Statistics (STAT)

School of Mathematics and Statistics
Faculty of Science

Note: see regulations concerning Deferred Final Examinations in the Academic Regulations section of this Calendar.

STAT 2507 [0.5 credit]
Introduction to Statistical Modeling I
A data-driven introduction to statistics. Basic descriptive statistics, introduction to probability theory, random variables, various discrete and continuous distributions, contingency tables and goodness-of-fit, sampling distributions, distribution of sample mean, Central Limit Theorem, application to interval estimation and hypothesis testing. A statistical software package will be used.
Precludes additional credit for STAT 2606, STAT 3502, ECON 2200, ECON 2201, and GEOG 2006.
Prerequisite: an Ontario Grade 12 university-preparation Mathematics (after Summer 2002) or an OAC in Mathematics or equivalent, or permission of the School of Mathematics and Statistics.
Lectures three hours a week, laboratory one hour a week.

STAT 2509 [0.5 credit]
Introduction to Statistical Modeling II
A data-driven approach to statistical modeling. Basics of experimental design, analysis of variance, simple linear regression and correlation, nonparametric procedures. A statistical software package will be used.
Precludes additional credit for STAT 2559, STAT 2607, ECON 2200, ECON 2202.
Prerequisites: i) STAT 2507 and ii) Grade 12 Mathematics (Geometry and Discrete Mathematics), or an OAC in Algebra and Geometry, or MATH 0107; or equivalents; or permission of the School.
Lectures three hours a week, laboratory one hour a week.

STAT 2559 [0.5 credit] (formerly 70.259*)
Basics of Statistical Modeling
Estimation and hypothesis testing for one and two samples, analysis of categorical data, basics of experimental design, analysis of variance, simple linear regression and correlation. Nonparametric procedures. A statistical software package will be used.
Precludes additional credit for STAT 2509, STAT 2607, ECON 2200, ECON 2202.
Prerequisite: STAT 2655 (or a grade of B- or better in STAT 2507); or permission of the School.
Lectures three hours a week, tutorial/laboratory one hour a week.

STAT 2605 [0.5 credit] (formerly 69.265*)
Probability Models
Introductory probability theory. Introduction to stochastic modeling, Markov chains and queueing theory. Random number generation and Monte Carlo simulation. Statistical methods for fitting and evaluating models; estimation and testing. Applications to computer system performance evaluation, analysis of algorithms, reliability, search and decision problems.
Restricted to students in the Bachelor of Computer Science, Computer Mathematics and Computer Statistics programs.
Precludes additional credit for STAT 3502, MATH 2600 and STAT 2655.
Prerequisites: MATH 2007 (or MATH 1002) and MATH 1104 (or MATH 1107).
Lectures three hours a week and one hour tutorial.

STAT 2606 [0.5 credit] (formerly 69.266*)
Business Statistics I
Introduction to statistical computing; probability concepts; descriptive statistics; estimation and testing of hypotheses. Emphasis on the development of an ability to interpret results of statistical analyses with applications from business.
Restricted to students in the School of Business.
Precludes additional credit for STAT 2507, STAT 3502, ECON 2200, ECON 2201, and Geography 45.206.
Prerequisites: either: item (iii); or both of items i) and ii):
i) MATH 1009 with a grade of C- or better; and ii) an OAC in Algebra and Geometry, or MATH 0107; (iii) BUSI 1703 with a grade of C- or better, or BUSI 1704 and BUSI 1705 with an average grade of C- or better; or equivalents.
Lectures three hours a week and one hour laboratory.

STAT 2607 [0.5 credit] (formerly 69.267*)
Business Statistics II
Topics include: experimental design, multiple regression and correlation analysis, covariance analysis, and introductory time series. Use of computer packages.
Restricted to students in the School of Business.
Precludes additional credit for STAT 2509, STAT 2559, ECON 2200, ECON 2202.
Prerequisite: STAT 2606.
Lectures three hours a week and one hour laboratory.

STAT 2655 [0.5 credit] (formerly 70.265*)
Introduction to Probability with Applications
Axioms of probability, basic combinatorial analysis, conditional probability and independence, discrete and continuous random variables, joint and conditional distributions, expectation, central limit theorem, sampling distributions, simulation and applications to descriptive statistics. A statistical software package will be used.
Precludes additional credit for STAT 2605 and MATH 2600.
Prerequisites: MATH 1002 (or MATH 2007) with a grade of C+ or better, and MATH 1102 (or MATH 2107) with a grade of C+ or better.
Lectures three hours a week, tutorial one hour a week.

STAT 3502 [0.5 credit] (formerly 69.352*)
Probability and Statistics
Axioms of probability; conditional probability and independence; random variables; distributions: binomial, Poisson, hypergeometric, normal, gamma; central limit theorem; sampling distributions; point estimation: maximum likelihood, and method of moments; confidence intervals; testing of hypotheses: one and two populations; engineering applications: acceptance sampling, control charts, reliability.
Restricted to students in the Faculty of Engineering, or in B.Sc.(Honours) in Applied Physics.
This course may not be used to meet the 3000-level course requirements in any Major or Honours program in Mathematics and Statistics.
Precludes additional credit for STAT 2507, STAT 2605, STAT 2606, ECON 2200, ECON 2201.
Prerequisite: MATH 2004, or MATH 2001.
Lectures three hours a week and one hour laboratory.

STAT 3503 [0.5 credit] (formerly 69.353*)
Regression Analysis
Review of simple and multiple regression with matrices, Gauss-Markov theorem, polynomial regression, indicator variables, residual analysis, weighted least squares, variable selection techniques, nonlinear regression, correlation analysis and autocorrelation. Computer packages are used for statistical analyses.
Precludes additional credit for STAT 3553, ECON 4706, and for STAT 3505, MATH 3501; PSYC 3000 is precluded for additional credit for students registered in a Mathematics program.
Prerequisites: i) STAT 2509 or STAT 2607, or ECON 2200, or ECON 2202, or equivalent; and ii) MATH 1102 or MATH 1107 or MATH 1109 or equivalent; or permission of the School.
Lectures three hours a week and one hour laboratory.

STAT 3504 [0.5 credit] (formerly 69.354*)
Analysis of Variance and Experimental Design
Single and multifactor analysis of variance, orthogonal contrasts and multiple comparisons, analysis of covariance;

Courses

nested, crossed and repeated measures designs; completely randomized, randomized block, Latin squares, factorial experiments, related topics. Computer packages are used for statistical analyses.
Precludes additional credit for STAT 4504, and for STAT 3505, MATH 3501; PSYC 3000 is precluded for additional credit for students registered in a Mathematics program.
Prerequisite: STAT 3503 or permission of the School.
Lectures three hours a week and one hour laboratory.

STAT 3506 [0.5 credit] (formerly 70.356*)
Stochastic Processes and Queueing Theory
Stochastic modeling, Markov chains, birth and death processes, renewal theory. Queueing theory: analytical and simulation methods. Applications to computer systems, operations research and social sciences.
Prerequisites: STAT 2655 or MATH 2600; or a CGPA of 6.00 or better over the three courses MATH 2007, MATH 2107 (or MATH 1102), and STAT 2605; or permission of the School.
Lectures three hours a week and one hour tutorial.

STAT 3507 [0.5 credit] (formerly 69.357*)
Sampling Methodology
The sample survey as a vehicle for information collection in government, business, scientific and social agencies. Topics include: planning a survey, questionnaire design, simple random, stratified, systematic and cluster sampling designs, estimation methods, problem of non-response, related topics.
Prerequisite: one of STAT 2507, or STAT 2509, STAT 2606, STAT 2607, ECON 2200, ECON 2201 or ECON 2202 or equivalent; or permission of the School.
Lectures three hours a week and one hour laboratory.

STAT 3508 [0.5 credit] (formerly 69.358*)
Elements of Probability Theory
Discrete and continuous distributions, moment-generating functions, marginal and conditional distributions, transformation theory, limiting distributions.
Precludes additional credit for STAT 3500, STAT 3550, and STAT 3558.
Prerequisites: i) MATH 2008 [or one of MATH 2001, MATH 2002, MATH 2004, or MATH 2009]; and ii) one of STAT 2507, STAT 2606, ECON 2200, or ECON 2201 or permission of the School.
Lectures three hours a week, tutorial one hour a week.

STAT 3509 [0.5 credit] (formerly 69.359*)
Mathematical Statistics
Point and interval estimation, sufficient statistics, hypothesis testing, chi-square tests with enumeration data.
Precludes additional credit for STAT 3500, MATH 3550, and STAT 3559.
Prerequisite: STAT 3508 or permission of the School.
Lectures three hours a week, tutorial one hour a week.

STAT 3553 [0.5 credit]
Regression Modeling
Linear regression – theory, methods and application(s). Normal distribution theory. Hypothesis tests and confidence intervals. Model selection. Model diagnostics. Introduction to weighted least squares and generalized linear models.
Precludes additional credit for STAT 3503, ECON 4706, and for MATH 3501, STAT 3505. PSYC 3000 is precluded for additional credit for students registered in a Mathematics program.
Prerequisites: i) STAT 2559 or STAT 2509; and ii) MATH 1102 or MATH 2107; or permission of the School.
Lectures three hours a week, laboratory one hour a week.

STAT 3558 [0.5 credit] (formerly 70.358*)
Elements of Probability Theory
Random variables and moment-generating functions, concepts of conditioning and correlation; laws of large numbers, central limit theorem; multivariate normal distribution; distributions of functions of random variables, sampling distributions, order statistics.
Precludes additional credit for STAT 3508, STAT 3500, STAT 3550.

Prerequisites: i) STAT 2655 (or STAT 2605 or MATH 2600); and ii) MATH 2000 (or a grade of C+ or better in MATH 2008); or permission of the School.
Lectures three hours a week, tutorial one hour a week.

STAT 3559 [0.5 credit] (formerly 70.359*)
Mathematical Statistics
Empirical distribution functions, Monte Carlo methods, elements of decision theory, point estimation, interval estimation, tests of hypotheses, robustness, nonparametric methods.
Precludes additional credit for STAT 3500, STAT 3509, STAT 3550.
Prerequisite: STAT 3558 or permission of the School.
Lectures three hours a week, tutorial one hour a week.

STAT 3608 [0.5 credit] (formerly 69.368*)
Probability in Communications and Electrical Engineering
Probability models and basic concepts; independence and conditional probabilities; discrete, continuous and multiple random variables; distribution and density functions; expectations and moments; sums of random variables; elementary statistics; introduction to random processes; applications to areas such as communication systems and networks.
Restricted to students in the Faculty of Engineering.
Precludes additional credit for STAT 3508 and STAT 3558.
Prerequisite: MATH 2004, or equivalent.
Lectures three hours a week, tutorial one hour a week.

STAT 4500 [0.5 credit] (formerly 70.450*)
Parametric Estimation
Preliminaries on probability theory; exact and asymptotic sampling distributions; unbiasedness, consistency, efficiency, sufficiency and completeness; properties of maximum likelihood estimators; least squares estimation of location and scale parameters based on order statistics and sample quantiles; Best Asymptotically Normal (BAN) estimators. Also offered at the graduate level, with additional or different requirements, as STAT 5600, for which additional credit is precluded.
Prerequisite: STAT 3550 or STAT 3559 or permission of the School.
Lectures three hours a week.

STAT 4501 [0.5 credit] (formerly 70.451*)
Probability Theory
Introduction to probability, characteristic functions, probability distributions, limit theorems.
Prerequisites: STAT 3506 and STAT 3558 or permission of the School.
Lectures three hours a week.

STAT 4502 [0.5 credit] (formerly 70.452*)
Survey Sampling
Basic concepts in sampling from finite populations; simple random sampling; stratified sampling; choice of sampling unit; cluster and systematic sampling; introduction to multistage sampling; ratio estimation; sampling with unequal probabilities and with replacement; replicated sampling; related topics.
Prerequisites: i) STAT 2559 or STAT 2509; and ii) either STAT 3559 (or STAT 3550) or a grade of C+ or better in STAT 3509 (or STAT 3550); or permission of the School.
Lectures three hours a week.

STAT 4503 [0.5 credit] (formerly 70.453*)
Applied Multivariate Analysis
Selected topics in regression and correlation non-linear models. Multivariate statistical methods, principal components, factor analysis, multivariate analysis of variance, discriminant analysis, canonical correlation, analysis of categorical data. Also offered at the graduate level, with additional or different requirements, as STAT 5509, for which additional credit is precluded.
Prerequisites: STAT 3553 (or STAT 3505); or: STAT 3509 and STAT 3503; or permission of the School.
Lectures three hours a week.

STAT 4504 [0.5 credit]
Statistical Design and Analysis of Experiments
An extension of the designs discussed in STAT 2559 to include analysis of the completely randomized design, designs with more than one blocking variable, incomplete block designs, fractional factorial designs, multiple comparisons; and response surface methods.
Precludes additional credit for STAT 3504, ECON 4706, and for MATH 3501, STAT 3505. PSYC 3000 is precluded for additional credit for students registered in a Mathematics program.
Prerequisite: STAT 3553 or STAT 3503; or permission of the School of Mathematics and Statistics.
Lectures three hours a week, laboratory one hour a week.

STAT 4506 [0.5 credit] (formerly 70.456*)
Non-Parametric Methods
Order statistics; rank statistics; permutations; asymptotics; hypothesis of randomness; stochastic ordering; Wilcoxon test; median test; Kolmogorov-Smirnov test; hypothesis of symmetry and random blocks; independence hypothesis; treatment of ties; power and efficiency. Also offered at the graduate level, with additional or different requirements, as STAT 5506, for which additional credit is precluded.
Prerequisite: STAT 3509 (or STAT 3550) or permission of the School.
Lectures three hours a week.

STAT 4507 [0.5 credit] (formerly 70.457*)
Statistical Inference
Sufficient statistics, simple and composite hypotheses, most powerful and similar region test, distribution-free tests, confidence intervals, goodness-of-fit and likelihood ratio tests, large sample theory, Bayesian and likelihood methods, sequential tests. Also offered at the graduate level, with additional or different requirements, as STAT 5501, for which additional credit is precluded.
Prerequisite: STAT 4500 or permission of the School.
Lectures three hours a week.

STAT 4508 [0.5 credit] (formerly 70.458*)
Stochastic Models
Review of discrete Markov chains and Poisson processes; pure jump Markov processes including the Q-matrix approach; the Kolmogorov equations; classification of states; stationary and limiting distributions; renewal theory. Also offered at the graduate level, with additional or different requirements, as STAT 5701, for which additional credit is precluded.
Prerequisite: STAT 3506 or permission of the School.
Lectures three hours a week.

STAT 4509 [0.5 credit] (formerly 70.459*)
Advanced Mathematical Modeling
Real-life situations in the physical, social, and life sciences are often modeled using mathematical tools. This course will examine various models and techniques used in their analysis, e.g., matrix procedures in connection with population models. Students will use a computer package to obtain numerical results. Also offered at the graduate level, with additional or different requirements, as STAT 5601, for which additional credit is precluded.
Prerequisites: i) MATH 2454 and STAT 2655 (or MATH 2600; or MATH 2404 and STAT 2605) and ii) STAT 3506; or permission of the School.
Lectures three hours a week.

STAT 4601 [0.5 credit]
Data Mining I
Data visualization; knowledge discovery in datasets; unsupervised learning: clustering algorithms; dimension reduction; supervised learning: pattern recognition, smoothing techniques, classification. Computer software will be used.
Prerequisite: STAT 3553 or STAT 3503 (or STAT 3505) or MATH 3806, or permission of the School.
Lectures three hours a week, laboratory one hour a week.

STAT 4603 [0.5 credit]
Time Series and Forecasting
Multiple regression and forecasting. Exponential smoothing. ARIMA (Box-Jenkins) models. Smoothing of seasonal data. A statistical software package will be used.
Prerequisite: STAT 3553 or STAT 3503, or STAT 3505, or permission of the School.
Lectures three hours a week, laboratory one hour a week.

STAT 4604 [0.5 credit]
Statistical Computing
Statistical computing techniques, pseudo-random number generation, tests for randomness, numerical algorithms in statistics; optimization techniques; environments for data analysis, efficient programming techniques; statistics with mainstream software.
Prerequisite: STAT 3553 or STAT 3503 or STAT 3505, or permission of the School.
Lectures three hours a week, laboratory one hour a week