APPLIED STATISTICS

The ability to analyze and use such data requires a new set of skills that a Bachelor of Arts in Applied Statistics, or a Bachelor of Science in Applied Statistics offers.

Statistics is the science of learning from data. It includes planning for the collection of data, managing data, analyzing, interpreting, and drawing conclusions from data, and identifying problems, solutions and opportunities using the analysis. Massive amounts of data are being collected from digital applications and mobile devices in addition to those from the fields of engineering, environment, finance, healthcare, retail, and social sciences. The volume, variety and velocity of this data poses unique opportunities and challenges. The ability to analyze and use such data requires a new set of skills that an Applied Statistics major offers. This makes Applied Statistics one of the fastest growing career fields today. The Applied Statistics major builds critical thinking and problem solving skills in data analysis and empirical research. It prepares students for careers in business, industry, and government as well as for advanced degree programs in statistics and quantitative fields. The applied statistics major allows students to focus on their passions including genetics, healthcare, pharmaceuticals, public transportation, automotive areas, communication systems, financial markets, utilities, public policy, public health, government, manufacturing, quality control and others.

In addition to the major requirements, students must complete all CASL Degree Requirements (http://catalog.umd.umich.edu/undergraduate/college-arts-sciences-letters/).

Prerequisites to the Major

Students majoring in Applied Statistics must take the following Prerequisites:

Code	Title	Credit Hours
MATH 113	Calc I for Biology & Life Sci	4
or MATH 115	Calculus I	
MATH 114	Calc II for Biology & Life Sci	4
or MATH 116	Calculus II	
MATH 227	Introduction to Linear Algebra	3
STAT 305	Intro. to Data Science for All	3
Total Credit Hours		14

Major Requirements

24 credit hours at the 300+ level is required.

Code	Title	Credit Hours
Mathematics Core		
6 credits required:		
MATH 325	Probability	3
MATH 425	Mathematical Statistics	3
Applied Statistics Core		
12 credits required:		12
STAT 301	Biostatistics I	
or STAT 325	Applied Statistics I	
STAT 327	Statistical Computing	
STAT 430	Applied Regression Analysis	
STAT 440	Design and Analysis of Expermt	
Electives in Statistics		
Select any two upper level STAT courses (6 credit hours) excluding STAT 305 and STAT 455		6
Cognates		
Select 6 credit hours from the following:		6
DS 350	Quantitative Model and Anly II	
ECON 335	Experimental Economics	
ECON 4015	Introduction to Econometrics	
IMSE 4675	Six Sigma & Stat Proc Improv	
MATH 300	Math Lang Proof & Struct	
MATH 413	Linear Algebra	
MATH 420	Stochastic Processes	
MATH 451	Advanced Calculus I	
MATH 472	Intro to Numerical Analysis	
MATH 473	Matrix Computation	
MATH 492	Introduction to Topology	
Other courses by Petition. See the Applied Statistics Program Advisor.		
Total Credit Hours		30

Notes:

1. At least 12 of the 24 upper level credit hours in Statistics (STAT) must be elected at UM-Dearborn
2. Students cannot receive credit for both STAT 301 and STAT 325. It is recommended that students complete STAT 325.
3. STAT 305 and STAT 455 may not count toward the upper level electives.
4. Students wishing to use graduate level courses (STAT 500+) as part of the 24 credit hours required for the major must submit a Petition to obtain the approval of the Applied Statistics Program Advisor.

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Minor or Integrative Studies Concentration Requirements

A minor or concentration consists of 12 credit hours of upper-level courses (300 or above level) in Applied Statistics (STAT). Only one of STAT 301 or STAT 325 can be used to satisfy this requirement. Students with majors in mathematics, the natural sciences, or the social sciences may find the minor in Applied Statistics to be a valuable supplement to their major.

STAT 263 Introduction to Statistics 3 Credit Hours
Frequency distributions and descriptive measures. Populations, sampling, and statistical inference. Elementary probability and linear regression, use of statistical computer packages to analyze data. Students intending to elect this course should have taken at least one year of high school algebra. (F,W,S).

STAT 301 Biostatistics I 3 Credit Hours
Samples and populations, quantitative vs. categorical data; clinical vs. epidemiological studies; comparative displays and analysis; linear regression. Estimation of effect size is emphasized along with the P-value for a statistical test: difference of means in simple comparative data together with a confidence interval and t-test; relative risk for appropriate categorical data; slope of a regression line together with a confidence interval and t-test. Study design is emphasized: clinical trials in experimental settings; case-control and cohort studies in epidemiological settings. Students are expected to make presentations interpreting and reporting the results of research from the literature. Students can receive credit for only one of MATH 301, MATH 363, STAT 301, CRJ 383, SOC 383, STAT 325.
Prerequisite(s): MATH 113 or MATH 115

STAT 305 Intro. to Data Science 3 Credit Hours
WIth increasing availability of data, companies, governments, and nonprofits alike are striving to convert this data into knowledge and insight. This course will provide students with the basic skill set needed to handle such data. The course will focus on three broad areas-inferential thinking, computational thinking, and real-word applications. We will discuss data collection, data cleaning and exploratory analysis of data so that students can connect the data to the underlying phenomena and be able to think critically about the conclusions that are drawn from the data analysis. The students will also learn how to write short programs to be able to automate the data analysis process developing an applied understanding of different analytics methods, including linear regression, logistic regression, clustering, data visualization, etc. Most of the material will be taught using real world data. (YR)

STAT 325 Applied Statistics I 4 Credit Hours
This course studies the principles and applications of statistics. Topics include descriptive statistics, random variables, probability distributions, sampling distributions, the central limit theorem, confidence intervals, hypothesis testing for mean and variance and the use of normal, chi-square, F and t distributions in statistical problems. Other topics are selected from regression and correlation, the design of experiments and analysis of variance. Students can receive credit for only one of CRJ 383, MATH 301, 363, STAT 301, 363, SOC 363 and STAT 325. (F,W)
Prerequisite(s): MATH 113 or MATH 115 or Mathematics Placement with a score of 116

STAT 327 Statistical Computing 3 Credit Hours
This course focuses on computational techniques that are crucial for statistics applications. Using the statistical packages R and SAS, the course teaches students about importing and storing data, manipulating and visualizing data, debugging and re-sampling, as well as simulation methods including bootstrap and Monte Carlo methods. (YR)
Prerequisite(s): STAT 325 or (STAT 301 and STAT 305)

STAT 330 Intro to Survey Sampling 3 Credit Hours
An introduction to survey sampling techniques assuming only-aiimited knowledge of higher- level mathematics. Topics include: simple and stratified random sampling, estimation, systematic sampling, simple and two stage cluster sampling, population size estimation.

STAT 390 Topics in Applied Statistics 3 Credit Hours
A course designed to offer selected topics in applied statistics. The specific topic or topics will be announced together with the prerequisites when offered. Course may be repeated for credit when specific topics differ. (OC)
Restriction(s):
Can enroll if Level is Undergraduate

STAT 430 Applied Regression Analysis 3 Credit Hours
Topics include single variable linear regression, multiple linear regression and polynomial regression. Model checking techniques based on analysis of residuals will be emphasized. Remedies to model inadequacies such as transformations will be covered. Basic time series analysis and forecasting using moving averages and autoregressive models with prediction errors are covered. Statistical packages will be used. Students cannot receive credit for both STAT 430 and STAT 530.
Prerequisite(s): STAT 425 or STAT 325 or IMSE 317

STAT 440 Design and Analysis of Expermt 3 Credit Hours
An introduction to the basic methods of designed experimentation. Fixed and random effects models together with the analysis of variance techniques will be developed. Specialized designs including randomized blocks, latin squares, nested, full and fractional factorials will be studied. A statistical computer package will be used. (W).
Prerequisite(s): STAT 326 or STAT 425 or STAT 325

STAT 445 Survival Analysis 3 Credit Hours
Full Course Title: Reliability and Survival Analysis This course focuses on fundamentals of statistics with emphasis on environmental problems and their relevance in everyday life. The course topics include data visualization, parametric and non-parametric statistical inferences such as multiple linear regression, analysis of bivariate measurements, contingency table, goodness of fit tests, and comparison of several groups, and ANOVA testing. (AY)
Prerequisite(s): STAT 430
Restriction(s):
Can enroll if Level is Undergraduate

STAT 450 Multivariate Stat Analysis 3 Credit Hours
An introduction to commonly encountered statistical and multivariate techniques, while assuming only a limited knowledge of higher-level mathematics. Topics include: multivariate analysis of variance, multivariate regression, principal components and factor analysis, canonical correlation, and discriminant analysis.
Prerequisite(s): STAT 430

STAT 455 Environmental Statistics 3 Credit Hours
The primary objective of the course is to introduce statistical techniques to make data driven decisions to students majoring in the environmental and biological sciences. This course aims to nurture the importance of statistical methods to enhance the understanding of issues related to environmental sciiences. A one-semester course cannot be exhaustive in depth and width of literature but the aim of this course is to create interest and encourage students to delve more into the subject. (AY)
Restriction(s):
Can enroll if Level is Undergraduate

STAT 460 Time Series Analysis 3 Credit Hours
An-Introduction to time series, including trend effects and seasonality, while assuming only a limited knowledge of higher-level mathematics. Topics include: linear Gaussian processes, stationarity, autocovariance and autocorrelation; autoregressive (AR), moving average (MA) and mixed (ARMA) models for stationary processes; likelihood in a simple case such as AR(1); ARIMA processes, differencing, seasonal ARIMA as models for non-stationary processes; the role of sample autocorrelation, partial autocorrelation and correlograms in model choice; inference for model parameters; forecasting: dynamic linear models and the Kalman filter.
Prerequisite(s): STAT 430

STAT 490 Topics in Applied Statistics 3 Credit Hours

STAT 490A Topics in Applied Statistics 3 Credit Hours
TOPIC TITLE: Multivariate Statistical Analysis A coverage of commonly encountered statistical and multivariate techniques, while assuming only a limited knowledge of higher-level mathematics. Topics include: Multivariate analysis of variance, multivariate regression, principal components and factor analysis, canonical correlation, discriminant analysis, and cluster analysis.

* An asterisk denotes that a course may be taken concurrently.

Frequency of Offering

The following abbreviations are used to denote the frequency of offering: (F) fall term; (W) winter term; (S) summer term; (F, W) fall and winter terms; (YR) once a year; (AY) alternating years; (OC) offered occasionally