# Essential Spatial Analysis (GGRC32)

Last updated October 17, 2018


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| **Instructor** | Nate Wessel | nate.wessel@mail.utoronto.ca |
| **TA** | Jeff Allen | jeff.allen@mail.utoronto.ca |
| **Lecture** | HL 006 | Tuesdays, 10:00 - noon |
| **Lab** | BV 469 | Tuesdays, 1:00 - 2:00pm |
| **Office Hours** | MW379 | Tuesdays, 2:00 - 3:00pm |


## General Information

This course builds on introductory statistics and GIS courses by introducing the core concepts and methods of spatial analysis. Topics covered include distance metrics, spatial distributions, autocorrelation, and hypothesis testing. These will be used to quantify spatial patterns and identify underlying spatial processes with an emphasis on spatial thinking in an urban context.

### Format

The course meets once a week and has a two hour lecture followed by one hour in a computer lab for hands on work with the assignments. The material covered in the assignments is an opportunity to apply the topics and techniques discussed in the lectures each day. There will be four lab assignments with about two weeks given to complete each. There is also a research paper on a topic of the student's choosing which will be assigned about halfway through the course and will be due near the end. The last class will be used for brief presentations of this work to the rest of the class. There will be a midterm and a final exam.

### Learning Objectives

Students should learn to use and understand the specific techniques of spatial analysis covered in this course, including:

- the correct interpretation of any statistical summaries,
- how to implement the techniques in various software packages,
- the types of situations in which they are appropriate

This course is not just about calculating statistical measures but also about learning when it is appropriate to use them, how to describe the results qualitatively, and what the applications and limitations of these techniques are.

## Prerequisites

To succeed in this course you will need to have taken both

- STAB22H3 or an equivalent introductory statistics course AND
- GGRB30H3 or an equivalent introductory GIS course.

If you do not have this background you may struggle with some statistical concepts or with using GIS software for the assignments.

## Readings

There will be one or two readings per week, consisting mostly of book chapters, and other online resources. Selections from three books form the majority of the reading assignments. They are:

1. *Geographic Information Analysis, 2nd Edition.* David OSullivan and David J. Unwin (**OU** in course schedule). This is available electronically through the library.
2. *An Introduction to Statistical Problem Solving in Geography, 3rd Edition.* J. Chapman McGrew, Jr., Arthur J. Lembo, Jr. and Charles B. Monroe. (**MLM** in course schedule). PDF's will be provided on Quercus.
3. *Introduction to Geographic Information Systems, 7th Edition.* Kang-Tsung Chang. PDF provided on Quercus.

More reading assignments may be added during the semester.

## Grading/Assessment

In general, students will be assessed on their ability to produce results that are correct, document their procedures, *and clearly explain and interpret their analysis*; these things are critical to using the techniques of spatial analysis in the real world.

**Lab assignments** are designed to apply the material discussed each week in the lectures and are important for testing your understanding of the methods. The kinds of problems given in the lab assignments will be seen again on the exams, so while these are relatively small part of the total grade, it's important to get them right.

**Exams** (midterm and final) will consist of a combination of multiple choice, short answer, and problem solving questions. Exams are open note and any materials *on paper* may be used in the exam; electronic resources however are prohibited.

The **research project** is an independent research project on a topic of the students choosing, with the instructors approval. The student will be responsible for acquiring a spatial dataset and using some of the tools demonstrated in the class to analyze a spatial process/phenomenon. More details will be provided in class.

All assignments must be submitted either on paper, at the start of class, or on Quercus by the same time. Please do not submit assignments by email. Assignments turned in late without a valid excuse (e.g. doctor's note) will be docked 10% per day. Assignments more than three days late will not be graded.

Weights for exams and assignments break down as follows:

| | **Assigned** | **Due** | **Percent of final Grade** |
|---|---|---|---|
| Lab 1 | Sept 11 | Sept 25, 10am | 6.25% |
| Lab 2 | Sept 25 | Oct 9, 10am | 6.25% |
| Midterm exam | — | Oct 16, in class | 20% |
| Lab 3 | Oct 23 | Nov 6, 10am | 6.25% |
| Lab 4 | Nov 6 | Nov 20, 10am | 6.25% |
| Project Proposal | Oct 2 | Oct 30, 10am | — |
| Research Project | Oct 2 | Nov 27, in class | 20% paper, 5% presentation |
| Final Exam | — | TBD | 30% |
| Extra credit | — | — | +4% possible (see below) |

## Extra Credit

The extra credit for this course is designed to encourage students to explore the numerous software options available for spatial analysis. While all of the calculations requiring software in this course

could be done in a single software package (e.g. QGIS or ArcMap), one percentage point extra credit on the final grade will be granted to students who can demonstrate the substantive use of a second (third, fourth, fifth) software package in the lab assignments and/or research paper. The maximum of four extra credit points will be granted to a student demonstrating a substantive (and valid!) use of five or more different software packages. These can include Python, R, QGIS, PostGIS, ArcMap, GRASS or something else with the instructor's approval. Spreadsheet software does not count.

Don't expect this to be easy; learning new software can take a lot of time and it's recommended that you only try for the extra credit if you have really mastered the other material in the course.

Opportunities for extra credit will be noted on the assignments.

### Office hours and email

Office hours will be held on Tuesdays from 2:00 - 3:00pm in MW379. At other times, email is the best way to contact the instructor or TA; please allow one day for a response.

## Course Schedule

| Lecture Time | Date | Readings | Lab time |
|---|---|---|---|
| Intro & Spatial Data | Sept 4 | OU Ch.2 | — |
| Central Tendency | Sept 11 | MLM Ch.4 | Lab 1 |
| Dispersion | Sept 18 | — | Lab 1 |
| Nearest Neighbors | Sept 25 | MLM Ch.14 | Lab 2 |
| Quadrat Analysis | Oct 2 | OU Ch 5 | Lab 2 |
| *reading week - no class* | *Oct 9* | — | — |
| **Midterm** | Oct 16 | — | Project Proposals |
| Area Pattern Analysis | Oct 23 | MLM15.1-15.2 | Lab 3 |
| *idem* | Oct 30 | OU 7.4,7.5 | Lab 3 |
| Local Statistics | Nov 6 | — | Lab 4 |
| Interpolation | Nov 13 | Chang Ch.15 | Lab 4 |
| Working on final projects | Nov 20 | — | Projects |
| **Presentations** | Nov 27 | — | Presentations |

# Additional Information and Resources

## Missed Test Policy

Students who miss the midterm test for an acceptable reason will be offered a make-up test. To document illness, use the university's illness verification form:

http://www.utsc.utoronto.ca/registrar/verification-illness-or-injury

## Privacy

For reasons of privacy as well as protection of copyright, unauthorized video or audio recording in classrooms is prohibited. This is outlined in the provosts guidelines on appropriate Use of information and communication technology. Note, however, that these guidelines include the provision that students may obtain consent to record your lectures and, in the case of private use by students with disabilities, the instructors consent must not be unreasonably withheld.

## Academic Integrity

The university treats cases of cheating and plagiarism very seriously. The University of Torontos Code of Behaviour on Academic Matters (www.governingcouncil.utoronto.ca/policies/behaveac.htm) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences in papers and assignments include using someone elses ideas or words without appropriate acknowledgement, submitting your own work in more than one course without the permission of the instructor, making up sources or facts, obtaining or providing unauthorized assistance on any assignment. On tests and exams cheating includes using or possessing unauthorized aids, looking at someone elses answers during an exam or test, misrepresenting your identity, or falsifying or altering any documentation required by the University, including (but not limited to) doctors notes. Please avoid academic dishonesty, have confidence in your own ability to learn and grow academically by doing your own thinking and writing!

## Accessibility

Students with diverse learning styles and needs are welcome in this course! In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the AccessAbility Services Office as soon as possible. I will work with you and AccessAbility Services to ensure you can achieve your learning goals in this course. Enquiries are confidential. The UTSC AccessAbility Services staff (located in SW302) are available by

appointment to assess specific needs, provide referrals and arrange appropriate accommodations (416) 287-7560 or ability@utsc.utoronto.ca.