Winter 2019

ECE286S: Probability & Statistics

Division of Engineering Science
University of Toronto

Instructor

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Course Description

A course in probability and statistics for Engineering Science students focusing on building solid probabilistic and statistical foundations. Topics include: sample space, events, definitions of probability, conditional probability, Bayes' theorem, important classes of discrete and continuous random variables and their distributions, joint, conditional, and marginal distributions, expectation, moment generating and characteristic functions, transformations of random variables, central limit theorem and approximations. Graphical methods, quantile plots, point and interval estimation of population parameters, method of maximum likelihood. Hypotheses testing, simple and multiple regression, correlation analysis, and introduction to Bayesian statistics.

Textbook R.E. Walpole, R.H. Myers, S.L. Myers and K. Ye, *Probability & Statistics for Engineers & Scientists*, 9th ed., Pearson, Inc., 2011. ISBN-13 978-0-13-411585-6.

Lectures	LEC 0101	Thursdays	1 pm – 2 pm	SS 2102
		Fridays	11 am – 1 pm	SS 2102
Tutorials	TUT 0101	Mondays	1 pm – 2 pm	BA 2159
	TUT 0102	Mondays	1 pm – 2 pm	SS 2111
	TUT 0103	Mondays	1 pm – 2 pm	BA 1200
	TUT 0104	Mondays	1 pm – 2 pm	SS 2105
	TUT 0105	Wednesdays	11 am – 12 noon	MY 320
	TUT 0106	Wednesdays	11 am – 12 noon	MY 430
	TUT 0107	Wednesdays	11 am – 12 noon	HA 410
	TUT 0108	Wednesdays	11 am – 12 noon	MY 420

Tutorials will begin the week of January 14, 2019 and will be used to teach problem-solving techniques based on the assigned problem sets as well as administer quiz(zes). Regular attendance is *strongly recommended*. Problem set questions are assigned as units are covered, but will not be marked.

Composition of Final Mark

Quiz(zes):	20 %
Test(s)	30 %
Final Exam:	50 %

Syllabus (Tentative topics):

- Introduction to Statistics, Data Analysis and Probability: The role of probability, sampling procedures, measures of location, measures of variability, discrete and continuous data, statistical modelling and graphical methods, sample space, events, definitions of probability, conditional probability, Bayes' rule. (Text, §1.1-1.6, §2.1, 2.2, 2.4-2.7)
- Random Variables, Probability Distributions and Expectation: Concept of a random variable, discrete probability distributions, continuous probability distributions, joint probability distributions, mean, variance, covariance, linear combinations of random variables. (Text, §3.1-3.4, §4.1-4.3)
- Discrete and Continuous Probability Distributions: Discrete uniform, binomial and multinomial, hypergeometric, negative binomial, geometric, Poisson, continuous uniform, normal distribution and its applications, normal, gamma, exponential, chi-squared, Weibull. (Text, §5.1-5.5, §6.1-6.7, 6.10)
- Functions of Random Variables: Transformations of random variables, moments and moment generating functions. (Text, §7.1-7.3)
- Fundamental Sampling Distributions and Data Descriptions: random sampling, central limit theorem, sampling distributions, *t*-distribution, *F*-distribution, quantiles, quartiles and percentiles. (Text, portions of §8.1-8.8)
- Estimation Problems: statistical inference, unbiased estimator, variance of a point estimator, interval estimation, mean estimation, standard error of a point estimate, prediction intervals, tolerance limits, absolute error and relative error, sample-size calculation, single- and two-sample estimators, maximum likelihood estimation. (Text, portions of §9.1-9.14)
- Hypothesis Testing: general concepts, Type I and Type II errors, significance level and *p*-value, tests on means and variances for single- and two samples, choice of sample size, fitting a distribution to data, goodness-of-fit tests. (Text, portions of §10.1-10.14)
- Simple Linear Regression and Correlation: simple linear regression model, least squares and the fitted model, properties of least squares estimators, inferences for regression coefficients, residual analysis and model checking, prediction, correlation analysis. (Text, portions of §11.1-11.12)

Quiz Schedule

Week of January 28, 2019	during tutorial time and in tutorial room
Week of March 18, 2019	during tutorial time and in tutorial room

Test Schedule

Thursday, February 14, 2019
9 am – 11 am
Room Assignment: Please please please make sure you go to the right room!

EX 310: If your last name is in the range **A – Li**
HA 403: If your last name is in the range **Lo – Z**

Course Website and Blackboard

The course will make use of Quercus (https://q.utoronto.ca). Course notices, handouts, office hours and important communications will be administered using this site. In addition, information will be provided at:
http://www.comm.utoronto.ca/~dkundur/course/ece-286-probability-and-statistics/.

Course Policies and Information

- All quiz(zes) and test(s) may make use of a non-programmable (**Type 2**) calculator. No programmable calculators are allowed. The final exam is **Type C** (candidates may prepare, bring to the exam and use a single standard aid sheet specified by the instructors).
- The Faculty of Applied Science and Engineering's policy on petitions for course work will be employed for missed tests and late assignments. Students must submit term-work petitions and supporting documentation through the Term-Work Petition (TWP) system, which is accessible through the Engineering Portal. Students must keep all original supporting documentation for one year after the submission date. The Academic Advisor will decide on the validity and the course instructor will select the appropriate accommodation.
- Questions regarding marking must be formally written on a piece of paper and submitted along with the associated test/assignment to the cognizant TA. There is a 48-hour limit (excluding weekends and official holidays) from the time the test/assignment is first returned in which you may request a recheck.
- Academic integrity is of utmost importance. Any issues of plagiarism and inappropriate collaboration will be taken seriously and reported to the appropriate higher authority; see http://academicintegrity.utoronto.ca.
- Students with diverse learning styles and needs are welcome in this course. Please feel free to approach me or contact Accessibility Services (accessibility.services@utoronto.ca) so we can assist you in achieving academic success in this course.
- As a university student, you may experience a range of health and/or mental health issues that may result in significant barriers to achieving your personal and academic goals. The University of Toronto offers a wide range of free and confidential services and programs that may be able to assist you. We encourage you to seek out these resources early and often.

  Student Life Website: http://www.studentlife.utoronto.ca
  Health and Wellness Website: http://studentlife.utoronto.ca/hwc

  If, at some point during the year, you find yourself feeling distressed and in need of more immediate support, visit the Feeling Distressed Webpage:
  http://www.studentlife.utoronto.ca/feeling-distressed, for more campus resources.

  Immediate help is available 24/7 through Good2Talk, a post-secondary student helpline at 1-866-925-5454.

  All students in the Faculty of Engineering have an Academic Advisor who can advise on academic and personal matters. You can find your department's Academic Advisor here:

  http://undergrad.engineering.utoronto.ca/advising-support-services/academic-advising/