UNIVERSITÀ DI PISA

GEOGRAPHIC INFORMATION SYSTEMS

PAOLO MOGOROVICH

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Moduli	Settore/i	Tipo	Ore	Docente/i
SISTEMI INFORMATIVI TERRITORIALI	INF/01	LEZIONI	42	MASSIMILIANO GRAVA PAOLO MOGOROVICH

Learning outcomes

Knowledge
GIS (Geographical Information System) are both technical and methodological tools that allow to address problems in a wide range of disciplines using, in addition to the basic techniques of analysis, also the geographical analysis for the construction of maps and, above all, as a tool for processing data.

The disciplines involved include natural resources management, environmental management, spatial planning, utilities management, support to productive sectors, navigation, civil protection, economic analysis, humanistic studies, tourism, epidemiology, criminology and many others.

The course aims to provide students with the tools and methods for the geographical treatment of information. In the initial phase of the course, the representation and meaning of the geographical information present in a physical map is analysed and then the principles of numerical modelling and analysis of spatial data are presented together with the main characteristics of the IT tools that support this sector.

Assessment criteria of knowledge

- Two intermediate tests
- Final examination

Skills
At the end of the course the student will be able to:

- analyze a generic type of spatial data and create the correct numerical model
- analysing a computerised data on the Web and assessing its suitability for a certain objective
- use a SW Gis (QGIS in our case) for the solution of problems in a geographical context, evaluating and controlling the parameters and options of the various functions.

Assessment criteria of skills
Self-assessment during the laboratory work and verification during the final exam.

Behaviors

- Spatial perception of phenomena in the analysis of technical problems and in everyday situations
- Reasoned and not random use of the SW that is being used and of the technical consequences of the decisions taken in the various phases of a processing process

Assessment criteria of behaviors
The behaviours described above are difficult to verify in a course; a partial verification occurs during the oral part of the final exam and during laboratory work.

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Prerequisites

- Basics of mathematics provided by the high school and in particular of geometry
- Experience of using basic computer tools
- Web browsing capability

Teaching methods

The course will be held in the form of lectures and laboratory work.
Laboratory concern the use of a GIS tool (QGIS in a long term release version) and the verification of theoretical concepts through exercises.
This practical part uses a large set of spatial data relating to the island of Elba.

On the course website are available in pdf format
- Lessons in text form
- Slides used during the lessons (original version and other adapted for printing)
- Exercises
- Data on the island of Elba can be freely downloaded (in suitable formats)

During the laboratory work students can use the equipment available in the classroom; alternatively students can use their own laptop (recommended choice).

During the course there will be two ongoing tests.

Syllabus

Part 1: Geographic information in a map and in a computer
- Overviews of cartography and organisation of geographical information
- The transition from Cartography to GIS
- The role of Numerical Cartography

Part 2: Modeling of geographic information
- Geometric vector primitives and topology
- The Raster model
- Indirect Georeferencing

Part 3: Basic processing
- Raster-Vector Conversions
- Morphology
- Map Algebra
- Overlay

Part 4: Practical part/Laboratory, carried out using the QGIS tool, with exercises on real data
- Introduction - Overview of GIS tools and SIT architecture
- Maps: visualization and querying
- Thematization and interpretation of vector and raster data
- Vector data editing
- Spatial analysis
- WMS, WCS and WFS services
- Cloud-GIS vs WebMapping

Bibliography

Text, slides and exercises available on the web site of the course are a good base for the examination to take place
For further information there are numerous texts, as well as a large amount of material on the Web. Some classic texts are:

M.N.DeMers, Fundamentals of Geographic Information Systems, J.Wiley&Sons (1997)
R.Laurini,D.Thompson, Fundamentals of Spatial Information Systems, Academic Press (1992)
D.J. Maguire, M.F. Goodchild and D.W. Rhind, Geographical Information Systems, Longman Scientific & Technical, New York, (1991)
M.F.Worboys, GIS: a computing perspective, Taylor&Francis (1995)

but the text that made GIS history is "P.Burrough, Principles of Geographic Information Systems, Oxford University Press (1998)" and I recommend it more than any other, as a first reading, to those who intend to deal with GIS in the future.

Non-attending students info

No special indication

Assessment methods

The examination consists of:
1) a written test with questions concerning both the theoretical part and the laboratory part
2) an oral test that includes a test of use of the SW GIS

Class web page

https://mog.labcd.unipi.it/

Additional web pages

On the Web are accessible sites in large quantity and in continuous evolution, related to different aspects of GIS technology, which can be classified as:

Sites of training oriented scientific organisations (e.g. http://www.ncgia.ucsb.edu/giscc/, http://www.didatticaericercasit.it/, http://www.spatialanalysisonline.com/HTML/index.html, etc.)
Institutional sites mainly providing data but also services (e.g. https://www.epsg-registry.org/, http://www.igmi.org/geodetica/, http://www.pcn.minambiente.it/GN/, http://www.regione.toscana.it/-/cartografia-tecnica-regionale-e-scarico-dati-geografici, etc.).)
Sites of both proprietary and OS SW providers (e.g. http://www.gdal.org/index.html, http://Qgis.org, http://www.ing.unitn.it/~grass/docs/tutorial_62/index.htm, etc.)
Sites of associations of users and/or manufacturers of SW (e.g. http://www.opengeospatial.org/, http://www.osgeo.org/, http://gfoss.it/drupal/,)

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