FACULTY OF SCIENCE

SCHOOL OF BEES

GEOS3821

GEOGRAPHIC DATA ANALYSIS

AND

GEOS9017

Advanced GIS

T1, 2022

Contents:

3. Course details

Course Description[2]
(Handbook Entry)

GEOS3821:

The field of Geographic Information Systems has expanded considerably over the past decade and the world has become very much richer in digital geographic information. Vast amounts of geographic data are routinely collected, with approximately 80% of all data collected having geographic attributes. This course explores a toolbox of conceptual approaches and methods to model and analyse a range of highly complex, often non-deterministic, geographic problems. It explores a true enabling technology for the natural sciences in addition to a rich source of computational and representational challenges for the computer sciences. This course emphasises a range of GIS and spatial data analysis approaches via a disparate selection of real-world applications.

GEOS9017:

Geographic information systems have improved considerably over the past decade in response to a world that has become very much richer in digital geographic information. The requirement to build complex applications and simulations has become more urgent with the need to plan for a changing climate, to feed an increasing population and to provide pinpoint marketing analysis for business. This course explores a toolbox of conceptual approaches and methods to model and analyse a range of highly complex, often non-deterministic problems. It provides a true enabling technology for the natural sciences and a rich source of computational and representational challenges for the computer sciences. Topics covered include spatial dynamic spatio-temporal modelling; geostatistics; error analysis and data accuracy; network analysis; and machine learning and artificial intelligence methods in GIS.

Graduate Attributes Developed in this Course

Science Graduate Attributes	***FOCUS*** *0 = NO FOCUS* *1 = MINIMAL* *2 = MINOR* *3 = MAJOR*	**Activities / Assessment**
1. Research, inquiry and analytical thinking abilities	3	All will be achieved through the main project
2. Capability and motivation for intellectual development	3	
3. Ethical, social and professional understanding	1	
4. Communication	2	
5. Teamwork, collaborative and management skills	3	
6. Information literacy	3	

Major Topics (Syllabus Outline)	See the lecture sequence
Relationship to Other Courses within the Program	This course explores the application of advanced conceptual approaches and techniques to model and analyse a range of highly complex, often non-deterministic spatial problems. Such approaches are essential for the modern study of many different components of the environmental and geosciences. It provides examples of what can be done using such spatial data, as well as a grounding in how to effectively use such data.

4. Rationale and strategies underpinning the course

Rationale for learning and teaching in this course – How this course is taught

Spatial analysis is technical in nature, in that one needs to use software to achieve one's aims. However, this course is not about teaching software. It is about the principles of GI Science and spatial analysis (software changes rapidly while principles do not).

There are three elements that you should use for learning in the course. The textbooks provide an overview of the subject, and are a key reference source. In the case of the software, there are detailed online manuals that

Access to the lecturer

I am available immediately after lectures, and the labs are devoted to the major project. If you encounter a problem outside of the scheduled contact periods, then what you should do depends on the nature of the problem.

If your problem is conceptual then please contact me by email or telephone to arrange a time to discuss it. I often have other meetings or am away from the university, so this will save you long periods of waiting around or trying to find me. Please provide a short summary of the area or topic you need help with to allow me to prepare for the meeting. Writing it in an email can also help you find the solution yourself.

Many of the challenges in this course are technical in nature. In turn, many of these technical problems are common to the entire course. So, **if your problem is technical and related to the software**, then please follow these five steps.

1. **Stop and think**. You will often be able to solve the problem with a little of your own brain power. I have found that walking away from the computer and doing something else for half an hour is a very effective approach. (Let your subconscious mind do some work).

2. **Read the manual**. The manuals have detailed explanations of much of what we need to do. They should be your next port of call. It will take a bit of time initially while you get used to the mindset of the software developers

5. Course schedule

Week	Lectures & topics	Labs	Assignment and Submission dates
1	1. Course introduction and overview 2. Spatial analysis concepts: Local & global; autocorrelation, dependence, structure; MAUP; geographic neighbourhoods	Explore data sets and select which you will use for the course. Try some initial analyses. *Tuesday only*	
2	Univariate spatial analysis of continuous field data 6. Local: Gi* hotspots, Moran's I autocorrelation 7. Global: Semivariograms, correlograms and related indices	Univariate analysis methods *Tues & Wed*	
3	Spatial analysis of discrete object/entity data; Point pattern analysis. 8. Kernel density analysis; Ripley's K Multivariate spatial analysis of continuous field data 9. Covariograms, bivariate Moran's I and related indices	Continue univariate analyses, start on multivariate as appropriate *Tues & Wed*	Quiz 1 during Wednesday lab.
4	10. Geographically Weighted Regression (GWR) Spatio-temporal 11. Space-time clustering	Start space-time analyses as appropriate *Tues & Wed*	
5	12. Applications 13. Revision	*Tues & Wed*	Quiz 2 during Wednesday lab
6	No lectures	*Tuesday only*	Project proposal due
7	No lectures	*Tuesday only*	
8	No lectures	*Tuesday only*	
9	No lectures	*Tuesday only*	Major report due
10	No lectures	No labs	

6. Additional r

7. Required Equipment, Training and Enabling Skills

Required equipment	Provided in the computer labs.
Enabling skills - training which may be required to complete this course	Working knowledge of ArcGIS Desktop or ArcGIS Pro.

8.

10. Administrative Matters

Expectations of Students	You are expected to attend all lectures and laboratories. All assessable items are compulsory.
Assignment Submissions	Assignments are to be submitted using the Moodle assignment submission system. Extensions will not be granted unless supported by documentation (e.g.

11. UNSW Academic Honesty and Plagiarism

available to UNSW Staff and students. See http://www.it.unsw.edu.au. You can also consider the Mendeley or Zotero packages (http://www.mendeley.com; https://www.zotero.org). Learning how to use such software will make writing assignments considerably easier, and will solve most of your problems with building referencing lists (providing your database is correct). Most journal web sites also now support the direct export of citations into reference management software.