Learning Outcomes for
ENGI 4421 - Probability and Statistics

1. Descriptive Statistics

1.01 Calculate summary measures of central location (mean, median, mode) and of variation (interquartile range, variance) for data sets, both manually and using statistical software.
1.02 Construct and interpret graphical summaries of data (histogram, bar chart, box plot).
1.03 Identify misleading graphical summaries of data.

2. Probability

2.01 Determine whether or not a set of probabilities is coherent.
2.02 Convert between odds and probabilities.
2.03 Appreciate the link between coherence and fair bets.
2.04 Calculate [or estimate] probabilities using classical [or empirical] definitions.
2.05 Represent compound probabilities on Venn diagrams or tree diagrams.
2.06 Appreciate the distinction between conditional and unconditional probability.
2.07 Evaluate probabilities for compound events using the total, general addition and general multiplication laws of probability.
2.08 Evaluate probabilities for compound events using combinations and permutations.
2.09 Use Bayes' theorem to evaluate conditional probabilities.
2.10 Construct decision trees and use them to determine optimum strategies.

3. Probability Distributions

3.01 Check whether a discrete function is a probability mass function.
3.02 Check whether a continuous function is a probability density function.
3.03 Convert between the cumulative distribution function and the probability mass (or density) function.
3.04 Use a cumulative distribution function to evaluate probabilities.
3.05 Use a cumulative distribution function to find the quartiles of a probability distribution.
3.06 Evaluate the expected value and variance of a random quantity (discrete or continuous).
3.07 Determine whether two random quantities are independent, using their joint distribution.
3.08 Calculate the covariance and correlation coefficient of two discrete random quantities.
3.09 Determine whether a discrete random quantity follows a binomial distribution.
3.10 Evaluate probabilities and expected values for random quantities following any of the uniform, Bernoulli, binomial, Poisson, hypergeometric, negative binomial, geometric, normal, t , exponential and chi-square distributions.
3.11 Use tables to evaluate probabilities for random quantities following any of the binomial, Poisson, normal, t and chi-square distributions.
3.12 Estimate uncertainties in combinations of measurements (propagation of error).

4. Inferential Statistics

4.01 Appreciate the consequences of the central limit theorem.
4.02 Calculate a confidence interval estimate (classical or Bayesian) for a population mean.
4.03 Calculate a confidence interval estimate for the difference in two population means.
4.04 Calculate an Agresti-Coull confidence interval estimate for a population proportion.
4.05 Conduct a classical hypothesis test on a population mean.
4.06 Conduct a classical hypothesis test on a difference in two population means.
4.07 Distinguish between paired and unpaired two-sample confidence intervals / hypothesis tests.
4.08 Distinguish between type I and type II errors in classical hypothesis tests.
4.09 Conduct a chi-square goodness of fit test.
4.10 Conduct a chi-square test for the independence of two random quantities.
4.11 Calculate the line of best fit through a set of bivariate data (simple linear regression).
4.12 Complete an ANOVA table for simple linear regression.
4.13 Conduct an hypothesis test to determine whether a useful linear relationship exists.
4.14 Calculate confidence and prediction intervals for simple linear regression.

Graduate Attributes
(Canadian Engineering Accreditation Board)

Learning outcome 1 (descriptive statistics) meets graduate attribute KB.1-I
A knowledge base for engineering (mathematics), introductory level.

All other learning outcomes above meet graduate attributes
KB.1-D A knowledge base for engineering (mathematics), development level
and PA.1-D Problem analysis (mathematics), development level.

The graduate attributes for Engineering courses are listed at
http://www.mun.ca/engineering/undergrad/graduateattributes.pdf

The learning outcomes are assessed in assignments, the term tests and the final examination.

Total Accreditation Units = 42 AUs, Mathematics: 100%

The course web site is at " http://www.engr.mun.ca/~ggeorge/4421 ".