Introduction to GIScience
Principles and techniques for application development, visualisation and spatial analysis

Scope
GIS are gradually imposing as management, editing, query and visualisation tools in different fields of research involving quantitative analysis. Relevant applications can be found in urban planning, environmental sciences and risk management. The wide diffusion of GIS pushes the demand of high skilled professionals in either private and public sector. The introductory GIScience course aims to give the fundamentals of GIScience theory supported by practical examples and laboratory exercises using ESRI ArcGIS 8/9™ and MsAccess™ in relational databases development (ORDBMSs – Object Relational Database Management Systems).

Program
The course, adopting a theoretical/practical approach, will cover the following topics:

- **Fundamentals**: GIS definition, GIS components (hardware, software, spatial data, human resources, project management), reference bibliography and web resources. The history of GIS with an emphasis on technology and geographical diffusion. Cartography principles: geodesy basics, geographic and plane coordinates, projections and reference systems. Map classification. Application development principles in environmental and social sciences.

- **Spatial data and modelling**: types, scale, spatial features (points, lines, polygons), attribute data, generalization. Topological concepts and their implementation in the ArcInfo™ Coverage model and ArcView™ Shapefile model. Spatial data sources characteristics: scale, costs, availability, time and space resolution. Remote sensing data, aerial photographs, national geographic databases and themes (elevation data, hydrography, administrative boundaries), National statistics. International data sources. GPS data acquisition, integration and harmonisation. Vector and raster data models: implementation, strengths and weaknesses. Alternative surface modelling with the TIN (Triangulated Irregular Network) data model, network data model (road networks, utilities, hydrography).
ArcGIS 10™ introduction

ESRI products architecture, from ArcView 3.x™ and ArcInfo™, to the current ArcGIS 8/9™ platform with its components (ArcCatalog, ArcMap ed ArcToolBox). Technical analysis of vector data model implementation in the ArcInfo™ coverage, shape file and geodatabase (feature, object e relationship classes). Basic functions in ArcMap™: TOC (Table Of Contents) and layers, simbology, access to attribute table, graphs and reports, spatial and attribute queries, layout. Introduction to the most used extensions: Spatial Analyst™ and 3D Analyst™, for cartographic modelling, map algebra and 3D visualisation, Geostatistical Analyst™ for ESDA (Exploratory Spatial Data Analysis), variography analysis and regionalization through Kriging.

Relational and geographic databases:

migration from traditional file oriented platforms (Idrisi 32™), through class relational databases and modern geodatabases, based on Object Oriented technology. Relational databases principles (Codd model), normalization rules and forms, referential integrity and SQL (Structured Query Language) commands. ESRI personal geodatabase and Spatial Oracle.

Data acquisition, editing and data quality (metadata):

digitalization and rasterization, georeferencing, data import, format conversion, link to external data sources (spreadsheet, database), reprojection, transformation, generalization, edge matching and rubber sheeting, design and implementation of relational databases and Personal Geodatabase (feature dataset, feature, object and relationship classes creation). Lineage and metadata (FGDC - Federal Geographic Data Committee models). Print layout: cartographic design; best representation model selection criteria and data analysis following project's scopes, visualisation theory and techniques.

Spatial analysis:


Further issues in GIScience: education and project management:

the debate on GIS, GI System or GIScience? From a technical to an epistemological approach. GIScience education in the private and public sector, the role of distance learning and part-time graduate studies of international institutions (UNIGIS, City University, Birkbeck College, della Penn State University). GIScience role in the organisations, integration with the traditional information systems, prototyping techniques, cost/benefits analysis (SWOT, Boston matrix). Foundation of distributed client-server architectures: from Desktop GIS to Internet GIS.
GIScience project

The course is part of a wider learning project in GIScience and GIS, applications and geographic mashup development, environmental applications. Supported by high-level professional and academic profiles, the project includes following courses:

- **Introduction to GIScience**: principle and techniques for application development, visualisation and spatial analysis
- **Design and development of GIS software applications**: software engineering, OO and components models, programming in VBA/ArcObjects for ArcGIS 8.x/9
- **Design and development of GIS software applications**: object oriented model, software engineering, Python programming
  - and its role in in ArcGIS.
- **Design and development of Web mapping applications**: a course on theory and practice in GeoWeb 2.0 mashups design and development, integrating Google Maps and OpenLayer web services and spatio-temporal PostgreSQL/PostGIS database
- **Object Oriented JAVA programming for GIS applications development**: a Open Source perspective to stand-alone and Web solutions
- **A hands-on introduction to databases and geodatabases**: A two-modules foundation course with examples in MySql, PostgreSQL/PostGIS, Oracle XE and ArcGIS/MsAccess for the design and development of Relational (I) and Spatial Databases (II)
- **Business Geographics & Geodemographics**
- **Google Maps Mashups**
- **Environmental project management**
- **Applied groundwater flow and transport modeling**: groundwater management at regional scale for water supply policies assessment and at local scale for environmental remediation of contaminated sites.

Following a complex and coherent learning path, after traditional part-time and distance learning philosophy, the course has been based, since its first edition in 2003, on both formal classes and self-learning periods, making course accessibility easier and learning objectives realistic.

**Software**

Office Automation MsOffice™, RDBMS MsAccess™, GIS ArcGIS 10.

**Who is it for?**

Professional working for both private and public sector interested in planning and environment issues, graduate and post-graduate students in similar disciplines. No formal GIS knowledge is required, but it is required experience in using a PC and MsOffice™.

**Location & dates**

The course will take place at the Environmental Education Centre Casa Archilei, located in Fano (PU) and easily accessible from major transport links. The course will have a duration of 40 hours, with 8 hours lessons, on 27-28-29 March and 11-12 April 2014.
Registration and payment options

Course fees are 900 € + VAT (22%), to be paid in a unique instalment before starting date. Fees are reduced to 850 € + VAT (22%) for participants with their own notebook. Further fees reduction is applicable, based on conditions stated below.

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<tr>
<th>Fees reduction</th>
<th>Reduction</th>
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<tbody>
<tr>
<td>Registration before February 28th, 2014</td>
<td>5%</td>
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<tr>
<td>Participants in previous GIScience courses promoted by <a href="http://www.GIScience.it">www.GIScience.it</a></td>
<td></td>
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<tr>
<td>Students regularly enrolled in degree, post-degree and Phd courses at italian or foreign universities at the moment of registration</td>
<td>10%</td>
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<td>Education Institutions, public and private companies enrolling more than one person</td>
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Registration modules is available for download in PDF format or they can be requested at info@giscience.it.

Certificate

At the end of the course, participants attending at least 70% of the lessons will be awarded a Completion certificate.

Didactic material

Partecipants will be provided with full documentation about relevant course issues. The course adopts the following textbook, included in registration fees:


Following textbook is highly recommended as well:

Info

For further information, please refer to info@giscience.it Email address or refer to contact references at Contacts section of web site www.giscience.it.

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