional factorial design, response surface design, repeated measures design, robust parameter design, cross-over design, analysis of covariance.

STAT 697 Capstone Experience (3 credits)

Prerequisite(s): Permission of graduate program coordinator. Culminating experience undertaken by students during their last semester who do not wish to pursue a formal Master's thesis. The capstone project focuses on a specific topic of interest to the student that incorporates and applies what they've learned throughout the course of their Statistics graduate program.

STAT 698 Master's Thesis (3 credits)

Prerequisite(s): Permission of graduate program coordinator. Independent study under faculty advisement. Students must follow the MSU Thesis Guidelines, which may be obtained from the Graduate School. Students should take STAT 699 if they do not complete STAT 698 within the semester.

STAT 699 Master's Thesis Extension (1 credit)

Prerequisite(s): STAT 698, permission of graduate program coordinator. Continuation of Master's Thesis project. Thesis extension will be graded IP (In Progress) until thesis is completed, at which time a grade of Pass or Fail will be given. Course may be repeated.