

STATISTICS (STAT)

STAT 120 – Statistical Reasoning Course count: 1

This course presents the basic concepts of statistics and data analysis in a non-technical way. Topics include graphical methods of summarizing data, descriptive statistics, and methods of statistical inference.

STAT 120 is a terminal, introductory course intended for students who are not interested in pursuing mathematics, economics, biology, psychology, sociology, or the health professions.

Students who have taken MATH 135, MATH 220, BIOL 275, ECON 249, PSYC 200, SOCL 226 may not enroll in this class.

GPA units: 1

Common Area: Mathematical Science

STAT 130 – Introduction to Data Science Course count: 1

This course provides an introduction to the field of data science with a focus on computation, data visualization, collaboration, and communication. Students will learn to extract and wrangle data, program basic scripts and functions in an integrated development environment, explore multivariable associations and understand the concepts of confounding and effect modification, create dynamic data visualization, and build interpretable machine learning models.

GPA units: 1

Common Area: Mathematical Science

Typically Offered: Annually

STAT 220 – Statistics Course count: 1

This course presents statistics intended for students aspiring to the health professions. Topics include sampling strategies and experimental design, numerical and graphical methods of describing data, basic concepts in probability, discrete and continuous probability distributions, sampling distributions, confidence intervals, hypothesis testing and simple linear regression. Statistics is a part of the health professions curriculum, but some majors at the College offer their own statistics courses that are tailored to their respective disciplines. Students majoring in mathematics, economics, biology, psychology and sociology should take the statistics course within their major. Health profession students are advised to wait and take the statistics course in their major, should it offer one. Otherwise, such students should take STAT 220 sometime after their first year at the College.

Prerequisite: MATH 133, 134, 135, or 136 or equivalent. Students who have taken ECON 249, BIOL 275, PSYC 200 or SOCL 226 or have credit for AP Statistics may not enroll in this course. ACCT, ECON, PSYC or SOCL majors may not enroll in STAT 220.

GPA units: 1

Typically Offered: Fall, Spring

STAT 225 – Experimental Design Course count: 1

This course provides an introduction to the statistical methodologies most commonly used in the design of experiments. Topics include experimental design, power and sample size determination, one-sample inference, two-sample inference, multi-sample inference, assumptions testing, linear contrasts, experiment-wise error rate, factorial treatment structure, and interaction. Also covered are equivalent non-parametric tests. Students will work extensively with data sets and the R statistical software package.

Mathematics prerequisite: MATH 133, 134, 135, 136 or equivalent
Statistics prerequisite: BIOL 275, ECON 149, ECON 249, PSYC 200, SOCL 226, or STAT 220

GPA units: 1

Typically Offered: Alternate Years, Fall

STAT 226 – Bayesian Statistics Course count: 1

While most courses cover statistics from a Frequentist point of view, this course will instead look at statistical inference from a Bayesian perspective. Bayesian statistics combines prior information with the information contained in the observed data to produce a (posterior) probability distribution on a parameter of interest. In the past, computational challenges limited the use of Bayesian techniques, but advances in modern computing along with the introduction of new algorithms that allow for sampling from complex, high-dimensional probability distributions have increased the popularity of these methods. Potential topics will include: an introduction to probability and Bayes rule, prior and posterior distributions, conjugate priors, single and multi-parameter likelihood models (e.g. binomial, Poisson, normal, etc.), Markov Chain Monte Carlo methods, Gibbs sampling techniques, hierarchical modeling, Bayesian analogs to confidence intervals and hypothesis testing, model comparison, model averaging, and Bayesian linear regression.

Mathematics prerequisite: MATH 134, MATH 136 or equivalent
Statistics prerequisite: BIOL 275, ECON 149, ECON 249, PSYC 200, SOCL 226, STAT 220, STAT 376 or equivalent

GPA units: 1

Typically Offered: Alternate Years, Fall

STAT 231 – Linear Models Course count: 1

This course provides a thorough examination of the theory and practice of ordinary least squares (OLS) regression modeling. Model interpretation and a conceptual understanding of confounding, mediation, and effect modification are emphasized. Specific topics include analysis of variance (ANOVA), derivation of parameter estimates, correlation, prediction, dummy variables, contrasts, testing general hypotheses, analysis of covariance (ANCOVA), multicollinearity, regression diagnostics, techniques for handling model misspecification (incorrect functional form, heteroskedasticity), and model-building strategies. Students will work extensively with data sets and the R statistical software package.

Prerequisite: One of MATH 133, 134, 135, or 136, and one of BIOL 275, ECON 249, PSYC 200, SOCL 226, STAT 220, or STAT 376. Students who have earned credit for ECON 314 cannot enroll in STAT 231.

GPA units: 1

Typically Offered: Fall

STAT 232 — Categorical Data Analysis Course count: 1

This course provides a focused introduction to the theory and practice of categorical data analysis. Model interpretation and conceptual understanding will be emphasized. Specific course topics include the chi-square test for independence, Fisher's exact test, logistic regression, multinomial logistic regression, prediction, dummy variables, contrasts, testing general hypotheses, effect modification and confounding, assessing fit, and model-building strategies. Students will work extensively with data sets and the R statistical software package.

Prerequisite: STAT 231 or ECON 314

GPA units: 1

Typically Offered: Spring

STAT 299-F24 — Causal Inference Course count: 1

This course introduces the principles and methodologies underlying the design and analysis of observational studies. Observational studies are critical in fields where controlled experiments are impractical or unethical, and offer insights into behaviors and outcomes in real-world settings. Throughout this course, student will explore the challenges and strategies associated with drawing causal inferences from observational data. Topics include the design of observational studies, including cohort, case-control, and cross-sectional studies, as well as techniques for managing common issues such as confounding, selection bias, and measurement error. Students will learn to apply data analysis techniques tailored to observational data, including regression models and propensity score matching. Students will analyze data sets using the R statistical software package.

Prerequisite: STAT 220 or ECON 249 or BIOL 275 or SOCL 226 or PSYC 200.

GPA units: 1

STAT 299-S01 — Computational Statistics Course count: 1

This course will explore statistical approaches that have grown in popularity over the last several decades along with advances in computing. Ultimately, the goal is to develop a practical understanding of how and why these methods work. The course will begin by exploring different approaches to simulate random variables, before moving on to Markov chains, Monte Carlo simulation, and MCMC algorithms. We end the course with bootstrap and permutation tests, which are simulation-based tests that provide a non-parametric alternative to the hypothesis tests introduced in previous courses.

Prerequisite: STAT 220 or the equivalent (ECON 149, ECON 249, BIOL 275, PSYC 200, SOCL 226)

GPA units: 1

STAT 375 — Probability Theory Course count: 1

An introduction to the theory and applications of probability. Includes both continuous and discrete distributions, conditional probability and Bayes' Theorem, random variables and expected values, joint distributions of several random variables, functions of random variables, and the Central Limit Theorem.

Prerequisite: MATH 241.

GPA units: 1

Typically Offered: Fall, Spring

STAT 376 — Mathematical Statistics Course count: 1

A course in the theory and applications of statistics. Topics include maximum likelihood estimation, the sampling distributions of estimators, confidence intervals, hypothesis testing, regression analysis, and an introduction to the analysis of variance.

Prerequisite: STAT 375

GPA units: 1

Typically Offered: Alternate Years

STAT 380 — Statistical Computing Course count: 1

This course covers statistical methods that would not be possible without the advances made in modern computing over the last 25-30 years. Specifically, these are simulation and Monte Carlo techniques that are appropriate where statistical theory does not yet provide a solution. Each of the statistical methods covered is computationally intensive and therefore requires a computer to arrive at a solution. Topics include techniques for simulating of random variables, Bayesian statistics, Markov chains, the Metropolis-Hastings algorithm, MCMC and Gibbs Sampling, mixture models, and classification schemes.

Prerequisite: CSCI 131 and STAT 220 or STAT 375

GPA units: 1

Typically Offered: Alternate Years

STAT 381 — Statistical Learning Course count: 1

This course is an introduction to the main principles of supervised and unsupervised machine learning within the context of data analytics. Methods include linear regression, logistic regression, K-nearest neighbors, and discriminant analysis. Resampling methods such as cross-validation and bootstrapping, as well as model selection and regularization techniques are discussed. Non-parametric methods, including classification and regression trees (CART), boosting, bagging, and random forests are presented. Unsupervised learning methods focus on principal components analysis, K-mean, and hierarchical clustering. The R statistical computing package is used extensively.

Prerequisite: STAT 231 or ECON 314

GPA units: 1

Typically Offered: Alternate Years

STAT 392 — Seminar Course count: 1

Provides an opportunity for individual and group investigation of topics not covered in ordinary course work. Active participation on the part of the students is normally required. Subject matter varies to suit individual students and is often related to the research activity of the professor.

Prerequisite: STAT 231

GPA units: 1

Typically Offered: Annually

STAT 400 — Directed Reading Course count: 1

GPA units: 1

STAT 410 — Directed Project Course count: 1

GPA units: 1