

# GGRA30: Geographic Information Systems (GIS) and Empirical Reasoning

## Course Overview

Students learn fundamental concepts concerning the structure and effective uses of geographical data and practical skills that will help them to find and apply geographical data appropriately in their studies. Hands-on exercises using a variety of software allow students to gain experience in finding, processing, documenting, and visualizing geographic data. Lecture topics introduce opportunities and pitfalls in the use of geographical data as empirical evidence across a range of social science topics.

**Instructor:** JieLan Xu

**Office:** HL507

**Email:** [jielan.xu@mail.utoronto.ca](mailto:jielan.xu@mail.utoronto.ca) (use of **Quercus Inbox** recommended, see the Course Communications section)

**Office hours:** Wednesdays 10:00 – 11:00 am (There will be extended office hours on Jan 29th, Feb 12th, Mar 5th, Mar 26th and April 3rd afternoons, before each assignment is due, time and location will be announced)

**Lectures:** Wednesdays, 11:00–13:00, HL 001

**Tutorials:**

PRA0001	Wednesdays	13:00-14:00	BV 471
PRA0002	Wednesdays	14:00-15:00	BV 471
PRA0003	Wednesdays	15:00-16:00	BV 471
PRA0004	Wednesdays	16:00-17:00	BV 471
PRA0005	Wednesdays	13:00-14:00	BV 469
PRA0006	Wednesdays	14:00-15:00	BV 469
PRA0007	Wednesdays	15:00-16:00	BV 469
PRA0008	Wednesdays	16:00-17:00	BV 469

**Teaching Assistants:**

**Nathan Wessel:** [nate.wessel@mail.utoronto.ca](mailto:nate.wessel@mail.utoronto.ca) (TA for students with Last Name A~I)

**Lauren Jewett:** [lauren.jewett@mail.utoronto.ca](mailto:lauren.jewett@mail.utoronto.ca) (TA for students with Last Name J~Q)

**Thomas Donald Saleh:** [thomas.saleh@mail.utoronto.ca](mailto:thomas.saleh@mail.utoronto.ca) (TA for students with Last Name R~Z)

## Learning Objectives

This course provides students with the opportunity to demonstrate understanding and application of introductory quantitative skills and methods broadly and GIS methods in particular. By the end of the course, you should:

1. Be able to explain the logic of empirical methods and the value of such methods as *one* way to understand aspects of the social and physical world.
2. Be able to demonstrate and explain basic quantitative methods using a spreadsheet.
3. Be able to demonstrate and explain the strengths and weaknesses of a relational database in comparison to Excel and demonstrate basic data filtering and summarizing using GIS tools.
4. Be able to describe geographic data and basic capabilities of geographic information systems.
5. Be able to demonstrate introductory mapping skills using Quantum GIS (QGIS).

6. Be able to explain the logic of basic geographic analyses conducted using GIS as discussed in case studies.

## ASSESSMENT

Final grades are composed of the following:

- Tutorial exercises ..... 6% (plus 1% possible bonus)
- Lecture exercises ..... 6%
- Assignments ..... 38%
- Midterm ..... 15%
- Final Exam ..... 35%

### Assignments

- |  |       |                         |
|--|-------|-------------------------|
| Assignment 1. Explore and summarize data with Excel                        | (8%)  | Due on <b>Jan 29th</b>  |
| Assignment 2. Mapping with QGIS  | (7%)  | Due on <b>Feb 12th</b>  |
| Assignment 3. Introduction to PostgreSQL Queries<br>& Joining Data in QGIS | (7%)  | Due on <b>Mar 5th</b>   |
| Assignment 4. Quantitative and Qualitative Data in QGIS<br>& Web Maps      | (10%) | Due on <b>Mar 26th</b>  |
| Assignment 5. Understanding spatial relations with QGIS                    | (6%)  | Due on <b>April 3rd</b> |

The assignments reinforce topics discussed during lectures and are your opportunity to learn and practice methods and the software introduced.

- Assignments are to be neatly word processed and, unless otherwise specified in the submission guidelines of an assignment, all parts of your assignment are to be **submitted electronically on Quercus**.
- Emailed assignments will not be marked.

Timely feedback on student work is important. For that to happen, all students must submit assignments when due. My policy for late assignments is as follows:

- Late assignments will be assessed a **1% of the total course grade for each weekday** up to one full calendar week. Late assignments will not be accepted after a full calendar week.
- Exceptions can only be granted when you provide the instructor or TA with proper documentation of a valid reason such as illness (e.g., a doctor's note) and make arrangements to submit the assignment as soon as possible. Requests for extensions received on or after due dates are less likely to be granted — by then the work should already be done.

**Start early!** This will give you the chance to finish on time even if initially you have difficulty understanding methods or requirements, or if you are ill just before your assignment is due. Ensure that you **back-up your computer files** for in-progress work to ensure that you do not need to redo or restart your work. Losing your data and needing to start over will not be sufficient reason for a deadline extension.

## Tutorial Exercises

Tutorials offer practice exercises that run in parallel to lecture and assignment topics and methods. These help you master methods and topics that you will demonstrate more fully on the assignments. Tutorials are conducted as workshops in which methods are demonstrated and then time will be available for you to practice those methods, ask questions, and complete tutorial exercises.

- Instructions for each tutorial will include information on what you should submit for credit and how to do that. Tutorial exercises are only available during the tutorial periods (Wednesday afternoon and evening), make sure to submit on time.
- There are a total of 9 tutorials. Marks will be given to your **best six (6)** submissions, each is worth **1%** (total 6%).
- You will receive a **1% bonus** if you have **8 or more** passing grades received for tutorial exercises. One tutorial is a freebie so that you can miss one week if, for example, you are ill without necessarily losing even bonus marks.

## Lecture Exercises

Many lectures will include paper exercises, based on lecture topics. These exercises provide you with an opportunity to think through methods or topics discussed in lecture and covered in course readings. These are also intended to ensure that you understand major ideas covered in the class.

- The lecture exercise questions will be graded as satisfactory/unsatisfactory with no part marks. A reasonable attempt to complete these exercises will be deemed satisfactory.
- If you satisfactorily complete six (6) lecture exercises, achieving more than 50% on each exercise, you will receive the full **6%** toward your final term grade. Marks will be given to your **best six (6)** submissions, each is worth **1%** (total 6%).

## Participation in Quercus Discussions

You are encouraged to ask all questions related to course materials, assignments and tutorials on Quercus Discussions board. You are also encouraged to discuss on questions and help answering them. TAs will check the Discussions board regularly and make sure all questions are resolved. To encourage active participation, the top 10% of active contributors (raising non-repetitive questions and sharing valid information) will receive **1% bonus mark**.

## Exams

The **midterm exam** will be held during the regular lecture period on **Feb 27th**. The test will be a mix of multiple choice and short answer questions. You will have almost the entire lecture period (1 hour, 40 minutes) to complete the exam. **No make-up exam will be offered** if you miss the midterm. If you provide documentation for a valid reason such as an illness (e.g., a doctor's note), the weighting of the midterm will transfer to the final exam. Otherwise, missing the midterm will result in a mark of 0. Contact the instructor as soon as you know you will be unable to attend the midterm.

The **final exam** will be scheduled during the normal exam period and will be cumulative, **covering topics from the entire term**. It will be a mix of multiple choice and short answer questions. **Duration: two (2) hours**.

## DETAILED SCHEDULE

#	Date	Lecture	Tutorial	Assignment	Reading
1	Jan 9	Intro & Course Overview.	—no tutorial—		
2	Jan 16	Reasoning with Empirical Evidence, Data presentation and Excel.	Excel: filtering, formulae and scatter plot.	#1 assigned	Nevo (2014, pp.36–51) or Nevo (2017 chapter 2); GCF (2018c)
3	Jan 23	Descriptive Statistics, Data Aggregation and Simple Models.	Excel: descriptive statistics, summarizing data with pivot tables.		Lloyd (2010, Chapter 3). GCF (2018d);
4	Jan 30	Geographic Information, Landscape Mapping and QGIS Overview.	QGIS: interface overview and print composer.	#1 due #2 assigned	McHarg (1969, pp. 31-41); Athan et al. (2018e); Athan et al. (2018d, up to & include Sample Session)
5	Feb 6	Introduction to QGIS Mapping.	QGIS: vector data and basic styling.		Hempel (2008, pp. 159–166, 171–175); GCF (2018a,b); Athan et al. (2018c, for point layers)
6	Feb 13	Introduction to Relational Database and SQL.	QGIS: joins and querying a database.	#2 due #3 assigned	Menke et al. (2015); Athan et al. (2018a); PostgreSQL Tutorial (2018) including GROUP and WHERE
	Feb 20		Reading week		
7	Feb 27	<b>Midterm</b>	—no tutorial—		
8	Mar 6	GIS for qualitative and quantitative research; Vector data and attributes.	QGIS: shapefiles, quantitative styling and map legend.	#3 due #4 assigned	Steinberg and Steinberg (2015, pp. 309–326); Brauen (2018a); Brauen (2018b)
9	Mar 13	Web maps and open street map.	QGIS: editing points and attributes; styling by descriptive categories.		Athan et al. (2018b,f,g); LearnOSM (2018).
10	Mar 20	Spatial analysis I. Understanding spatial relations.	QGIS: create buffers; select by location.	#5 assigned	Tobler (1970); Block et al. (2004).
11	Mar 27	Spatial analysis II. Point pattern, Modifiable Areal Unit Problem.	QGIS: spatial join	#4 due	Jelinski & Wu (1996); Lloyd (2010, Chapter 7).
12	April 3	Course summary	—no tutorial—	#5 due	

\* Assignments are due before the day of class except assignment 5, after 11:59 pm will be considered as a delay. Instructor reserves the right to adjust the weekly schedule of topics covered in lectures and tutorials as needed.

## READINGS

There is no text book for this course. All readings are referred to from the detailed schedule and will be available through the library or as links available through Quercus.

- Athan, T., P. Ersts, W. Macho, C. A. Engel, L. Junek, T. Sutton, and A. Emde (2018a). *DBManager Plugin*. Available at [https://docs.qgis.org/2.18/en/docs/user\\_manual/plugins/plugins\\_db\\_manager.html#dbmanager-plugin](https://docs.qgis.org/2.18/en/docs/user_manual/plugins/plugins_db_manager.html#dbmanager-plugin) , accessed Dec. 2018.
- (2018b). *Digitizing an existing layer*. Available at [https://docs.qgis.org/2.18/en/docs/user\\_manual/working\\_with\\_vector/editing\\_geometry\\_attributes.html#digitizing-an-existing-layer](https://docs.qgis.org/2.18/en/docs/user_manual/working_with_vector/editing_geometry_attributes.html#digitizing-an-existing-layer) , accessed Dec. 2018.
- (2018c). *Labels Properties*. Available at [https://docs.qgis.org/2.18/en/docs/user\\_manual/working\\_with\\_vector/vector\\_properties.html?highlight=labels#labels-properties](https://docs.qgis.org/2.18/en/docs/user_manual/working_with_vector/vector_properties.html?highlight=labels#labels-properties) , accessed Dec. 2018.
- (2018d). *Overview of the Print Composer*. Available at [https://docs.qgis.org/2.18/en/docs/user\\_manual/print\\_composer/overview\\_composer.htm](https://docs.qgis.org/2.18/en/docs/user_manual/print_composer/overview_composer.htm) , accessed Dec. 2018.
- (2018e). *QGIS GUI*. Available at [https://docs.qgis.org/2.18/en/docs/user\\_manual/introduction/qgis\\_gui.html#qgis-gui](https://docs.qgis.org/2.18/en/docs/user_manual/introduction/qgis_gui.html#qgis-gui) , accessed Dec. 2018.
- (2018f). *Style Properties (Tab in Layer Properties Dialogue)*. Available at [https://docs.qgis.org/2.18/en/docs/user\\_manual/working\\_with\\_vector/vector\\_properties.html#style-properties](https://docs.qgis.org/2.18/en/docs/user_manual/working_with_vector/vector_properties.html#style-properties) , accessed Dec. 2018.
- (2018g). *Working with the Attribute Table*. Available at [https://docs.qgis.org/2.18/en/docs/user\\_manual/working\\_with\\_vector/attribute\\_table.html](https://docs.qgis.org/2.18/en/docs/user_manual/working_with_vector/attribute_table.html) , accessed Dec. 2018.
- Block, J. P., R. A. Scribner, and K. B. DeSalvo (2004). “Fast Food, Race/Ethnicity, and Income: A Geographic Analysis”. *American Journal of Preventive Medicine* 27:3, pp. 211–217.
- Brauen, G. (2018a). “Organizing Your QGIS Projects”.
- (2018b). “Understanding Shapefiles”.
- Burrough, P., R. McDonnell, and C. Lloyd (2015). *Principles of Geographical Information Systems*. Oxford University Press. ISBN: 9780198742845.
- GCF (2018a). *Access 2016: Introduction to Databases*. Goodwill Community Foundation. Available at <https://www.gcflearnfree.org/access2016/introduction-to-databases/1/> , accessed Dec. 2018.
- (2018b). *Access 2016: Introduction to Objects*. Goodwill Community Foundation. Available at <https://www.gcflearnfree.org/access2016/introduction-to-objects/1/> , accessed Dec. 2018.
- (2018c). *Excel 2016: Getting Started with Excel*. Goodwill Community Foundation. Available at <https://www.gcflearnfree.org/excel2016/getting-started-with-excel/1/> , accessed Dec. 2018.
- (2018d). *Excel 2016: Pivot Tables*. Goodwill Community Foundation. Available at <https://www.gcflearnfree.org/excel2016/intro-to-pivottables/1/> , accessed Dec. 2018.

- Hempel, S. (2008). *The Strange Case of the Broad Street Pump: John Snow and the Mystery of Cholera*. Berkeley; Los Angeles: University of California Press.
- Jelinski, D. E. and J. Wu (1996). “The modifiable areal unit problem and implications for landscape ecology”. *Landscape ecology* 11:3, pp. 129–140.
- Lloyd, Christopher D.. (2010). *Spatial Data Analysis - An Introduction for GIS users*. Oxford University Press. Retrieved from <https://app.knovel.com/hotlink/toc/id:kpSDAAIGI8/spatial-data-analysis/spatial-data-analysis> , accessed Dec. 2018.
- LearnOSM (2018). Getting started on OpenStreetMap.org <https://learnosm.org/en/beginner/start-osm/> , accessed Dec. 2018.
- McHarg, I. L. (1969). *Design with nature*. Garden City, NY: American Museum of Natural History New York.
- Menke, K., R. Smith Jr., L. Pirelli, and J. V. Hoesen (2015). *Mastering QGIS: Working with Tables (excerpt)*. Packt Publishing Ltd. [Course Reserve G70.212 .M46 2016]
- Nevo, D. (2017). *Making Sense of Data through Statistics: An Introduction*. 2nd ed. Legerity Digital Press. Available at <http://www.ldpress.com/publications/making-sense-of-data-throughstatistics-an-introduction-second-edition/> , accessed Dec. 2018. [1st edition Nevo (2014) on Course Reserve QA276.12 .N48 2014]
- O’Sullivan, D. and D. Unwin (2003). *Geographic Information Analysis*. Hoboken, N.J.: John Wiley & Sons.
- PostgreSQL Tutorial (2018). *PostgreSQL SELECT*. Available at <http://www.postgresqltutorial.com/postgresql-select/> , accessed Dec. 2018.
- Steinberg, S. L. and S. J. Steinberg (2015). *GIS Research Methods: Incorporating Spatial Perspectives*. Redlands, California: Esri Press.
- Tobler, W. R. (1970). “A computer movie simulating urban growth in the Detroit region”. *Economic geography* 46:sup1, pp. 234–240.

### QGIS Online Manual

We are running Quantum GIS (QGIS) version 2.18 in the computer labs on campus and I will be designing labs and assignments with that version of the software in mind. The documentation for QGIS version 2.18 is available at: <https://docs.qgis.org/2.18/en/docs/> . I have provided directURLs (links) to Specific sections of the manual listed as readings in the schedule.

### Making Sense of Data: Dorit Nevo

We only need a limited amount of reference material for Excel and quantitative methods using Excel. It is possible to buy individual digital chapters from this book. The week 2 reading is from Chapter 2, “Data Presentation,” and is available at the following link: <http://www.ldpress.com/publications/making-sense-of-data-through-statistics-an-introduction-second-edition/>

## COURSE COMMUNICATIONS

The syllabus, lecture summaries, assignments and tutorial materials are available through the course **Quercus portal**. An up-to-date copy of this syllabus will always be available there.

**Quercus Discussions** board will be available. You are encouraged to post appropriate questions that relate to course subjects on the boards. Questions about lecture and tutorial discussions and about the use of software and lab systems are all excellent topics for the discussion boards. Discussion boards will be checked regularly during the term.

For questions that are not appropriate for the discussion board, contact me through **Quercus Inbox**. You should receive a response within about 24 hours (possibly slightly delayed on weekends).

- Allow reasonable time for a response before due dates. Last minute emails sent just prior to an assignment due date will be dealt with on the same schedule outlined above.
- **Look at and subscribe to the discussion board and inbox.**

– If you use email to ask a question that is well suited to the discussion board, I will probably ask you to post the question there so that others can learn from it as well.

– If a question has been answered on the discussion board, I will refer you there.

Please remember that all **assignment work in this course must be completed individually**. Therefore, discussion board posts asking how other students have answered specific assignment problems are **not appropriate**. Any discussions of this sort will be removed from the boards.

## POLICIES AND REGULATIONS

**Academic Integrity** is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously.

The University of Toronto's Code of Behaviour on Academic Matters

([www.governingcouncil.utoronto.ca/policies/behaveac.htm](http://www.governingcouncil.utoronto.ca/policies/behaveac.htm)) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences.

While you are expected to talk with other students to understand how to use the systems and software required to complete assignments for this course, each assignment submitted by you must be your own work (i.e., your map-making and your writing), clearly demonstrating your understanding, interpretation and analysis of the assignment.

In your scholarly work, develop the practice of acknowledging the ideas of others when you use them. If you summarize the work of others, cite your sources. When you use their words, use quotations and citations. To do otherwise is to risk being accused of plagiarism. When creating maps, using data that was developed by someone else is almost impossible to avoid. But for others to evaluate a map you have made, it is important that you list the data sources you have used. If you are uncertain about whether or not something constitutes an academic offence, please ask your instructor.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, please seek out additional information on academic integrity from your instructor or from other institutional resources, for example:

- <http://teaching.utoronto.ca/teaching-support/u-of-t-resources/students/>
- <http://teaching.utoronto.ca/teaching-support/strategies/inclusive-teaching/supportoffices/>

## RESOURCES

**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 contact the AccessAbility Services Office as soon as possible to make arrangements for accommodations. I and AccessAbility Services will work with you to ensure you can achieve your learning goals in this course. Enquiries are confidential. AccessAbility Services (S302, 416-287-7560, [ability@utsc.utoronto.ca](mailto:ability@utsc.utoronto.ca)) is available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations.

**Accommodations for Religious Observances** It is the policy of the University of Toronto to arrange reasonable accommodation of the needs of students who observe religious holy days other than those already accommodated by ordinary scheduling and statutory holidays. Students have a responsibility to alert members of the teaching staff in a timely fashion of upcoming religious observances and anticipated absences. I will make every reasonable effort to avoid scheduling tests, examinations or other compulsory activities at these times. If the scheduling of compulsory activities conflict with your religious observances, I will try to arrange alternative times as soon as possible after the original date of the missed activities for you. For more information, please see <http://tinyurl.com/hykkp2m>.

**Equity, Diversity, and Human Rights** At the University of Toronto, we strive to be an equitable and inclusive community, rich with diversity, protecting the human rights of all persons, and based upon understanding and mutual respect for the dignity and worth of every person. We seek to ensure to the greatest extent possible that all students and employees enjoy the opportunity to participate as they see fit in the full range of activities that the University offers, and to achieve their full potential as members of the University community. For more information, please see <http://www.governingcouncil.utoronto.ca/Assets/Governing+Council+Digital+Assets/Policies/PDF/ppdec142006.pdf>.

**English Language Development Centre** Academic English is nobody's mother-tongue. Every student is expected to achieve a high level of Academic English to cope with the demands of their courses. The English Language Development Centre supports all students in developing better Academic English and critical thinking skills needed in academic and professional communication. Make use of the personalized support in academic writing skills development and Communication Café sessions to enhance your ability to do better

in the various components of this course. Details and sign-up information available at <http://www.utoronto.ca/eld/>

- **Academic English Health Check:** This is a quick 20-minute diagnostic in the computer lab, with results and recommendations for support emailed to students confidentially on the same day: <https://utoronto.ca/eld/academic-english-health-check-aehc>
- **Reading and Writing Excellence (RWE)** program: students are assigned a writing instructor for personalized support on reading and writing: <https://play.library.utoronto.ca/Mi1RHG8lyFNr>
- **Vocabulary Expansion Accelerator (VEA):** A new online support tool, that can support students with readings online has been integrated into Quercus. VEA enables students to look up meanings of unfamiliar words in their readings by just pointing their cursor at those words. Students can also hear the pronunciation of the new words.