

CONCORDIA UNIVERSITY
DEPARTMENT OF ELECTRICAL & COMPUTER ENGINEERING

Syllabus and General Information

ENGR 371

Probability and Statistics

Summer 2017

Course Objective

This is an introductory course in probability and statistics. It aims at teaching engineering students the fundamentals of the probability and statistics theory with applications to various engineering disciplines. Many examples related to real life engineering (probabilistic) problems will be addressed.

Instructor:

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Office Hours: Mondays 3 to 5PM

Pre-req.: ENGR 213 and ENGR 233

Textbook

Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, 6th Edition, Wiley 2014.

References

Any text on probability and/or statistics can serve as a reference. There is a large number of them available at the Concordia University Library.

Course Website: MOODLE and https://users.encs.concordia.ca/~hrivaz/ENGR_371/summer2017/

Topics:

- Introduction (Chapter 1)
- Probability (Chapter 2)
- Discrete random variables and probability distributions (Chapter 3)
- Continuous random variables and probability distributions (Chapter 4, excluding 4.9-4.12)
- Joint probability distributions (Chapters 5, excluding 5.5,5.6)
- Descriptive Statistics (Chapter 6, 6.1 and 6.7 only)
- Sampling distributions (Chapter 7, excluding 7.3.4, 7.4)
- Statistical Intervals (Chapter 8, excluding 8.4, 8.6)
- Tests of Hypotheses (Chapter 9, 9.1-9.4 only)

Course Schedule (Note that in the summer session each class corresponds to a week)

| <i>Date</i> | Topic | Suggested Problems |
|---|--|--|
| Week 1, We Jun 28 Ch. 2.1-2.4 | Sample Spaces, Events, Counting, Axioms of Probability, Addition rules, conditional probability. | 2.15, 2.27, 2.66, 2.70, 2.87, 2.89, 2.92, 2.103, 2.107, 2.114 |
| Week 2, Mo Jul 3 Ch. 2.5-2.8 | Multiplication rule, Total Probability Rule, Independence of events, Bayes Theorem, Random Variables. | 2.153, 2.156, 2.169, 2.171, 2.175, 2.182, 2.221, 2.227 |
| Week 3, We Jul 5 Ch. 3.1-3.6 | Discrete Random Variables, pmf's, cdf's, Mean and Variance for discrete random variables, discrete uniform distribution, binomial distribution. | Quiz 1 3.10, 3.27, 3.32, 3.47, 3.52, 3.66, 3.68, 3.86, 3.91, 3.92, 3.110 |
| Week 4, Mo Jul 10 Ch. 3.7-3.9, 4.1-4.2 | Geometric distribution, negative binomial distribution, hypergeometric distribution, Poisson Distribution, Continuous Random Variables, pdf's. | 3.125, 3.131, 3.149, 3.165, 3.185, 3.187, 3.201, 3.202, 4.4, 4.7 |
| Week 5, We Jul 12 Ch. 4.3-4.8 | cdf's, Mean and Variance of Continuous random variables, continuous uniform distribution, normal distribution, normal approximation for binomial and poisson distributions, exponential distribution. | Quiz 2 4.18, 4.26, 4.49, 4.55, 4.67, 4.73, 4.100, 4.124 |
| Week 6, Mo Jul 17 Ch 5.1-5.2 | Bivariate and multivariate distributions, Joint distributions, marginal distributions, conditional distributions, independence of two random variables, covariance and correlation. | 5.1, 5.3, 5.9, 5.14, 5.16, 5.20, 5.23, 5.27, 5.34, 5.42 |
| Week 7, We Jul 19 Midterm | Midterm on Wednesday July 19. Starts at 7:00PM and finishes at 8:15PM. | |
| Week 8, Mo Jul 24 Ch 5.3-5.4 | Common Joint Distributions: multinomial distribution, bivariate normal distribution. Linear functions of random variables. | 5.48, 5.49, 5.52, 5.54, 5.55, 5.62, 5.67, 5.70, 5.71, 5.78 |
| Week 9, We Jul 26 Ch 6.1,6.7, 7.1-7.3 (excluding 7.3.4) | Numerical summaries of data, Probability plots. Point estimation, Sampling distributions, Central Limit Theorem, Unbiased estimators, variance of a point estimator, mean squared error. | Quiz 3 6.12, 6.16, 7.4, 7.11, 7.12, 7.13, 7.14, 7.24, 7.29, 7.34 |
| Week 10, Mo Jul 31 Ch 8.1-8.3,8.5 | Confidence Intervals on the mean of a normal distribution both with variance known and unknown. Confidence intervals on the variance and on the standard deviation. Guidelines for confidence intervals. | 8.1, 8.8, 8.10, 8.14, 8.17, 8.21, 8.31, 8.38, 8.52, 8.54 |
| Week 11, Wed Aug 2, Ch 8.7, 9.1 | Tolerance and prediction intervals. Hypothesis Testing. | Quiz 4 9.1, 9.3, 9.10, 9.15, 9.17, 9.20, 9.21, 9.25 |
| Week 12, Mo Aug 7, Ch 9.2-9.4 | Tests on the mean of a normal distribution both with variance known and unknown. Tests on the variance and standard deviation of a normal distribution. | 9.36, 9.40, 9.43, 9.48, 9.52, 9.58, 9.62, 9.65, 9.80, 9.83 |
| Week 13, We Aug 9 | Review | |

Graduate attributes: All engineers must be able to analyze data and draw valid conclusions from it. Many of the tools that you learn in this course will be aimed toward that. This course emphasizes and develops the following CEAB (Canadian Engineering Accreditation Board) graduate attributes and indicators:

| Attribute | Indicator | Level of knowledge | Evaluation method |
|----------------------------------|---|--------------------|--------------------------|
| Investigation | Background and Hypothesis Formulation | Introductory | Group project |
| | Designing Experiments | Introductory | Group project |
| | Conducting Experiments and Collection of Data | Intermediate | Group project |
| | Analysis and Interpretation of Data | Intermediate | Group project |
| A knowledge base for engineering | Knowledge-base of mathematics | Advanced | Assignment/project/exams |
| | Knowledge base in a specific domain | Advanced | Assignment/project/exams |

Exams: One midterm and one final exam will be given. All exams will be closed book. If you miss the midterm exam for any reason, the weight on the midterm will be added to that of the final exam. The crib sheets will be provided.

Assignments: One of the most important skills that you can have as an engineer is the ability to read a technical document and get something out of it. One of the best techniques to get more out of what you read is to make notes and formulate questions and hypothesis as you read. This takes often passive activity of reading and makes it active. Before the first class of each week you should have read the sections in the textbook for the upcoming week. You should turn in:

1. Three pages of “jottings”. This is original handwritten material concerning the material you have read. Jottings can take any form, for example: summary, questions that occurred to you, insights, etc.
2. Three sentences that summarize what you’ve read.

A teaching assistant will do two things: Check that you did the jottings (no photocopies!!) and give you a mark on your three sentences. We will do this once a week except for the week when there is a midterm. This means there will be 4 such assignments, which will be used for 5% of your grade.

Quizzes

Four quizzes will be given and the best three will be counted. The questions on the quizzes will be related to the suggested problems. Your best three quizzes will be used for 10% of your grade. The quizzes will take place during tutorials.

Project

The project will be a team project (not more than three students per group). This will count for 15% of your grade.

Grading*Scheme A*

| | |
|-------------|-----|
| Assignments | 5% |
| Project | 15% |
| Quizzes: | 10% |
| Midterm: | 20% |
| Final exam: | 50% |

Or

Scheme B

| | |
|-------------|-----|
| Assignments | 5% |
| Project | 15% |
| Quizzes: | 10% |
| Final exam: | 70% |

Whichever is better.

If you miss the midterm for any reason scheme B will be used.

Academic Code of Conduct

- All students are expected to fully respect the academic honor system and abide by the Code of Academic Conduct set by Concordia University.
- Any reasonable suspicion of an honor violation will be reported.