

Pre-requisite Module codes	Co-Requisite Module code(s)	ECTS Credits	Module Code	Module Title
	None	5	CMPU4046	Spatial Databases

8.9.8. Spatial Databases

Module author: Patrick Browne

Module Description:

This module focuses on the use of database management systems (DBMS) to manage spatial information. A Spatial Database is a specialised DBMS that is designed to facilitate the collection, querying, management, and analysis of large volumes of geographical knowledge. A spatially enabled DBMS is a central component of a Geographical Information System (GIS). Spatial databases have a major role to play in managing the national physical and informational infrastructure. The understanding of advanced spatially enabled DBMS is vital in implementing any information system where geographic data is required. This module focuses on the role of the DBMS in geographical applications.

Module aim

The aim of this module is to familiarise students with the features of a spatially enabled database systems and to develop applications that use the spatial database extensions.

Learning Outcomes:

On completion of this module, the student will be able to:

- use a database to store and query spatial data
- develop applications that use a spatially enabled DBMS, e.g. spatial data mining, navigation.
- distinguish and use appropriate database models
- apply the various query languages appropriate to spatial querying to given situations
- understand the extensions required by application programs to handle spatial data

Learning and Teaching Methods:

Lectures, self-study, labs, tutorials, and any combination of discussion, case study, problem-solving exercises, readings, seminars, and computer-based learning.

Module content:

Foundations Fundamental geographic concepts for GIS The world in spatial terms, how natural and man made features can be stored in a DBMS. Qualitative and quantitative location e.g. coordinate systems and geo-referencing. Maps as representation of the world and of information. Geometric and thematic information.

Algorithms and Data Structures for GIS: Abstract Data Type (ADT), spatial ADTs and their operations e.g. intersection, overlay, network traversal, auto-correlation, statistical operations, searching.

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Spatial representations: ADTs for representation, raster, vector, TIN, quadrees, R-trees, scan orders, polygon coverage, discrete objects, networks, time, connections and topology, networks, distance and direction, flow and diffusion, spatial hierarchies, boundaries, spatial patterns, attributes, and representations of relationships.

Applications of spatial databases: Spatial data mining, spatial data on the World Wide Web, transportation networks, natural resources, soil data, oceanography, land cover, geology, climate, terrain, land records, administrative boundary data, demographic studies, and health data.

Spatial databases Spatial data: definitions, formats, models, queries the relational model, advanced SQL, data modelling techniques, implementing a simple database, post relational database models, object-relational and object-oriented models, spatial data structures, spatial indexing e.g. R-Tree, networking, database issues in GIS.

The course will involve practical work on a range of appropriate software e.g. spatially extended DBMS, map servers, statistical packages, markup languages, client and server side programming..

Module Assessment

The methods of assessment to be used to measure the learning objectives stated above are written examination and continuous assessment including one or more of assignment, essay, problem-solving exercise, oral presentation, and class or lab tests.

Continuous Assessment 50%

Examination 50%

Essential Reading:

Shekhar and Chawla; Spatial databases – A tour, 2003, Prentice Hall, 2003

Supplemental Reading:

(1) Obe, Hsu; PostGIS in Action, 2010 Manning.

(2) Rigaux, Scholl, Voisard; Spatial databases, 2002, Morgan Kaufmann

Web references:

The Open Geospatial Consortium, Inc. (OGC) - <http://www.opengeospatial.org/>

Further Details:

This module will be delivered in one semester. 2 hours lecture / tutorial and 1 hour lab per week.

Date of Academic Council approval