

STATISTICS

statistics.northwestern.edu

Statistics is the scientific discipline that deals with the collection, organization, analysis, and interpretation of numerical data. Statistical methods are widely used in observational studies and for the design and analysis of experiments, sample surveys, and censuses. Such analysis involves both description of the properties of groups of observations and problems of drawing inferences from such data. Applications to the biological, social, and physical sciences are widespread, and statistical analyses are increasingly required in actuarial work, accounting, finance, engineering, medicine, and law.

Programs of Study

- Statistics Major (<https://catalogs.northwestern.edu/undergraduate/arts-sciences/statistics/statistics-major>)
- Statistics Minor (<https://catalogs.northwestern.edu/undergraduate/arts-sciences/statistics/statistics-minor>)

STAT 101-6 First-Year Seminar (1 Unit) *WCAS First-Year Seminar*

STAT 202-0 Introduction to Statistics (1 Unit) Data collection, summarization, correlation, regression, probability, sampling, estimation, tests of significance. Does not require calculus and makes minimal use of mathematics. May not receive credit for both STAT 202-0 and STAT 210-0. *Formal Studies Distro Area*

STAT 210-0 Introductory Statistics for the Social Sciences (1 Unit) A mathematical introduction to probability theory and statistical methods, including properties of probability distributions, sampling distributions, estimation, confidence intervals, and hypothesis testing. STAT 210-0 is primarily intended for economics majors. May not receive credit for both STAT 202-0 and STAT 210-0. Prerequisite: strong background in high school algebra (calculus is not required). *Formal Studies Distro Area*

STAT 232-0 Applied Statistics (1 Unit) Basic concepts of using statistical models to draw conclusions from experimental and survey data. Topics include simple linear regression, multiple regression, analysis of variance, and analysis of covariance. Practical application of the methods and the interpretation of the results will be emphasized. Prerequisites: STAT 202-0, STAT 210-0, or equivalent; MATH 220-0. *Formal Studies Distro Area*

STAT 301-1 Data Science 1 (1 Unit) Series aims to develop the practical skills necessary for conducting data science while surveying foundational analytic methods with a focus on application. Substantial data analysis project required in each course. Data Science 1 focuses on data management, manipulation, and visualization skills and techniques for exploratory data analysis. Prerequisite: STAT 202-0 or equivalent *Formal Studies Distro Area*

STAT 301-2 Data Science 2 (1 Unit) Series aims to develop the practical skills necessary for conducting data science while surveying foundational analytic methods with a focus on application. Substantial data analysis project required in each course. Data Science 2 focuses on foundational analytic methods such as linear regression, resampling, and tree-based methods. Prerequisite: STAT 301-1 or consent of instructor. *Formal Studies Distro Area*

STAT 301-3 Data Science 3 (1 Unit) Series aims to develop the practical skills necessary for conducting data science while surveying

foundational analytic methods with a focus on application. Substantial data analysis project required in each course. Data Science 3 focuses on methods such as support vector machines, clustering, and neural networks. Prerequisite: STAT 301-2 or consent of instructor. *Formal Studies Distro Area*

STAT 302-0 Data Visualization (1 Unit) Introduction to the knowledge, skills, and tools required to visualize data of various formats across statistical domains and to create quality visualizations for both data exploration and presentation. Prerequisite: STAT 202-0 or equivalent. *Formal Studies Distro Area*

STAT 320-1 Statistical Methods 1 (1 Unit) Sample spaces, computing probabilities, random variables, distribution functions, expected values, variance, correlation, limit theory. May not receive credit for both STAT 320-1 and any of STAT 383-0, MATH 310-1, MATH 311-1, MATH 314-0, MATH 385-0, EECS 302-0, or IEMS 202-0. Corequisites: STAT 202-0 or STAT 210-0, MATH 234-0. *Formal Studies Distro Area*

STAT 320-2 Statistical Methods 2 (1 Unit) Sampling, parameter estimation, confidence intervals, hypothesis tests. Prerequisite: STAT 320-1 or MATH 310-1. *Formal Studies Distro Area*

STAT 320-3 Statistical Methods 3 (1 Unit) Comparison of parameters, goodness-of-fit tests, regression analysis, analysis of variance, and nonparametric methods. Prerequisites: STAT 320-2, MATH 240-0. *Formal Studies Distro Area*

STAT 325-0 Survey Sampling (1 Unit) Probability sampling, simple random sampling, error estimation, sample size, stratification, systematic sampling, replication methods, ratio and regression estimation, cluster sampling. Prerequisites: MATH 230-0 and 2 quarters of statistics, or consent of instructor. *Formal Studies Distro Area*

STAT 328-0 Causal Inference (1 Unit) Introduction to modern statistical thinking about causal inference. Topics include completely randomized experiments, confounding, ignorability of assignment mechanisms, matching, observational studies, noncompliance, and Bayesian methods. Prerequisites: STAT 320-2, STAT 350-0. *Formal Studies Distro Area*

STAT 330-1 Applied Statistics for Research 1 (1 Unit) First Quarter: Design of experiments and surveys, numerical summaries of data, graphical summaries of data, correlation and regression, probability, sample mean, sample proportion, confidence intervals and tests of significance, one and two sample problems, ANOVA. Second Quarter: Simple linear regression, inference, diagnostics, multiple regression diagnostics, autocorrelation, 1-way ANOVA, power and sample size determination, 2-way ANOVA, ANCOVA, randomized block designs.

STAT 330-2 Applied Statistics for Research 2 (1 Unit) Second Quarter: Simple linear regression, inference, diagnostics, multiple regression diagnostics, autocorrelation, 1-way ANOVA, power and sample size determination, 2-way ANOVA, ANCOVA, randomized block designs.

STAT 332-0 Statistics for Life Sciences (1 Unit) Application of statistical methods and data analysis techniques to the life sciences. Parametric statistics, nonparametric approaches, resampling-based approaches. Prerequisite: 1 introductory statistics course. *Formal Studies Distro Area*

STAT 342-0 Statistical Data Mining (1 Unit) Methods for modeling binary responses with multiple explanatory variables. Potential topics include statistical decision theory, binary regression models, cluster analysis, probabilistic conditional independence, and graphical models. Prerequisites: courses in probability and statistics comparable to

STAT 320-1, STAT 320-2; a course in multiple regression comparable to STAT 350-0; familiarity with statistical computing software such as MINITAB or SPSS. *Formal Studies Distro Area*

STAT 344-0 Statistical Computing (1 Unit) Exploration of theory and practice of computational statistics with emphasis on statistical programming in R. Prerequisite: STAT 320-2 or equivalent. *Formal Studies Distro Area*

STAT 345-0 Statistical Demography (1 Unit) Introduction to statistical theory of demographic rates (births, deaths, migration) in multistate setting; statistical models underlying formal demography; analysis of error in demographic forecasting. Prerequisite: STAT 350-0, MATH 240-0, or equivalent. *Formal Studies Distro Area*

STAT 348-0 Applied Multivariate Analysis (1 Unit) Statistical methods for describing and analyzing multivariate data. Principal component analysis, factor analysis, canonical correlation, clustering. Emphasis on statistical and geometric motivation, practical application, and interpretation of results. Prerequisites: STAT 320-2, MATH 240-0. *Formal Studies Distro Area*

STAT 350-0 Regression Analysis (1 Unit) Simple linear regression and correlation, multiple regression, residual analysis, selection of subsets of variables, multi-collinearity and shrinkage estimation, nonlinear regression. Prerequisite or corequisite: STAT 320-2. *Formal Studies Distro Area*

STAT 351-0 Design and Analysis of Experiments (1 Unit) Methods of designing experiments and analyzing data obtained from them: one-way and two-way layouts, incomplete block designs, factorial designs, random effects, split-plot and nested designs. Prerequisite: STAT 320-1 or equivalent. *Formal Studies Distro Area*

STAT 352-0 Nonparametric Statistical Methods (1 Unit) Survey of nonparametric methods, with emphasis on understanding their application. Estimation of a distribution function, density estimation, and nonparametric regression. Prerequisite: STAT 350-0 *Formal Studies Distro Area*

STAT 354-0 Applied Time Series Modeling and Forecasting (1 Unit) Introduction to modern time series analysis. Autocorrelation, time series regression and forecasting, ARIMA and GARCH models. Corequisite: STAT 350-0. Prerequisites: STAT 320-1. *Formal Studies Distro Area*

STAT 355-0 Analysis of Qualitative Data (1 Unit) Introduction to the analysis of qualitative data. Measures of association, loglinear models, logits, and probits. Prerequisite: STAT 320-2 or equivalent. *Formal Studies Distro Area*

STAT 356-0 Hierarchical Linear Models (1 Unit) Introduction to the theory and application of hierarchical linear models. Two and three level linear models, hierarchical generalized linear models, and application of hierarchical models to organizational research and growth models. Prerequisites: STAT 320-2, STAT 350-0. *Formal Studies Distro Area*

STAT 359-0 Topics in Statistics (1 Unit) Topics in theoretical and applied statistics to be chosen by instructor. Prerequisite: consent of instructor. *Formal Studies Distro Area*

STAT 365-0 Introduction to the Analysis of Financial Data (1 Unit) Statistical methods for analyzing financial data. Models for asset returns, portfolio theory, parameter estimation. Prerequisites: STAT 320-3, MATH 240-0. *Formal Studies Distro Area*

STAT 370-0 Human Rights Statistics (1 Unit) Development, analysis, interpretation, use, and misuse of statistical data and methods for description, evaluation, and political action regarding war, disappearances, justice, violence against women, trafficking, profiling, elections, hunger, refugees, discrimination, etc. Prerequisites: Two of STAT 325-0, STAT 350-0, STAT 320-2, STAT 320-3; or ECON 381-1, ECON 381-2; or MATH 386-1, MATH 386-2; or IEMS 303-0, IEMS 304-0. *Formal Studies Distro Area*

STAT 383-0 Probability and Statistics for ISP (1 Unit) Probability and statistics. Ordinarily taken only by students in ISP; permission required otherwise. May not receive credit for both STAT 383-0 and any of STAT 320-1; MATH 310-1, MATH 311-1, MATH 314-0, MATH 385-0; EECS 302-0; or IEMS 202-0. Prerequisites: MATH 281-1, MATH 281-2, MATH 281-3; PHYSICS 125-1, PHYSICS 125-2, PHYSICS 125-3. *Formal Studies Distro Area*

STAT 398-0 Undergraduate Seminar (1 Unit)

STAT 399-0 Independent Study (1-3 Units) Independent work under the guidance of a faculty member. Consent of department required.