

Winter 2018  
**STA286S: Probability & Statistics**  
Division of Engineering Science  
University of Toronto



**Instructors**

Prof. Deepa Kundur  
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<http://www.comm.utoronto.ca/~dkundur>

Prof. Mark Ebden  
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**Course Description**

A general introduction to probability and applied statistics for engineers. Topics include: definitions of sample space, events, probability, conditional probability, Bayes' theorem. An overview of discrete- and continuous random variables and their distributions; joint-, marginal-, and conditional distributions; expectation; transformation of random variables; moment generating function. Central limit theorem; sampling distributions of  $\bar{X}$  and  $S^2$ ; the  $\chi^2$ -,  $t$ -, and  $F$ -distributions; point- and interval estimation of population parameters; method of maximum likelihood; hypothesis testing. Fitting the distribution to the data, probability plots, goodness-of-fit tests. Simple linear regression.

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

<b>Lectures</b>	LEC 0101	Thursdays	1 pm – 2 pm	MC 102
		Fridays	11 am – 1 pm	SF 1105
<b>Tutorials</b>	TUT 0101	Mondays	1 pm – 2 pm	BA 3012
	TUT 0102	Mondays	1 pm – 2 pm	BA 2159
	TUT 0103	Mondays	1 pm – 2 pm	BA 3116
	TUT 0104	Mondays	1 pm – 2 pm	BA 2185
	TUT 0105	Wednesdays	11 am – 12 noon	HA 403
	TUT 0106	Wednesdays	11 am – 12 noon	SF 2202
	TUT 0107	Wednesdays	11 am – 12 noon	SF 3202
	TUT 0108	Wednesdays	11 am – 12 noon	MP 118

Tutorials will begin the week of January 15, 2018 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 sets will be assigned weekly, but will not be marked.

**Composition of Final Mark**

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

**Course Website and Blackboard**

The course will make use of Blackboard (<http://portal.utoronto.ca>). All students must register on Blackboard. Course notices, handouts, office hours and important communications will be administered using this website. In addition, information will be provided at:  
<http://www.comm.utoronto.ca/~dkundur/course/sta-286-probability-and-statistics/>.

### 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)

### Course Policies and Information

- All quiz(zes) and test(s) 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. If you have a disability/health consideration that may require accommodations, please feel free to approach the instructor(s) and/or Accessibility Services at (416) 978 8060; see <http://accessibility.utoronto.ca>.

Winter 2018 (Tentative) Schedule  
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<b>Lectures</b>	LEC 0101	Thursdays	1 pm – 2 pm	MC 102
		Fridays	11 am – 1 pm	SF 1105
	Weeks 1 to 7:	Prof. Deepa Kundur		(probability)
	Weeks 8 to 13:	Prof. Mark Ebden		(statistics)
<b>Tutorials</b>	TUT 0101	Mondays	1 pm – 2 pm	BA 3012
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Tutorials will begin the week of January 15, 2018 and will occur weekly unless otherwise specified.

**Tentative Quiz Schedule**

Week of January 22, 2018  
 Week of February 5, 2018  
 Week of March 5, 2018  
 Week of April 2, 2018

**Tentative Test Schedule**

Monday, February 12, 2018  
 Thursday, March 22, 2018