



ORIGINAL COURSE IMPLEMENTATION DATE: July 1994  
 REVISED COURSE IMPLEMENTATION DATE: September 2022  
 COURSE TO BE REVIEWED (six years after UEC approval): February 2028  
 Course outline form version: 09/08/2021

## OFFICIAL UNDERGRADUATE COURSE OUTLINE FORM

**Note: The University reserves the right to amend course outlines as needed without notice.**

<b>Course Code and Number:</b> STAT 420	<b>Number of Credits:</b> 3 <a href="#">Course credit policy (105)</a>										
<b>Course Full Title:</b> Empirical and Non-Parametric Statistics <b>Course Short Title:</b> Emp. & Non-Parametric Stats											
<b>Faculty:</b> Faculty of Science	<b>Department (or program if no department):</b> Mathematics & Statistics										
<b>Calendar Description:</b> Introduction to various non-parametric techniques to test parameters for location and dispersion, including problems in single sample, two or more independent samples, and two or more related samples. Non-parametric inferential procedures are used when the assumptions underlying parametric tests are invalid. Goodness-of-fit tests and tests of association are also discussed.											
<b>Prerequisites (or NONE):</b>	One of STAT 270, STAT 271, STAT 315, or STAT 330.										
<b>Corequisites (if applicable, or NONE):</b>	NONE										
<b>Pre/corequisites (if applicable, or NONE):</b>	NONE										
<b>Antirequisite Courses</b> ( <i>Cannot be taken for additional credit.</i> ) Former course code/number: <b>MATH 420</b> Cross-listed with: Equivalent course(s): <i>(If offered in the previous five years, antirequisite course(s) will be included in the calendar description as a note that students with credit for the antirequisite course(s) cannot take this course for further credit.)</i>	<b>Course Details</b> Special Topics course: <b>No</b> <i>(If yes, the course will be offered under different letter designations representing different topics.)</i> Directed Study course: <b>Yes; cannot be repeated for credit</b> <i>(See <a href="#">policy 207</a> for more information.)</i> Grading System: <b>Letter grades</b> Delivery Mode: <b>May be offered in multiple delivery modes</b> Expected frequency: <b>Infrequent</b> Maximum enrolment (for information only): <b>36</b>										
<b>Typical Structure of Instructional Hours</b> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <td style="width: 80%;">Lecture/seminar</td> <td style="width: 20%; text-align: center;">40</td> </tr> <tr> <td>Supervised laboratory hours (computer lab)</td> <td style="text-align: center;">10</td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td> </td> <td> </td> </tr> <tr> <td style="text-align: right;"><b>Total hours</b></td> <td style="text-align: center;"><b>50</b></td> </tr> </table>	Lecture/seminar	40	Supervised laboratory hours (computer lab)	10					<b>Total hours</b>	<b>50</b>	<b>Prior Learning Assessment and Recognition (PLAR)</b> PLAR is available for this course. <b>Transfer Credit</b> (See <a href="#">bctransferguide.ca</a> .) Transfer credit already exists: <b>No</b> Submit outline for (re)articulation: <b>No</b> <i>(If yes, fill in <a href="#">transfer credit form</a>.)</i>
Lecture/seminar	40										
Supervised laboratory hours (computer lab)	10										
<b>Total hours</b>	<b>50</b>										
<b>Scheduled Laboratory Hours</b> Labs to be scheduled independent of lecture hours: <input checked="" type="checkbox"/> No <input type="checkbox"/> Yes											
<b>Department approval</b>	<b>Date of meeting:</b> June 14, 2021										
<b>Faculty Council approval</b>	<b>Date of meeting:</b> February 4, 2022										
<b>Undergraduate Education Committee (UEC) approval</b>	<b>Date of meeting:</b> February 25, 2022										

**Learning Outcomes** (These should contribute to students' ability to meet program outcomes and thus Institutional Learning Outcomes.)

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

1. Test the location parameter using sign test, Wilcoxon signed ranks test, median test, Mann-Whitney test, Kruskal-Wallis test and Friedman test.
2. Construct confidence intervals for location parameter based on sign test, Wilcoxon signed ranks test, median test and Mann-Whitney test.
3. Use Moses' test and Ansari-Bradley test for dispersion parameter.
4. Apply chi-square test, Kolmogorov-Smirnov test and Lilliefors test for goodness of fit test.
5. Employ the Spearman rank correlation coefficient, Kendall's tau, chi-square test and Kendall's coefficient of concordance to test for association.
6. Use one-sample runs test and Cox-Stuart test for trend.
7. Apply Hollander test of extreme reactions and Fisher exact test.
8. Use McNemar test for two related samples.
9. Apply the non-parametric techniques learned from the course to analyze the real-life data.

**Recommended Evaluation Methods and Weighting** (Evaluation should align to learning outcomes.)

Assignments:	20%	Project:	20%	[click to select]	%
Quizzes/tests:	20%	Final exam:	40%	[click to select]	%

**Details:**

The above percentages may vary among instructors and years. The final exam is comprehensive. Students must obtain at least 40% on the final exam to pass the course.

**NOTE: The following sections may vary by instructor. Please see course syllabus available from the instructor.**

**Texts and Resource Materials** (Include online resources and Indigenous knowledge sources. [Open Educational Resources](#) (OER) should be included whenever possible. If more space is required, use the [Supplemental Texts and Resource Materials form](#).)

Type	Author or description	Title and publication/access details	Year
1. Textbook	Conover, W.J.	Practical Nonparametric Statistics, Wiley. 3 <sup>rd</sup> ed.	1999
2. Textbook	Daniel, W.	Applied Nonparametric Statistics, Duxbury. 2nd ed.	1990
3. Textbook	Hollander, M., Wolfe, D., and Chicken, E.	Nonparametric Statistical Methods	2014
4. Textbook	Corder, G and Foreman D.	Nonparametric Statistics A Step-by-Step Approach	2014
5. Textbook	Sprent, P. and Smeeton, N.C.	Applied Nonparametric Statistical Methods	2001

**Required Additional Supplies and Materials** (Software, hardware, tools, specialized clothing, etc.)**Course Content and Topics**

Test for location parameter:

- One sample---sign test, Wilcoxon signed ranks test and their associated confidence intervals.
- Two independent samples---median test, Mann-Whitney test and their associated confidence intervals.
- Two related samples---sign test, Wilcoxon matched-pairs signed ranks test and their associated confidence intervals.
- Three or more independent samples---extension of median test, Kruskal-Wallis test, multiple comparisons, Lehman contracts, comparing all treatments with a control.
- Three or more related samples---Friedman two-way analysis of variance by ranks, multiple comparisons, Durbin's test for incomplete block designs, aligned ranks.

Test for dispersion parameter:

- Two independent samples---Moses' test, Ansari-Bradley test.

Goodness-of-fit test:

- One sample---chi-square test, Kolmogorov-Smirnov test, confidence band for a population distribution function, Lilliefors test.
- Two independent samples---Kolmogorov-Smirnov test.

Test for association:

- One sample---Spearman rank correlation coefficient, Kendall's tau and its confidence interval.
- Two independent samples---chi-square test of independence.
- Three or more independent samples---Kendall's coefficient of concordance, chi-square test, partial rank correlation.

Other tests:

- One sample---binomial test, one-sample runs test, Cox-Stuart test for trend.
- Two independent samples---Hollander test of extreme reactions, Fisher exact test, chi-square test of homogeneity.

Two related samples---McNemar test.