Statistics

**STAT 1342 (MATH 1342)** Statistical Decision Making (3 semester credit hours) Principles of quantitative decision making: summarizing data, modeling uncertainty, loss functions, probability, conditional probability, random variables. Introduction to statistics: estimation, confidence intervals, hypothesis testing, regression. Introduction to statistical packages. May not be used to satisfy degree requirements for majors in the School of Engineering and Computer Science, or major requirements in the Schools of Management or Natural Sciences and Mathematics. Prerequisite: MATH 1306 or MATH 1314 or equivalent. (3-0) S

**STAT 2332** Introductory Statistics for Life Sciences (3 semester credit hours) Graphs, histograms, mean, median, standard deviation, standardized scores, simple linear regression and correlation; basic rules of probability, Normal t, chi squared, binomial and Poisson distributions; point estimation; hypothesis tests and confidence intervals for means, proportions; contingency tables. Applications in life sciences will be emphasized throughout the course. May not be used to satisfy degree requirements for mathematics, engineering, or computer science majors. Prerequisite: MATH 1325 or MATH 2312 or equivalent. (3-0) S

**STAT 3103** Statistical Computer Packages (1 semester credit hour) An introduction to the use of statistics packages, such as SAS, BMD, SPSS, Minitab, and S, for the analysis of data. Based primarily on self-study materials. May not used to satisfy degree requirements for mathematics majors. Prerequisites: one semester of statistics and instructor consent required. (1-0) S

**STAT 3332** Statistics for Life Sciences (3 semester credit hours) Graphs, histograms, mean, median, standard deviation, Chebyshev's inequality, standardized scores, simple linear regression and correlation; basic rules of probability, Normal t, chi squared, F, binomial and Poisson distributions; point estimation; hypothesis tests and confidence intervals for means, proportions regression coefficients, and correlation; one way ANOVA; contingency tables. Applications in life sciences will be emphasized throughout the course. May not used to satisfy degree requirements for mathematics, engineering, or computer science majors. Prerequisite: MATH 2312 or MATH 1325 or equivalent. (3-0) S

**STAT 3341** Probability and Statistics in Computer Science and Software Engineering (3 semester credit hours) Axiomatic probability theory, independence, conditional probability. Discrete and continuous random variables, special distributions of importance to CS/SE, and expectation. Simulation of random variables and Monte Carlo methods. Central limit theorem. Basic statistical inference, parameter estimation, hypothesis testing, and linear regression. Introduction to stochastic processes. Illustrative examples and simulation exercises from queuing, reliability, and other CS/SE applications. Credit cannot be received for both courses, (CS 3341 or SE 3341 or STAT 3341) and ENGR 3341. Prerequisites: (MATH 1326 or MATH 2414 or MATH 2419, and CE 2305 or CS 2305 or TE 2305 with a grade of C or better). (Same as CS 3341 and SE 3341) (3-0) S

**STAT 3355** Data Analysis for Statisticians and Actuaries (3 semester credit hours) Methods of data analysis used in different areas of Statistics and Actuarial Science. Sampling, fitting and testing models, regression, and comparison of populations. A statistical computer package will be used. Prerequisite: MATH 2415 or MATH 2419 or equivalent. (3-0) Y

**STAT 3360** Probability and Statistics for Management and Economics (3 semester credit hours) Probability
theory including independence, conditioning, density functions, frequently used families of distributions, random variables, expectation, moments, and the central limit theorem; statistical inference including sampling, estimation, hypothesis testing, and regression. May not used to satisfy degree requirements for mathematics, engineering, or computer science majors. Prerequisite: **MATH 1326**. (3-0) S

**STAT 4351** Probability (3 semester credit hours) Sample spaces, probability of events, Kolmogorov's axioms, independence and dependence, Bayesian methodology. Discrete and continuous random variables. Expected values, variances, moment generating functions, covariances and related issues. Probability inequalities. Special probability distributions and special probability densities. Functions of random variables, distribution function techniques, transformation techniques for one and several variables, moment-generating techniques. The law of large numbers, the central limit theorem and classical sampling distributions. Proofs of all main results. Practical examples illustrating the theory. The course can be used as a preparation for the first (Probability) actuarial exam. Prerequisite: **MATH 2451**. (3-0) Y

**STAT 4352** Mathematical Statistics (3 semester credit hours) Sampling distributions. Order statistics. Decision theory including minimax and Bayes criterion. Point estimation including unbiased estimators, efficiency, consistency, sufficiency, robustness, the method of moments, the method of maximum likelihood, Bayesian estimation. Interval estimation including the estimation of means, differences of means, proportions, differences between proportions, variances and ratios of variances. Hypothesis testing including Neyman-Pearson lemma, power function and likelihood ratio test. Special tests involving means, variances and proportions. Nonparametric tests. Foundations of regression, correlation, design and analysis of experiments. Proofs of all main results. Practical examples illustrating the theory. The course can be used as a preparation for the statistical part of the fourth actuarial exam. Prerequisite: **STAT 4351** or equivalent. (3-0) Y

**STAT 4354** Numerical and Statistical Computing (3 semester credit hours) Solving linear and nonlinear equations; numerical differentiation and integration; optimization; Newton-Raphson and EM algorithms; QR, Cholesky, eigenvalue, and singular value decompositions; random number generation; Monte Carlo methods; Markov chain Monte Carlo methods; bootstrap and jackknife; power analysis and sample size determination; and use of a statistical software package such as R. Prerequisites: **MATH 2451** and **STAT 4351**, or instructor consent required. (3-0) Y

**STAT 4355** Applied Linear Models (3 semester credit hours) Introduction to linear statistical models and their application to empirical data. Topics include linear and logistic regression; multiple regression; diagnostic measures; detection of outliers and influential observations; variable selection; one- and two-way ANOVA; analysis of covariance; model fitting and validation using the statistical programming language R. Prerequisite: **STAT 3355** or instructor consent required. (3-0) Y

**STAT 4360** Introduction to Statistical Learning (3 semester credit hours) Supervised and unsupervised learning; classification; clustering; tree-based methods; support vector machines; cross-validation; model selection and regularization; and principal components analysis. Prerequisites: **STAT 4355** or instructor consent required. (3-0) Y

**STAT 4382** Stochastic Processes (3 semester credit hours) Stochastic models including Markov chains, random walks, Poisson processes, renewal processes, and an introduction to time series and forecasting. Prerequisite: **STAT 4351** or equivalent. (3-0) Y

**STAT 4475** Capstone Project (4 semester credit hours) This course is intended to provide hands-on experience in a data science project. Students will work in teams on projects and will be involved in
formulating a relevant problem, collecting the requisite data, finding a solution, and developing the necessary computational tools. The deliverables will include a final project report that details these steps and presentation of the project. Prerequisites: STAT 4355 and CS 4375. (Same as CS 4475 and MATH 4475) (4-0) Y

**STAT 4V02** Independent Study in Statistics (1-6 semester credit hours) Independent study under a faculty member's direction. Student must obtain approval from participating mathematics faculty member and the undergraduate advisor. May satisfy the School of Natural Sciences and Mathematics' advanced writing requirement if it has a major writing/report component. May be repeated for credit as topics vary (9 semester credit hours maximum). Instructor consent required ([1-6]-0) S

**STAT 4V97** Undergraduate Topics in Statistics (1-9 semester credit hours) May be repeated for credit as topics vary (9 semester credit hours maximum). Instructor consent required. ([1-9]-0) S