Yukon University	**School of Science**
	MATH 200 **Statistics for Physical and Life Sciences**
	Term: Winter 2027 **Number of Credits: 3 Credits**

Course Outline

INSTRUCTOR:	David Heilig, PhD	**CLASSROOM:**	Lecture: A2101 Tutorial: A2101
OFFICE:	L03 (YRC Lab building)	**CLASS TIME:**	Lecture: Wed 09:00 AM – 10:20 AM
OFFICE HOURS:	By appointment		Tutorial: Fri 09:00 AM – 10:20 PM
E-MAIL:	david.heilig@yukonu.ca	**CRN:**	20147
PHONE:	(867) 336 3535	**FINAL EXAM**	April 21, 2027. 09:00 AM – 12:00 PM (A2202)

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(s): RRMT 202 - Statistics for Biological Sciences (CRN: 20148, 20149)

EQUIVALENCY OR TRANSFERABILITY

Receiving institutions determine course transferability. 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 analyse 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

Weekly breakdown of instructional hours

Students are expected to attend one 80-minute tutorial and one 80-minute lecture each week, for a total of approximately 32 hours of in-class instruction over the semester.

Homework and assignments are to be completed outside scheduled class hours and are expected to require an additional 3-4 hours of independent work per week.

Please note that the time required to successfully complete the course may vary depending on individual learning needs, prior knowledge, and study habits.

Delivery format

This course will be delivered in a face-to-face format. Students are expected to attend one lecture and one tutorial each week on campus. Lectures will introduce statistical concepts, methods, and their practical applications, while tutorials will provide opportunities to learn through problem-solving, exercises, and the application of statistical techniques. Students will also be expected to complete homework, assignments, and independent study outside scheduled class hours.

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%**

COURSE WITHDRAWAL INFORMATION

Refer to the YukonU website for important dates.

TEXTBOOKS & LEARNING MATERIALS

Textbook

Illowsky B, Dean S. 2024. Introductory statistics. 2nd ed. Houston (TX): OpenStax. www.openstax.org/details/introductory-statistics

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:

Duthie AB. 2024 Fundamental statistical concepts and techniques in the biological and environmental sciences: with jamovi. Boca Raton (FL): CRC Press. https://bradduthie.github.io/stats/index.html#structure

Khan Academy: Probability and Statistics (https://www.khanacademy.org/math/probability)

Software

Students are required to use Microsoft Excel and R throughout the course. Students are expected to have access to both programs. Guidance and support will be provided during lectures and tutorials to help students develop the necessary software skills. R is freely available, and students are encouraged to install both R and RStudio on their personal computers.

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 for further details about academic standing and student rights and responsibilities.

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.

TOPIC OUTLINE

Week	Date	Class	Lecture topics
1	Jan. 06	1	Introduction to Statistics: Statistical thinking and types of statistics; types of variables; populations and samples; scales of measurement; precision and accuracy; summation notation.
	Jan. 08	2	Summarizing & Graphing Data: Grouped versus ungrouped data; frequency distributions and tables; relative frequency and percentage distributions; outliers, bar graphs, pie charts, histograms, dot plots and stem-and-leaf displays; implied class limits; class intervals and class mark.
2	Jan. 13	3	Using Excel and R to prepare descriptive statistics
	Jan. 15	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. 20	5	Plotting frequency distributions and using Histogram feature in Excel, plotting in R
	Jan. 22	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. 27	7	Exploring Probability Concepts with Excel and R
	Jan. 29	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. 03	9	Discrete Variable Probability Distributions with Excel and R
	Feb. 05	10	Continuous Variables and the Normal Distribution: continuous probability distribution; normal and standard normal distributions; z-scores and the z-table; standardizing a normal curve; one and two-tailed regions, calculating x-values; level of significance; normal approximation to the binomial distribution.
6	Feb. 10	11	Continuous Variables and the Normal Distribution with Excel and R
	Feb. 12	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 estimate of population parameters; confidence levels and confidence intervals; margin of error and required sample size estimates; introduction to t-distributions and degrees of freedom.

Week	Date	Class	Lecture topics
7	Feb. 17	13	Sampling Distributions and Estimation with Excel and R
	Feb. 19	14	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.
8	Feb. 24	-	*Reading Week (no classes)*
	Feb. 26	-	*Heritage Day (no classes)*
9	Mar. 03	-	Mid-term Exam Review
	Mar. 05	**-**	**Mid-term Exam (in class)**
10	Mar. 10	15	Hypothesis Testing – One Samples (Excel and R)
	Mar. 12	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. 17	17	Hypothesis Testing – Two Samples (Excel and R)
	Mar. 19	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. 24	19	Intro to Chi-squared tests in Excel an R
	Mar. 26	20	Analysis of Variance: F distributions; one-way analysis of variance (ANOVA); sums of squares.
13	Mar. 31	21	Comparing several samples, one-way ANOVA (in Excel and R)
	Apr. 02	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	Apr. 07	23	Correlation and Regression (in Excel and R)
	Apr. 09	-	Final Exam Review