Course Outline

INSTRUCTOR:	David Heilig, PhD	**OFFICE HOURS:**	By appointment
OFFICE:	-	**CLASSROOM:**	Lecture: A2202 Tutorial: A2702
E-MAIL:	david.heilig@yukonu.ca	**CLASS TIME:**	Lecture: Fridays 10:30 AM – 12:30 PM Tutorial: Mon 05:30 AM – 07:00 PM
PHONE:	(867) 336 3535		

COURSE DESCRIPTION

This course provides a comprehensive introduction to statistical principles and methods. At the end of the course, students should be able to utilize statistical techniques to characterize and assess research datasets and critically evaluate statistical work done by others. Topics include descriptive statistics, elementary concepts in probability, correlation and regression, sampling, estimation and hypothesis testing (including one-sample, two-sample, ANOVA, and chi-squared). This course is directed towards undergraduate science and engineering students for which fluency in basic statistical methods can greatly contribute to the depth of their core program.

COURSE REQUIREMENTS

Prerequisite(s): Successful completion of MATH 100 (Single Variable Calculus I), or
MATH 120 (Mathematics for the Life Sciences),
or permission of the instructor.
Cross-listed Course: RRMT 202 - Statistics for Biological Sciences

EQUIVALENCY OR TRANSFERABILITY

Find course transfer at https://www.bctransferguide.ca/]

Students are reminded that it is always the receiving institution that determines whether a course is acceptable as an applicable, equivalent course or if it may be transferred to their program for credit.

Find further information at: https://www.yukonu.ca/admissions/transfer-credit

LEARNING OUTCOMES

Upon successful completion of the course, students will be able to:

- Apply the techniques of descriptive statistics in order to organize and analyze data (using histogram, mean, median, mode, and standard deviation).
- Demonstrate an understanding of probability (simple/addition/multiplication/conditional) and counting rules (combinations and permutations).
- Apply hypothesis tests to means, proportions, and variances.
- Demonstrate an understanding of ANOVA and nonparametric statistics.
- Apply the techniques of inferential statistics (correlation and regression).
- Present the findings of a research project that employs the statistical techniques learned throughout the course to a real-world, local dataset.

COURSE FORMAT

Delivery format

Students are expected to attend 110 min. tutorials once a week (Monday) and 150 min lectures once a week (Friday), for a total of approximately 42 hrs. Homework and assignments are completed outside of class time, and it is expected these will require an additional 3-4 hrs of work per week. It is important to note that the time required for successful course completion will vary by individual.

Workload

The course content is covered through lectures, tutorials, and assignments. Students are expected to prepare for each class by doing assigned readings from the textbook and are also expected to engage in substantial self-directed review and practice of the material. One should plan on spending between 3-4 hours in study and preparation outside class for each hour spent in class.

EVALUATION

Engagement and Participation

Regular attendance and engagement, including completing homework and assignments, will provide the best opportunity for success in the course.

Assignments

Two take-home assignments (both are worth 10% of the final mark) will be distributed by the instructor over the course of the semester. Late assignments will be graded based on the following scheme: a deduction of 10% per business day up until a total deduction of 50% is reached. Following that, assignments will no longer be accepted and will receive a mark of zero (F).

Quizzes

There will be five "open book" quizzes (each is worth 2% of the final mark) administered during the term, all through the University's online learning management system (Moodle). Many questions on the quizzes will draw heavily on the techniques mastered while completing the assigned problem sets. Missed quizzes cannot be made up unless prior arrangements have been made with the instructor.

Research Project

Students will complete a research project in small groups (2-3 students) where they will apply the statistical techniques learned in the course to a scientific dataset from their own field of study. Students are encouraged to contact faculty members in their respective programs at the start of the semester; the course instructor will assist in obtaining datasets if needed, and vet those provided by School of Science faculty for suitability for the class project. The project will involve both oral and written components and be due during the last week of class. Smaller components of the project will be due at various points throughout the term to ensure forward progress. More information on the project will be presented in the first few weeks of class. The research project worth 20% of the final mark.

Exam

There will be one midterm exam worth 20% of the final mark.

The final examination will cover the entire course and is worth 30% of the final mark. It will be held at the end of the term during the exam period. The exact date of the examination is available on the course website from the date that registration is available. Students should contact their instructor immediately if conflicts arise.

Summary

Assignments	20%
Quizzes	10%
Midterm Exam	20%
Final Exam	30%
Research Project	20%
Total	**100%**

TEXTBOOKS & LEARNING MATERIALS

Textbook

Triola, M.F., Goodman, W.M., Law, R., and LaBute, G. 2011. Elementary Statistics (3rd Canadian Edition). Pearson Canada: ISBN: 9780321225979

Supporting Materials

In addition to the textbook, some students may find it helpful to supplement their reading with free online resources. Excellent online resources include:

- Introductory Statistics, OpenStax
  www.openstax.org/details/introductory-statistics
  This is a free textbook, available online in PDF or web view format.
- Khan Academy: Probability and Statistics
  https://www.khanacademy.org/math/probability
  Use it for: Short YouTube videos explaining each concept.

Calculator

You will require a scientific calculator for this course. It need not be a graphing calculator, but it should have a statistics function and be capable of square roots, powers, exponents, factorials, etc.

COURSE WITHDRAWAL INFORMATION

Students may officially withdraw from a course or program without academic penalty up until two-thirds of the course contact hours have been completed. Last day to withdraw or change to audit from winter term academic courses without academic penalty is Thursday, Mar 13 2025.

See withdrawal information at www.yukonu.ca/admissions/money-matters

Refer to the YukonU website for important dates: www.yukonu.ca/admissions/important-dates

Refunds may be available. See the Refund policy and procedures at www.yukonu.ca/admissions/money-matters

ACADEMIC INTEGRITY

Students are expected to contribute toward a positive and supportive environment and are required to conduct themselves in a responsible manner. Academic misconduct includes all forms of academic dishonesty such as cheating, plagiarism, fabrication, fraud, deceit, using the work of others without their permission, aiding other students in committing academic offences, misrepresenting academic assignments prepared by others as one's own, or any other forms of academic dishonesty including falsification of any information on any Yukon University document.

Please refer to Academic Regulations & Procedures (updated bi-annually) for further details about academic standing, and student rights and responsibilities: www.yukonu.ca/policies/academic-regulations

ACCESSIBILITY AND ACADEMIC ACCOMMODATION

Yukon University is committed to providing a positive, supportive, and barrier-free academic environment for all its students. Students experiencing barriers to full participation due to a visible or hidden disability (including hearing, vision, mobility, learning disability, mental health, chronic or

temporary medical condition), should contact Accessibility Services for resources or to arrange academic accommodations: access@yukonu.ca. [Text updated 16 November 2022]

TOPIC OUTLINE
Lecture Schedule

Week	Date	Class	Lecture topics
1	Week of Jan. 10th	1	Introduction to Statistics: Statistical thinking and types of statistics; types of variables; populations and samples; scales of measurement; precision and accuracy; summation notation.
		2	Summarizing & Graphing Data: Grouped versus ungrouped data; frequency distributions and tables; relative frequency and percentage distributions; outliers, bar graphs, pie charts, histograms, dotplots and stem-and-leaf displays; implied class limits; class intervals and class mark.
2	Jan. 17	3	Using Excel and R to prepare descriptive statistics
		4	Numerical Descriptive Statistics: Measures of central tendency and dispersion for ungrouped data; mean, variance, and standard deviation for grouped data; relative standing/measures of position and box-and-whisker plots; sum of squares, degrees of freedom.
3	Jan. 24	5	Plotting frequency distributions and using Histogram feature in Excel, plotting in R
		6	Probability: Simple and compound events; conceptual approaches: classical probability, relative frequency, and subjective probability; marginal and conditional probabilities; independent, dependent and complementary events; intersection of events and the multiplication rule; union of events and the addition rule; counting rule; factorials, combinations, and permutations.
4	Jan. 31	7	Exploring Probability Concepts with Excel and R
		8	Discrete Variable Probability Distributions: discrete versus continuous random variables, probability distributions of random variables and their mean/standard deviation; binomial distribution; hypergeometric distribution; Poisson distribution.
5	Feb. 07	9	Discrete Variable Probability Distributions with Excel and R
		10	Continuous Variables and the Normal Distribution: continuous probability distribution; normal and standard normal distributions; z-scores and the z-table;

Week	Date	Class	Lecture topics
			standardizing a normal curve; one and two-tailed regions, calculating x-values; level of significance; normal approximation to the binomial distribution.
6	Feb. 14	11	Continuous Variables and the Normal Distribution with Excel and R
		12	Sampling Distributions: population distribution; sampling distribution and sampling errors; mean, standard deviation and shape of the sampling distribution; central limit theorem; applications of the sampling distribution; population and sample proportions; mean, standard deviation, and shape of the sampling distribution of the sample proportion; applications of proportion sampling distributions. Estimation: point and interval estimates of population parameters; confidence levels and confidence intervals; margin of error and required sample size estimates; introduction to t-distributions and degrees of freedom.
	Feb. 21	-	*Reading Week (no classes)*
8	Feb. 28	-	Sampling Distributions and Estimation with Excel and R
		-	Hypothesis Testing – One Sample: null and alternate hypotheses; rejection and non-rejection regions; Type I and Type II errors; one and two-tailed tests; confidence levels; hypothesis tests about the mean with known and unknown standard deviation; p-values; critical-value and p-value approaches; t-tests; hypothesis tests about a population proportion.
9	***Mar. 06***	*13*	*Mid-term Exam Review*
		14	***Mid-term Exam (in class)***
10	Mar. 13	15	Hypothesis Testing – One Samples (Excel and R)
		16	Hypothesis Testing – Two Samples: independent versus dependent samples; inferences about differences in sample and population means given multiple standard deviation relationships; confidence interval estimation; testing for population mean differences in paired samples; hypothesis testing for two population proportions.
11	Mar. 20	17	Hypothesis Testing – Two Samples (Excel and R)
		18	Chi-Square Distributions: chi-square distributions; goodness-of-fit tests; observed and expected frequencies; tests of independence and homogeneity; contingency tables; population variance.
12	Mar. 27	19	Intro to Chi-squared tests in Excel an R
		20	Analysis of Variance: F distributions; one-way analysis of variance (ANOVA); sums of squares.
13		21	Comparing several samples, one-way ANOVA (in Excel and R)

Week	Date	Class	Lecture topics
	Apr. 04	22	Correlation & Regression: Simple and linear regression; scatter diagrams and least squares routines; standard deviation of errors and coefficient of determination; correlation coefficients, mean predictions and confidence intervals, prediction intervals.
14		23	Correlation and Regression (in Excel and R)
	Apr. 11	-	*Final Exam Review*