Department of Geography and the Environment

GEOG 2271: QUANTITATIVE METHODS IN GEOGRAPHY

Winter 2023

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Graduate Assistant: TBA

Course Location and Schedule:

Labs	AT 3009 on Wednesdays, 2:30 – 4:00 pm
Lectures	RC 2003 on Mondays and Wednesdays, 5:30-7:00 pm

Office Hours:

RB 1005 at 4-5pm on Wednesdays or make appointments by email in advance

Supplementary Course Website: Mycourselink/D2L

Course Content:

The course introduces Geography majors to statistical methods. Topics include describing a distribution, discrete and continuous probability distributions, estimating means and proportions, hypothesis testing, linear regression, contingency tables and point pattern analysis. Time permitting, multiple regression and non-linear regression will be introduced. The application of statistics to geographical problems is emphasized. **A more detailed schedule of the topics to be covered is included in the Course Materials Package.**

Evaluation Scheme:

Assignments (11)	**30%**
Tests (2)	**30%**
Practical Lab Test	**10%**
Final Examination	**30%**

Required Materials

Course Text

Johnson and Kuby (2012). *STAT, 2nd ed.* Brooks/Cole.

Alternative Text

Rogerson, P (2020). *Statistical Methods for Geography: A Student's Guide, 5th ed.* Sage Publications.

A good statistics textbook is an invaluable reference for this course and others you will take in the future. I can suggest other alternatives if the recommended texts are not to your liking.

Course Materials Package

The Course Materials Package contains a detailed course syllabus (lecture topics, recommended readings, dates for assignments and tests). The manual also comes with a beginner's guide to SPSS, materials for in-class workshops, and review questions with answers. For convenient use, you may consider printing all or part of this package.

Other Supplies

- A pencil and eraser
- A calculator with scientific functions (factorials, logarithms, exponents)
- A memory stick is recommended for backing up work

Software

While some assignments should be completed with a calculator, others will be completed using two software packages: **Microsoft Excel and SPSS**. These are available for use in the ATAC computer labs, and versions of Microsoft Office 365 (which includes Excel) and IBM SPSS are **available for free** through the Helpdesk.

Course Delivery

The primary mode of contact will be **on-site Lectures and Labs** during the scheduled time periods each week.

Course materials will be delivered through the **Desire2Learn** platform at MyCourselink.

Assignments

Assignments for this course are included in this manual and may be completed at any time. The course schedule indicates the due dates and also the point at which we will have covered all of the necessary material in class (i.e., when you should get started). **Late assignments will be penalized at a rate of 10%/day of the mark allocation.** If you believe you will require an extension, please make that request **in advance** of the deadline.

Expectations

To succeed in this course, *regular involvement is **essential***. During the pandemic protocols, I can understand that not everyone will be able to connect synchronously every time. I am willing and available to help students who have made the effort to review the lecture notes and recordings and still find they are struggling with a concept or technique. However, ***it is critical not to fall behind***. This is not a course that can be 'binged' at the last minute.

Learning Outcomes

Knowledge

- Review common descriptive statistics and the appropriate usage of each
- Utilize probability theory to develop expected frequencies of events
- Utilize standard statistical approaches for making inferences from samples
- Design and test hypotheses using a variety of parametric and non-parametric techniques, including:
  - Student's t and χ^2 distributions
  - Differences between two samples
  - Linear regression
  - ANOVA

- Incorporate spatial information into quantitative analysis

Skill Development

- Application of statistical techniques to common geographical tasks
- Problem-solving and quantitative evaluations using mathematical skills
- Data models, analysis, and graphic representation using common statistical and spreadsheet software

LU Notice for Recording Lectures and Class Activities

In GEOG2271, in the context of remote instruction and participation, video and audio recordings of class activities will be made to ensure students' and instructors' easy and comprehensive access to those activities. The recordings are confidential and are intended only for the use of the course students and instructors. They may otherwise not be used or disclosed. During recording, to protect others' privacy, each student should ensure that no one else is present in the location where they are being recorded without that non-student's consent. The recordings are made under the authority of sections 3 and 14 of The Lakehead University Act, 1965. Questions about the collection of the images and sounds in the recordings may be directed to the Dean of Science and Environmental Studies, ses@lakeheadu.ca .

LU Accommodation Statement

Lakehead University is committed to achieving full accessibility for persons with disabilities/medical conditions. Part of this commitment includes arranging academic accommodations for students with disabilities/medical conditions to ensure they have an equitable opportunity to participate in all of their academic activities. If you are a student with a disability/medical condition and think you may need accommodations, you are strongly encouraged to contact Student Accessibility Services (SAS) and register as early as possible. For more information, please email sas@lakeheadu.ca or visit https://www.lakeheadu.ca/faculty-and-staff/departments/services/sas .

Mental Health Statement

All of us can benefit from support during times of struggle. If you or anyone you know experiences academic stress, difficult life events or feelings of anxiety or depression, Student Health and Wellness is here to help. Their services are free for Lakehead Students and appointments are available. You can learn more about confidential mental health services available on and off campus at:

https://www.lakeheadu.ca/shw

As a university student, you may sometimes experience mental health concerns or stressful events that interfere with your academic performance and negatively impact your daily activities. Lakehead has resources available to you. Check in with the following **WellU Key** to find the mental health resources you are looking for.

https://lakehead.portal.gs

Remember that getting help is a smart and courageous thing to do - for yourself, for those you care about, and for those who care about you. Asking for support sooner rather than later is almost always helpful.

Week-by-Week Schedule for GEOG 2271

Week	LECTURE (Mon. 5:30-7pm)	LAB PERIOD (Wed. 2:30-4pm)	LECTURE (Wed. 5:30-7pm)
1	**January 9** **Slideshow 1 / Workshop 1** ▪ Course objectives ▪ Analyzing the distribution of a variable ▪ Constructing frequency tables and histograms Reading: Chapter 2 (Sections 2.1 – 2.2) ***Get started on Assignment 1.***	**January 11** **Workshop 3 Introduction to Excel** Learn / practice basic spreadsheet skills. ▪ Entering / editing data ▪ Formatting Data ▪ Sorting Data ▪ Building Equations ▪ Using Fill Down and Right features Built in Functions	**January 11** **Slideshow 2 / Workshop 2** ▪ Choropleth maps ▪ Measures of Central Tendency Reading: Chapter 2 (Sections 2.3 – 2.4)
2	**January 16** **Slideshow 3 / Workshop 2 (continued)** ▪ Measures of Dispersion ▪ Spatial Measures Reading: Chapter 2 (Sections 2.4 – 2.7) ***Get started on Assignment 2.***	**January 18** **Workshop 6** **Descriptive Stats & Charts with Excel** ▪ Use of built-in functions (SUM, AVERAGE, STDEV, etc.). ▪ Weighted Means ▪ Creating Bar Charts and Histograms ***Assignment 1 due.***	**January 18** **Slideshow 4 / Workshop 4** ▪ Concept of Probability ▪ Discrete vs. continuous events ▪ Binomial distributions Reading: Chapter 4
3	**January 23** **Slideshow 5 / Workshop 5** ▪ Geographical applications of binomial distributions ▪ Geometric distributions ▪ Poisson distributions Reading: Chapter 5 ***Get started on Assignment 3.***	**January 25** **Workshop 8** **Importing CANSIM Data into Excel** ▪ Accessing Statistics Canada data via E-STAT ▪ Review of spreadsheet functions learned in Workshops 1 and 5 ***Assignment 2 due.***	**January 25** **Slideshow 6 / Workshop 7** **Continuous Probability Distributions** ▪ Normal distributions ▪ Exponential distributions Reading: Chapter 6 ***Get started on Assignment 4.***

Week	LECTURE (Mon. 5:30-7pm)	LAB PERIOD (Wed. 2:30-4pm)	LECTURE (Wed. 5:30-7pm)
4	**January 30** **Slideshow 7** **The Central Limit Theorem** ▪ Concept of sampling ▪ Properties of a Sampling Distribution Reading: Chapter 7	**February 2** **Workshop 9** **Probability Distribution Functions in Excel** ▪ Using built-in statistical functions to calculate probabilities for the normal, exponential, binomial and Poisson distributions. ***Assignment 3 due.***	**February 2** **MIDTERM 1** **Covers material up to and including Slideshow 6 and Workshop 7**
5	**February 6** **Slideshow 8 / Workshop 10** **Confidence Intervals** ▪ Estimating a population mean based on large and small samples ▪ Estimating a proportion Reading: Chapter 8 (Sections 8.1 – 8.2)	**February 8** **Workshop 11** **A Database in SPSS** ▪ Identifying nominal, ordinal and interval/ratio data ▪ Coding a questionnaire survey ▪ Entering survey data into SPSS ***Assignment 4 due.***	**February 8** **Slideshow 9 / Workshop 10 (continued)** ▪ Estimating Sample Sizes Needed for Interval Estimates **Slideshow 10 / Workshop 12** **Introduction to Hypothesis Testing** ▪ Constructing null and research hypotheses ▪ One vs. two tails Reading: Chapter 8 (Sections 8.3 – 8.5) ***Get started on Assignment 5.***
6	**February 13** **Slideshow 11 / Workshop 12 (continued)** **Hypotheses about Means and Proportions** ▪ Testing hypotheses about population means with large and small samples ▪ Testing hypotheses about proportions. Reading: Chapter 9 (Sections 9.1 – 9.2) ***Get started on Assignment 6.***	**February 15** **Workshop 13** ▪ Descriptive stats using SPSS ▪ Recoding / frequency count function in SPSS ▪ Use of the Compute Function ***Assignment 5 due.***	**February 15** **Slideshow 12 / Workshop 14** **Bivariate Analysis and Correlation** ▪ Constructing scatter plots ▪ Finding Pearson's *r* Reading: Chapter 3

Week	LECTURE (Mon. 5:30-7pm)	LAB PERIOD (Wed. 2:30-4pm)	LECTURE (Wed. 5:30-7pm)
7	**February 27** **Slideshow 13 / Workshop 14 (cont'd)** **Explanation using Regression** ▪ Determining Best Fit Equations ▪ Residuals ▪ Explained / Unexplained Variation Reading: Chapter 13 (Sections 13.1 – 13.2) ***Get started on Assignment 7.***	**March 1** **Assignment 8** **Applications of Regression Analysis** ▪ SPSS regression output Reading: Chapter 8 (Section 8.9) ***Assignment 6 due.*** ***Get started on Assignment 8.***	**March 1** **Slideshow 14 / Workshop 15** **Regression Hypothesis Tests** ▪ Testing a slope for significance ▪ Assumptions and pitfalls of regression Reading: Chapter 13 (Sections 13.3 – 13.6)
8	**March 6** **Slideshow 15 / Workshop 16** **Comparing Means – Independent Samples** ▪ Two sample difference of means *t*-test for independent samples ▪ Mann-Whitney *U*-Test Reading: Chapter 10 (Sections 10.1, 10.3 and 10.5) and Chapter 14 (Section 14.3)	**March 8** **Work/Study Period** ***Assignment 7 due.*** ***Assignment 8 due at end of lab.***	**March 8** **Slideshow 16 / Workshop 16 (cont'd)** **Comparing Means – Dependent Samples** ▪ Matched Pairs *t*-Test ▪ Flex period (catch up if necessary) ▪ Review for Midterm 2 Reading: Chapter 10 (Section 10.2)
9	**March 13** **Slideshow 17 / Workshop 17** **Comparing Two Proportions** ▪ Test for comparing two sample proportions Reading: Chapter 10 (Section 10.4) ***Get started on Assignment 9.***	**March 15** **Assignment 10** **Comparing Means in SPSS** ▪ Using SPSS to conduct comparison tests on means. ***Get started on Assignment 10.***	**March 15** **MIDTERM 2** **Covers material up to and including Slideshow 16 and Workshop 16.**

Week	LECTURE (Mon. 5:30-7pm)	LAB PERIOD (Wed. 2:30-4pm)	LECTURE (Wed. 5:30-7pm)
10	**March 20** **Slideshow 18 / Workshop 18** **ANOVA** ▪ Analysis of variance technique ▪ Difference between multiple means Reading: Chapter 12	**March 22** **Work/Study Period** ***Assignment 9 due.*** ***Assignment 10 due at end of lab.***	**March 22** **Slideshow 19 / Workshop 19** **Contingency Tables** ▪ Calculation of expected values in a contingency table ▪ Manual calculation of a chi-square statistic Reading: Chapter 11
11	**March 27** **Slideshow 20 / Workshop 20** **Other Applications of the Chi-Square Test** ▪ Testing the representativeness of a sample ▪ Testing for randomness in a spatial pattern of residuals	**March 29** **Assignment 11** **Contingency Tables** ▪ Using SPSS to generate contingency tables and the chi-square statistic ***Get started on Assignment 11.***	**March 29** **Slideshow 21 / Workshop 21** **Point Pattern Analysis** ▪ Testing for Randomness
12	**April 3** **Slideshow 22 / Workshop 21 (continued)** **Nearest Neighbour Analysis** **Slideshow 23 / Workshop 22** **Multivariate Modelling** ***Assignment 11 due.***	**April 5** **Practical Lab Test** A test of your ability to use SPSS and Excel to find answers to problems in descriptive and inferential statistics.	**April 5** **Slideshow 23 / Workshop 22 (continued)** **Multivariate Modelling** ▪ The need for multivariate models ▪ Building a Multiple Regression Model ▪ Dummy variable in a regression model **Exam Preparation**