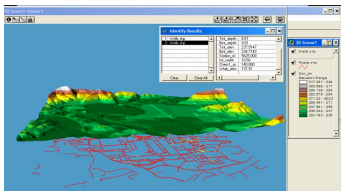
TRENT UNIVERSITY

Environmental and Resource Studies Program / Department of Geography

ERSC/GEOG 301H



Fundamentals of Vector GIS

2008- 2009

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1. Introduction

Vector data models in Geographical Information Systems (GIS) are an essential component of modern geographical work. There are dominant areas of application of GIS that demand an object-oriented vector representation of reality. The digital handling and analysis of mapped objects and spatial patterns and the manipulation of large spatial databases in GIS require of vector data structures and analytical capabilities. Industry standard GIS programs, their analytical capabilities and their applications in many areas of human activity in both, the rural and urban environments, make it imperative to have an understanding of Vector GIS. GIS is a field of research, development, and applications encompassing computer technology oriented to the acquisition, storage, processing, analysis and presentation of spatial information. Knowledge of the fundamentals of vector GIS is essential for work applications in government agencies, the private sector and research organizations.

2. Course Objectives.

The objectives of this course are:
a). To introduce the theoretical and practical fundamentals of GIS focusing on the Vector data model, its analytical functions and applications, and to offer practical exposure to problem-solving in such environment.
b). To provide an opportunity for practical application of the theoretical constructs, concepts and procedures of vector GIS using industry-standard GIS software, within a problem-solving framework.
c). To initiate students in the development of skills in industry-standard GIS software, applied to geographical analysis and problem-solving.

3. Course requirements, assignments, grading and deadlines.

The course consists of one two-hour lectures weekly and one 3-hour lab fortnightly (see university time table for details). **Registration into a selected lab time slot should be finalized after the first lecture session. A lab manual is essential for the practical part of this course.** The manual can be acquired on a cost-recovery basis from the instructor and demonstrator-technicians.

Workload Warning: The successful completion of some of the lab assignments may require work in excess of the hours scheduled for the lab in the calendar, time-table and syllabus, depending on

individual ability, background and work ethic.

PRE-LAB QUIZ

Since practical work is fundamental in GIS learning, preparation for laboratory exercises is deemed essential to efficient learning. Therefore, there will be a short pre-lab quiz before every lab session to earn the right to lab work. This quiz will be worth 10% of the lab mark for a given lab. The lab quiz will be implemented through MyLearningSystem (MLS).

The **grading of course work** will be according to the following scheme:

Lab assignment reports 55%
Mid-term quiz.....…….…. 15%
Final Examination.....30%

Lab assignments breakdown:
Lab 1..... 6%
Lab 2.....9%
Lab 3.....9%
Lab 4.....9%
Lab 5.....7%
Lab 6……15%

Lab due dates

Unless otherwise indicated, the lab assignments are automatically due at the beginning of the next lab session, without exception.

Lab Sessions.

The lab manual or handout must be read in advance of every lab session (pre-lab quiz). The lab sessions will be fortnightly and will take place in the Geomatics Lab (Science Complex Room 207)

Lab groups A: Wednesday 13:00-15:50
B: Thursday 9:00-11:50

Penalty for lateness in an assignment

A penalty of 10% of the mark of a given assignment for lateness, per day, will be imposed without exception.

MyLearningSystem and Internet resources

This course will use **MyLearningSystem** for delivery of lecture materials, readings, notices and other course-related items. As possible, the features of **MyLearningSystem** will be utilized for course delivery. Other internet resources may be used for particular topics.

Academic Dishonesty: Academic dishonesty, which includes plagiarism and cheating, is an extremely serious academic offense and carries penalties varying from failure in an assignment to suspension from the University. Definitions, penalties, and procedures for dealing with plagiarism and cheating are set out in Trent University's Academic Dishonesty Policy, which is printed in the University Calendar and on the university web site at: http://www.trentu.ca/deansoffice/policies_dishonesty.php. Although plagiarism most commonly refers to academic writing (reports, essays and theses) in the arts and social sciences, *lab courses are not exempt. Cooperation among students is encouraged in the laboratory sessions to strengthen their learning experience. However, this should not be misconstrued to include copying or sharing answers to the questions in the assignments.*

Grammar and Style: It is expected that written assignments in Geography courses will conform to high standards of grammar and style. Although the penalty may vary from course to course, and from one kind of written assignment to another, bad grammar and style will be penalized in all grading of written work submitted in Geography courses.

Access to Instruction : It is Trent University's intent to create an inclusive learning environment. If a student has a disability and/or health consideration and feels that he/she may need accommodations to succeed in this course, the student should contact the Disability Services Office (BL Suite 109, 748-1281; disabilityservices@trentu.ca as soon as possible. Complete text can be found under Access to Instruction in the Academic Calendar.

ERSC/GEOG 301H
FUNDAMENTALS OF VECTOR GIS
(Outline and time table)
2007-2008

Week	Date	Lecture	Lab
1	Jan 7	**- Introduction and Course Syllabus** 1. THE VECTOR DATA MODEL Introduction to the Vector data model. Graphic primitives, arcs, nodes, open and close polygons, objects and shapes. Topology and its elements. Coding and storing topology.	Lab groups confirmed. Acquisition of lab manual
1	Jan 7&8		Lab 1: Examining Map data, map composition and presentation (ArcMap), and adding features and layers (ArcCatalog)
2	Jan 14	2. THE VECTOR DATA MODEL (continued) Attributes of objects and attribute tables. The ArcGIS approach to the vector data model: coverages, shapefiles and geodatabases. Examining and presenting map data in vector format: Working with maps. Exploring a map, spatial query. Adding features from a database. Map symbology, adding labels, map layouts.	
3	Jan 21	3. GEODATABASES IN VECTOR AND OBJECT MODELLING**.** Object modelling and geodatabases. The object-relational approach to a geodatabase. Guidelines to geodatabase design. Geodatabase structure and storage of geographic data. Data sets, feature classes and coverages. Input and import of map and attribute data.	
3	Jan 21 & 22		Lab 2: Fundamentals of geodatabase design, development and maintenance using ArcCatalog
4	Jan 28	4. GEODATABASES IN VECTOR (continued): Managing geodatabases. Input and import of map and attribute data. Adding layers to a map. Coordinate data, geo-referencing and geo-coding.	
5	Feb 4	5. VECTOR GIS ANALYSIS: Simple Vector Operations**.** Spatial query,classification and patterns. Selecting and summarizing features by areas (“what is inside”). Density Mapping: by areas and by points. Defining areas around features: “buffering”.	

5	Feb 4 & 5		Lab 3: Site suitability analysis in vector. Finding a suitable site for facility development (ArcMap, ArcCatalog, Geoprocessing)
6	Feb 11	6. VECTOR GIS ANALYSIS (continued): Overlay of areas and features**:** Topological map overlay. Overlay types and geo-processing. Combination of attributes, attribute tables and information extraction. Measurements (area, perimeter, etc.). Statistics by area, census data. Demographic applications. Practical applications of vector overlay.	
		******** READING WEEK**********	
7	Feb 25	7. VECTOR ANALYSIS: DISTANCE, ADJACENCY AND CONTIGUITY Contiguity measures, distance and areas of "influence". Feature selection within a distance. Creating "Buffers".Distance, cost and friction. Network Analysis. Practical applications of distance functions: urban planning, emergency routing, marketing and retailing. Risk analysis and environmental protection.	Mid-term Quiz (30 min in Lecture time)
7	Feb 25 & 26		Lab 4: Network Analysis, friction, cost, routing and transportation (ArcMap, ArcCatalog and Network Analyst).
8	March 4	8. VECTOR ANALYSIS (continued)**:** Linear Network Analysis**.** Linear modelling with networks. Network feature connectivity, network flow. Network solvers. Modelling surfaces with TINs (triangulated irregular networks)	
9	March 11	9. MODELLING SURFACES WITH TINs (triangulated irregular networks): Elements of a TIN. Creating TINs: selection of vertices, triangulation and topology. Fitting surfaces to points to create surface features. Displaying surfaces with a TIN. Analysis with TIN. Applications of TINs to natural resources: topography, hydrology and associated phenomena.	
9	March 11 & 12		Lab 5 : Digital Terrain Models with TIN (ArcMap, ArcCatalog and 3D-Analyst).
10	March 18	10. MODELLING SPATIAL PROCESSES IN VECTOR GIS: Cartographic modeling. Problem-solving. Project planning. Project geodatabase design. Point Processes and Latice Processes. Statistical	Lab 6. Modelling sediment transport and soil erosion. (Briefing in lecture).

		tests for patterns	
11	March 25	11. GIS APPLICATIONS AND ERROR ANALYSIS: Major vector GIS applications. Error measurement and assessment in Vector databases. Positional and attribute error. Statistical tests	Lab 5 due
12	April 1	12. GIS CUSTOMIZATION ISSUES 13. INTERNET GIS	
12	April 3	******* Course Ends **********	Lab 6 due