Lecturers

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NUMBER OF ACTIVITIES AND THEIR CONTRIBUTION (%) TO THE FINAL GRADE

	Number	% to the final grade
Quiz	-	-
Midterm exam	1	30
Final exam	1	50
Laboratory work-	-	-
Homework	1	20

WELCOME

to

Introduction to Geographic Information Systems

What will you learn?

- An overview of GIS
- How GIS data are captured, stored, retrieved, analyzed & displayed
- Where to go for information (self-help)
- GIS software and its functionality
- Where GIS is going
- How to use a basic GIS
- GIS problem solving

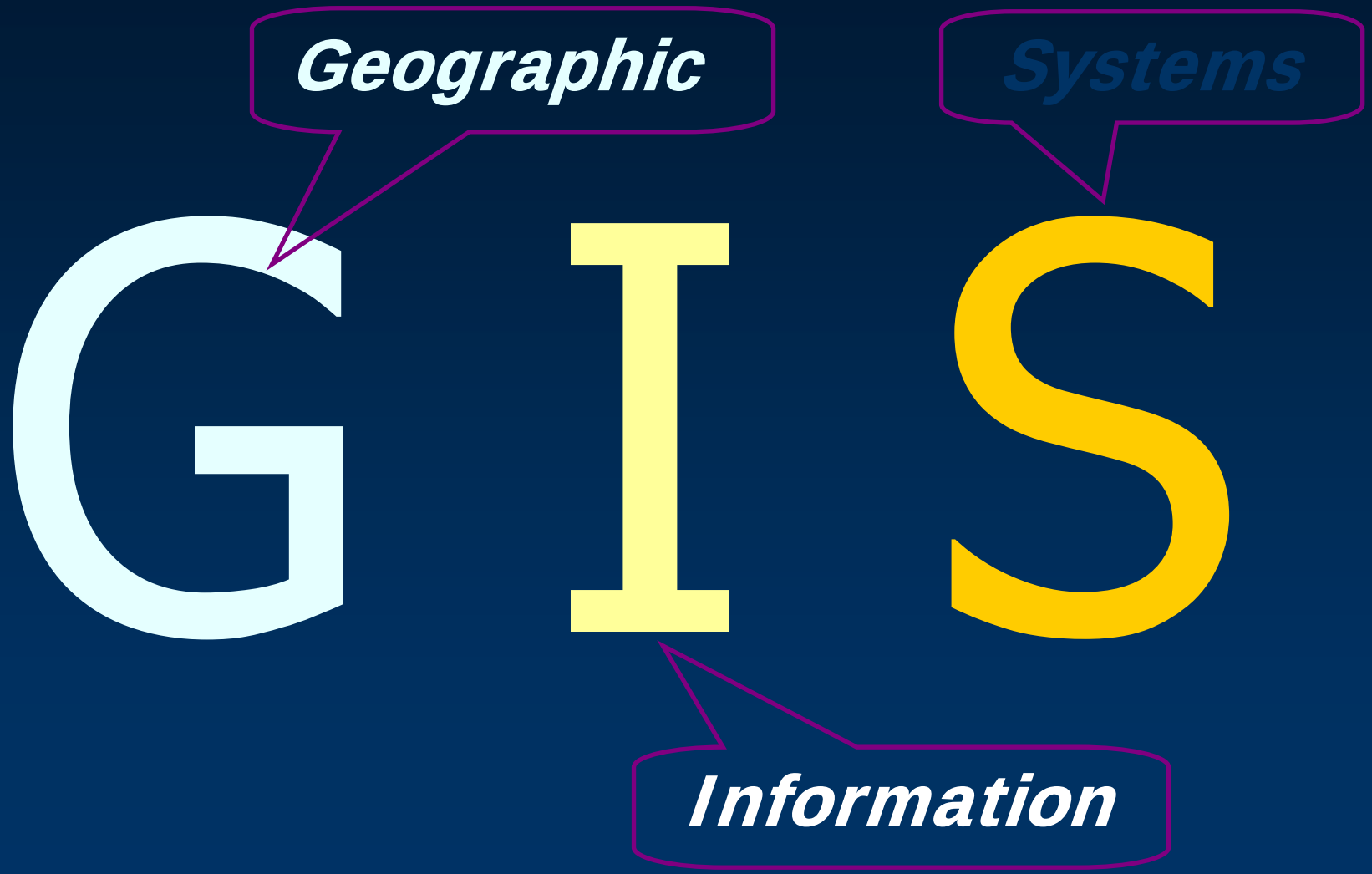
Lecture 1: What is a GIS?

- 1.1Getting Started
- 1.2 Some Definitions of GIS
- 1.3A Brief History of GIS
- 1.4 Sources of Information on GIS

Lecture 1: What is a GIS?

What in the world is a "GIS"?
—Item on the Internet's
comp.infosystems.gis FAQ.

GISs are simultaneously the telescope, the microscope, the computer, and the Xerox machine of regional analysis and synthesis of spatial data. (Ron Abler, 1988)


Geographic
Systems
G I S
Information

Where did GIS come from?

- GIS is built upon knowledge from geography, cartography, computer science and mathematics
- Geographic Information Science is a new interdisciplinary field built out of the use and theory of GIS

Defining GIS

- Different definitions of a GIS have evolved in different areas and disciplines
- All GIS definitions recognize that spatial data are unique because they are linked to maps (Space matters!)
- A GIS at least consists of a database, map information, and a computer-based link between them

GEOGRAPHIC INFORMATION SYSTEMS

GIS is an organised collection of *computer hardware*, *software*, *geographic data* and *personnel* design to efficiently capture, store, update, manipulate, analyze and display all forms of geographically referenced information.

Definition 1: A GIS is a toolbox

"*a powerful set of tools for storing and retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes*" (Burrough, 1986, p. 6).

"*automated systems for the capture, storage, retrieval, analysis, and display of spatial data*." (Clarke, 1995, p. 13).

Definition 2: A GIS is an information system

"*An information system that is designed to work with data referenced by spatial or geographic coordinates. In other words, a GIS is both a database system with specific capabilities for spatially-referenced data, as well as a set of operations for working with the data*" (Star and Estes, 1990, p. 2).

Map Overlay

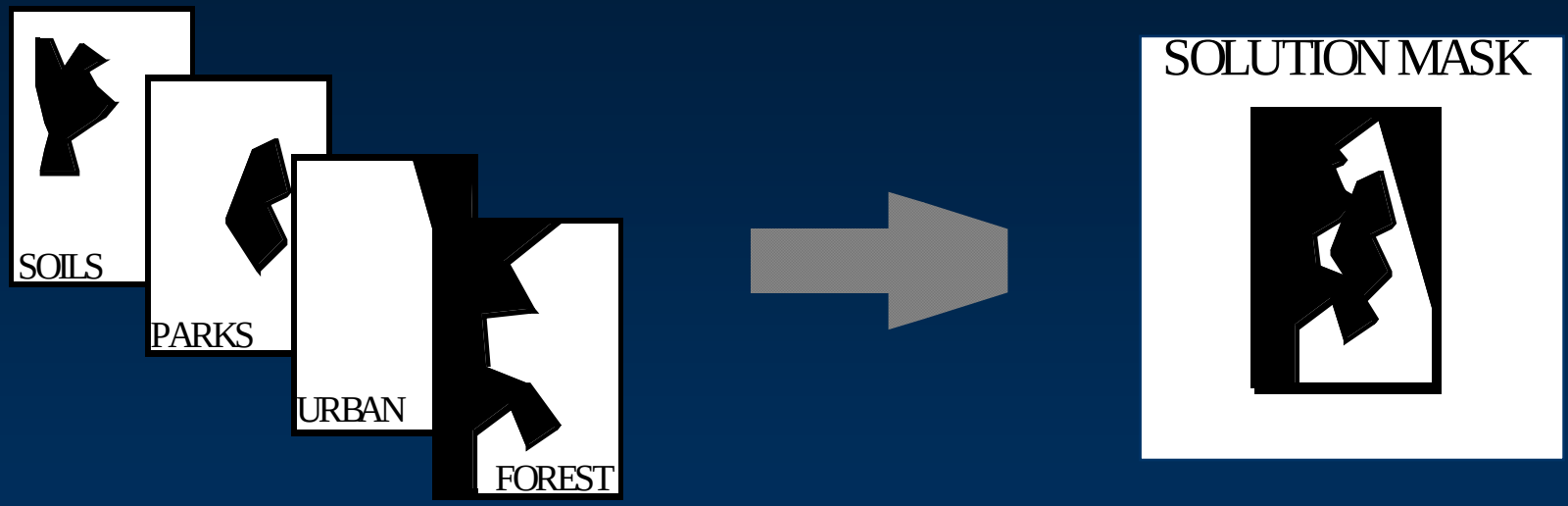


Figure 1.3 Map overlay as presented in *Design with Nature* by Ian McHarg. Each transparent layer map "blacked out" areas excluded as unsuitable locations.

Dueker's 1979 definition (p. 20) has survived the test of time.

"*A geographic information system is a special case of information systems where the database consists of observations on spatially distributed features, activities or events, which are definable in space as points, lines, or areas. A geographic information system manipulates data about these points, lines, and areas to retrieve data for ad hoc queries and analyses*" (Dueker, 1979, p 106).

The Feature Model

- Dueker's definition uses the feature model of geographic space.
- The standard feature model divides a mapped landscape up into features, that can be points, lines, or areas.
- Using a GIS involves capturing the spatial distribution of features by measurement of the world or of maps.
- Almost all human activity and natural phenomena are spatially distributed, so can be studied using a GIS.

Dueker (ctd)

- A GIS is flexible enough to be used for ad hoc query and analysis (in space, about place)
- A GIS can do analysis, modeling and prediction

A Brief History of GIS

- GIS's origins lie in thematic cartography
- Many planners used the method of map overlay using manual techniques
- Manual map overlay as a method was first described comprehensively by Jacqueline Tyrwhitt in a 1950 planning textbook
- HcHarg used blacked out transparent overlays for site selection in *Design with Nature*

A Brief History of GIS (ctd)

- The 1960s saw many new forms of geographic data and mapping software
- Computer cartography developed the first basic GIS concepts during the late 1950s and 1960s
- Linked software modules, rather than stand-alone programs, preceded GISs
- Early influential data sets were the World Data Bank and the GBF/DIME files
- Early systems were CGIS, MLMIS, GRID and LUNR
- The Harvard University ODYSSEY system was influential due to its topological arc-node (vector) data structure

A Brief History of GIS (ctd)

- GIS was significantly altered by (1) the PC and (2) the workstation
- During the 1980s, new GIS software could better exploit more advanced hardware
- User Interface developments led to GIS's vastly improved ease of use during the 1990s
- During the 1980s, new GIS software could better exploit more advanced hardware

allied technologies

- Photogrammetry
- Surveying
- Remote sensing
- GPS
- Computer Science

allied disciplines

- Geodesy
- Geography
- Geology
- Geophysics
- Meteorology
- Statistics
- …

- Anthropology,
- Epidemiology,
- Facilities management,
- Forestry,
- Business
- …

Components of a GIS

Software

Hardware

Data

People

Method

Components of a GIS

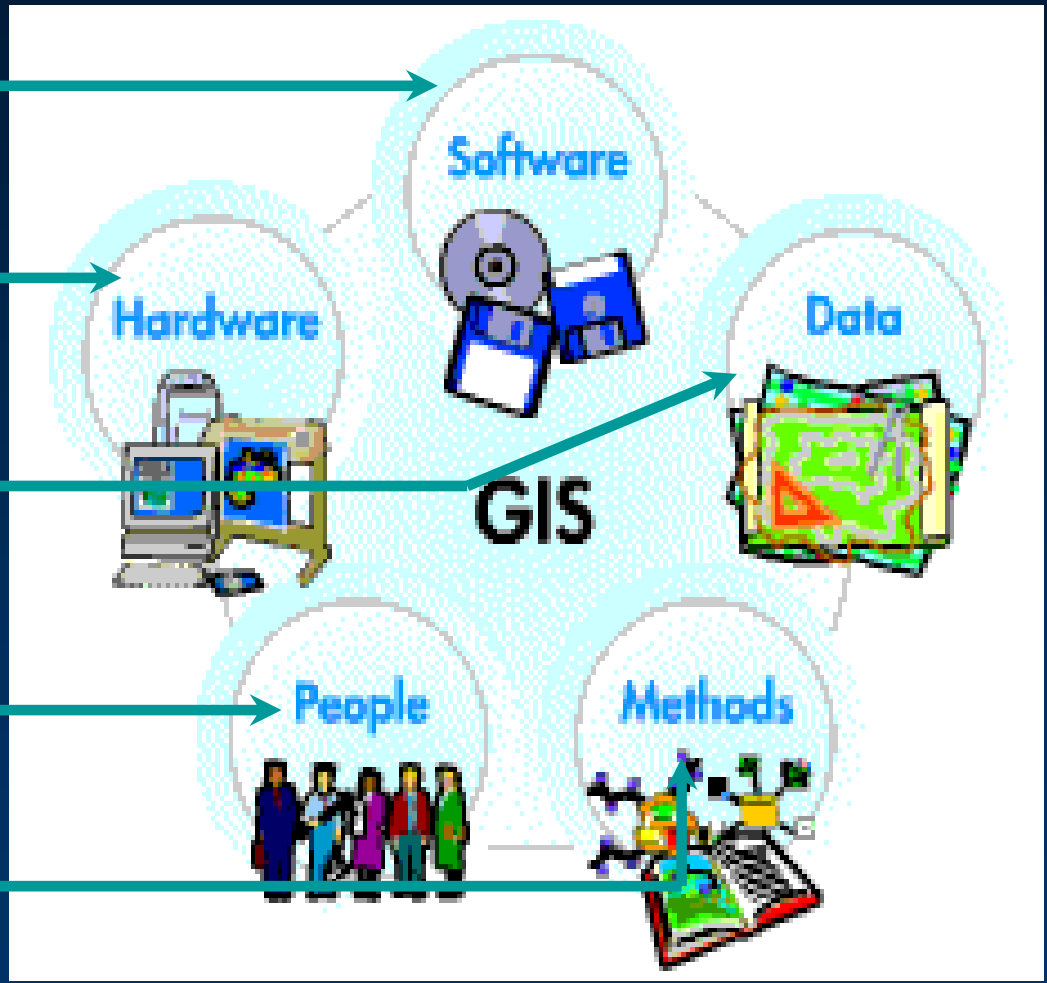
Software

Hardware

Data

People

Method



Data Types

There are two types of data:

Spatial Data	Attribute Data
Point	Descriptive (parcel no, owner, etc.)
Line	Quantitative (area, parcel, value etc.)
Polygon	Qualitative (water, air, soil etc.)

spatial data / non-spatial data

- means related to the space around us.
- a simple description of the three parts of GIS as

  the database,

  the spatial or map information,

  some way to link the two.

Data Types

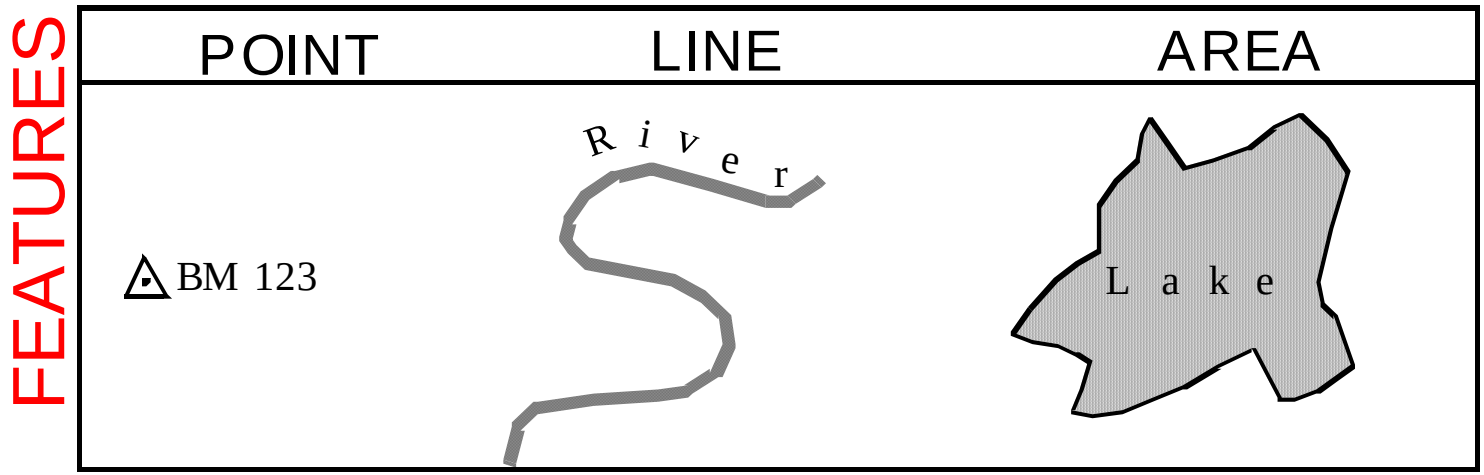


Figure 1.2 The Feature Model: Examples of a point feature (elevation benchmark), a line feature (river) and an area feature (lake).

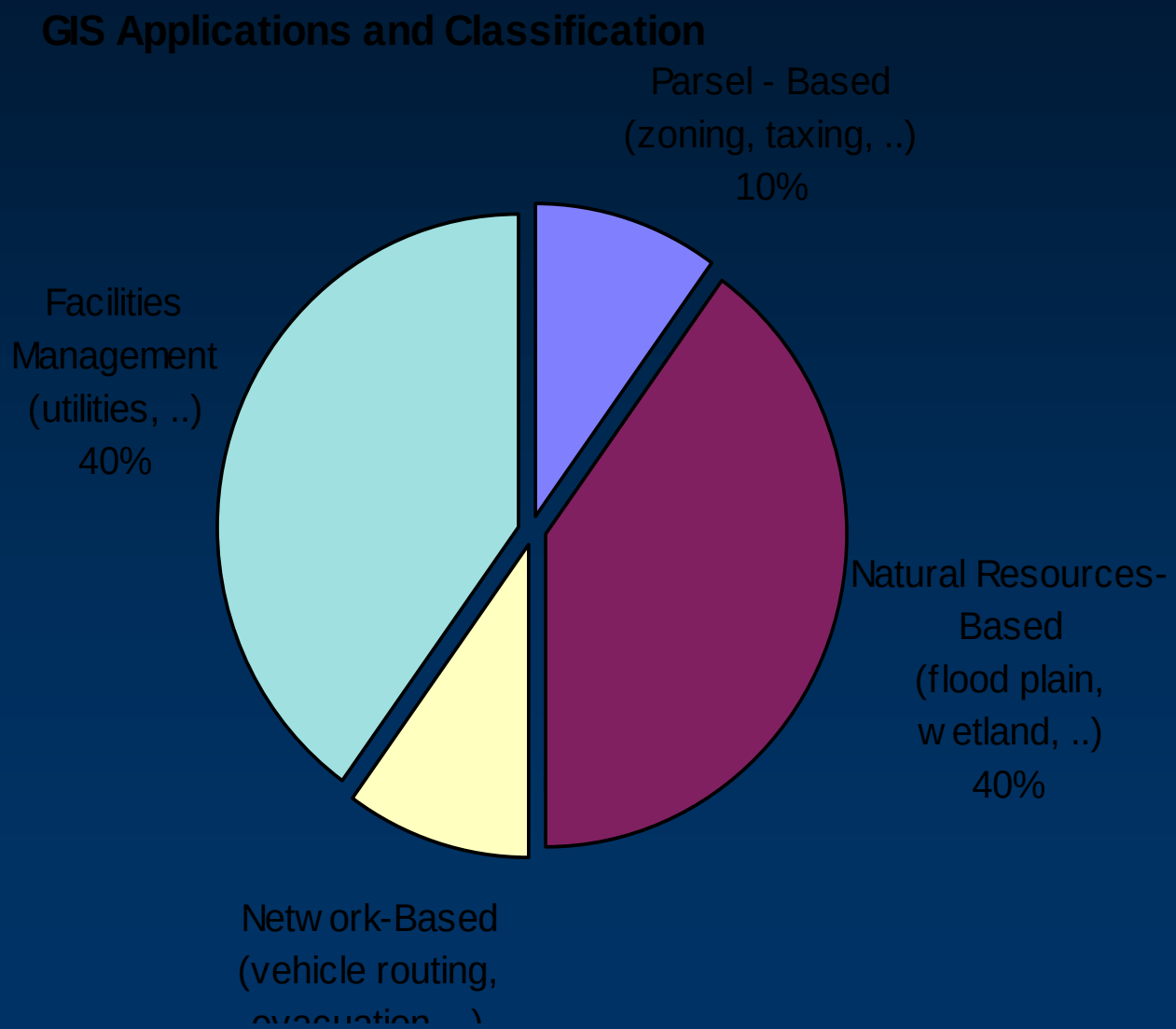
Features

- *Point features* (bench mark)
- *Line features* (river)
- *Area features* (lake)

Why is GIS so popular?

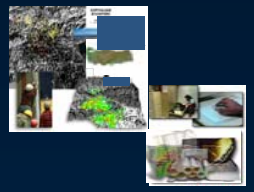
- ✓ High level of interest in new developments in computing,
- ✓ GIS gives a ‘high tech’ feel to geographic information,
- ✓ Maps are fascinating and so are maps in a computer,
- ✓ There is increasing interest in geography and geographic education,
- ✓ GIS is an important tool in understanding and managing the environment.

GIS Applications



DEPREM BÖLGESİ PLANLAMA ve YÖNETİM BİLGİ SİSTEMİ

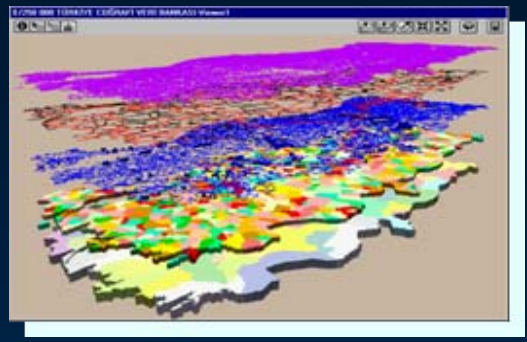
SİSTEM ANALİZİ ve VERİTABANI TASARIMI

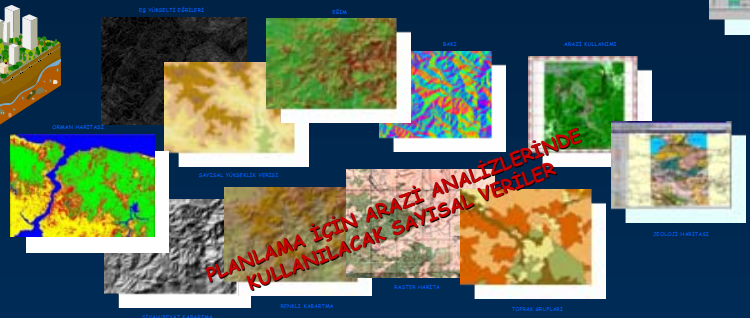


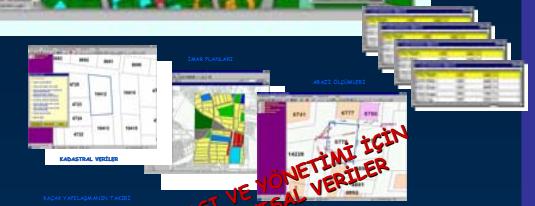
Deprem Bölgesi Planlama ve Yönetim Bilgi Sistemi Projesi kapsamında; Arazide yapılan etüd çalışmaları sonucunda elde edilecek ve arşivde mevcut bulunan verilerin analizi ve veri tabanı tasarımı yapılacaktır.

Sistem Analizi ve ve Veritabanı Tasarımı yapıldıktan sonra; mevcut tüm verilerin Coğrafi Bilgi Sistemine sayısal ortamda aktarılması gerçekleştirilecektir.

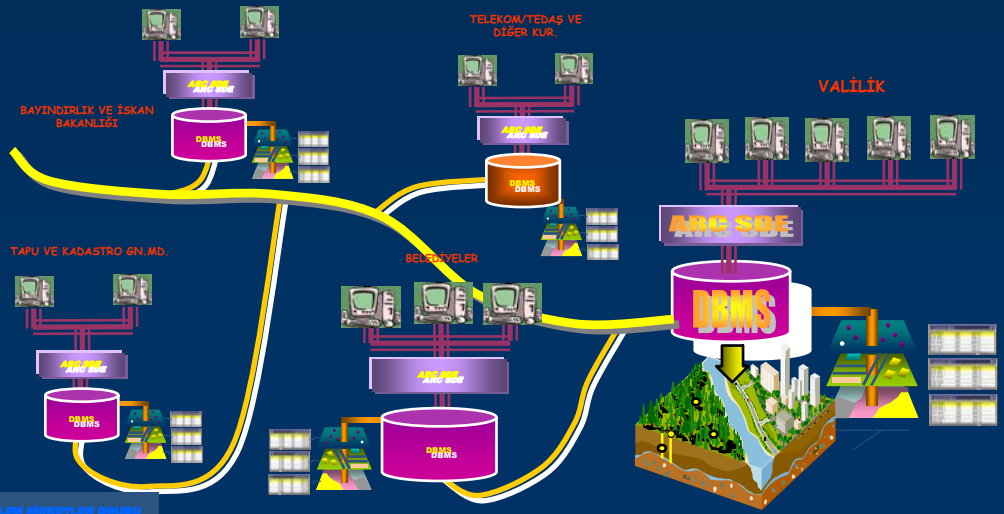
VERİ ÜRETİMİ ve ENTEGRASYONU

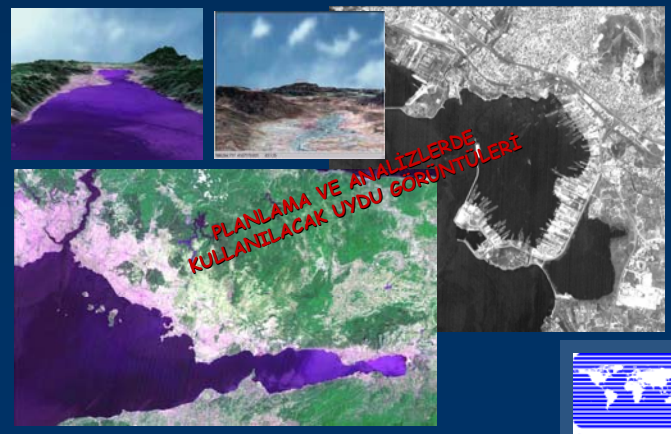






BİLGİ SİSTEMİ ENTEGRASYONU



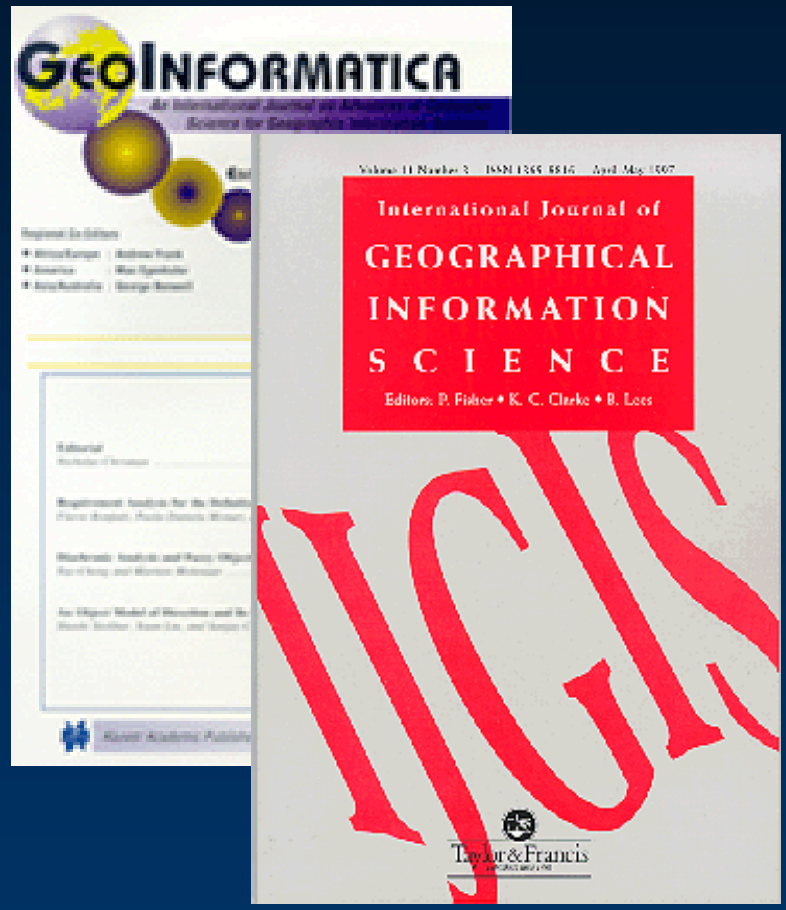


İŞLEM GIS®

Sources of Information on GIS

Journals and Magazines

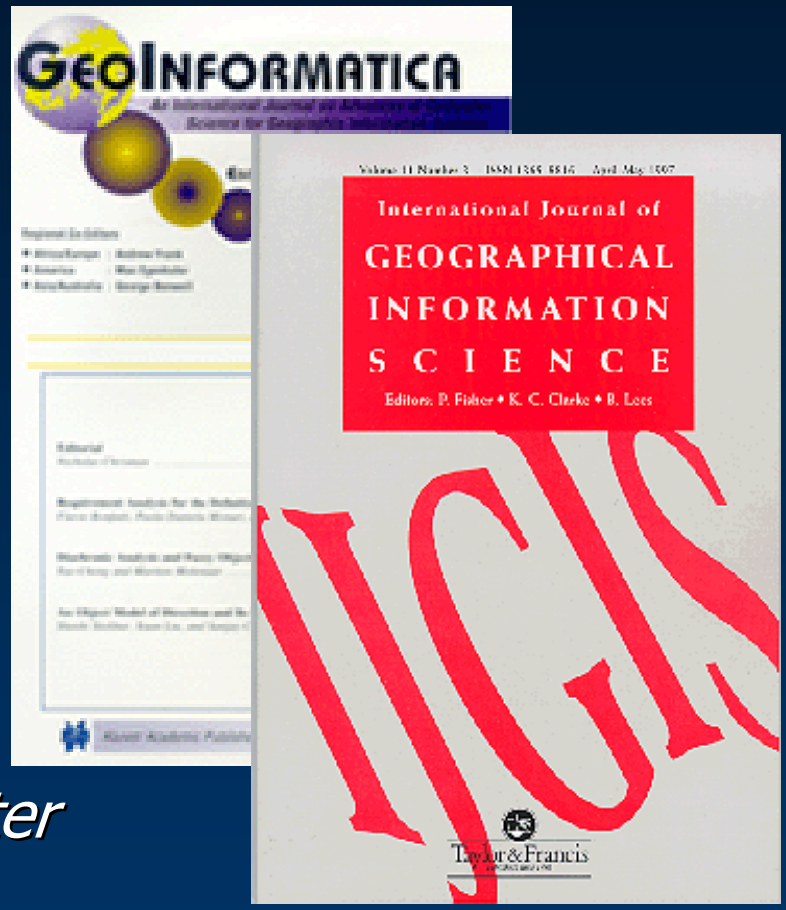
- *International Journal of Geographical Information Systems,*
- *Geographical Systems,*
- *Transactions in GIS,*
- *Geo Info Systems,*
- *GIS World*.



Sources of Information on GIS

Journals and Magazines

- *Annuals of the Association of American Geographers,*
- *Cartographica,*
- *Cartography and GIS;*
- *Environment and Urban Systems;*
- *Computers and Geosciences;*
- *IEEE Transactions on Computer Graphics and Applications;*
- *Photogrammetric Engineering and Remote Sensing.*



Major GIS-Only Journals

- International Journal of Geographical Information Systems
- Geographical Systems
- Transactions in GIS
- Geo Info Systems
- GIS World

Specialty Journals

- Business Geographics
- GIS Law
- GrassClippings
- GIS Asia/Pacific
- GIS World Report/CANADA
- GIS Europe
- Mapping Awareness

Regular GIS Papers

- Annals of the Association of American Geographers
- Cartographica
- Cartography and GIS
- Computers, Environment, and Urban Systems
- Computers and Geosciences
- IEEE Transactions on Computer Graphics and Applications
- Photogrammetric Engineering and Remote Sensing

Occasional GIS papers

- Cartographic Perspectives
- Cartographica
- Journal of Cartography
- Geocarto International
- IEEE Geosciences
- International Journal of Remote Sensing
- Landscape Ecology
- Remote Sensing Review
- Mapping Science and Remote Sensing
- Infoworld

Popular Distribution Magazines

- Business geographics
- Geo info systems
- GIS Law
- GIS World
- GPS World
- Mapping awareness/Mapping awareness and GIS in Europe/Asia/Africa

Proceedings of Conferences

- AUTOCARTO International Symposium on Automated Cartography
- GIS/LIS. Sponsored by AAG, ACSM, AM/FM, ASPRS, URISA. Held every year, retired in 1998.
- International Advanced Study Symposium on Topological Data Structures for Geographic Information Systems
- Proceedings International Symposium on Spatial Data Handling. IGU Commission on GIS.
- SSD Advances in spatial databases

Sources of Information on GIS

Professional Societies

- *International Society for Photogrammetry and Remote Sensing*
- *American Society for Photogrammetry and Remote Sensing,*
- *Association of American Geographers,*
- *AM/FM (Automated Mapping/Facilities Management group)*
- *Urban and Regional Information Systems Association (URISA).*

Sources of Information on GIS

Professional Societies

- *Cartography and Geographic Information Systems,*
- *the American Cartographer,*
- *Surveying and Land Information Systems,*
- *International Cartographic Association (ICA)*
- *the American Congress of Surveying and Mapping*

isprs
information from imagery

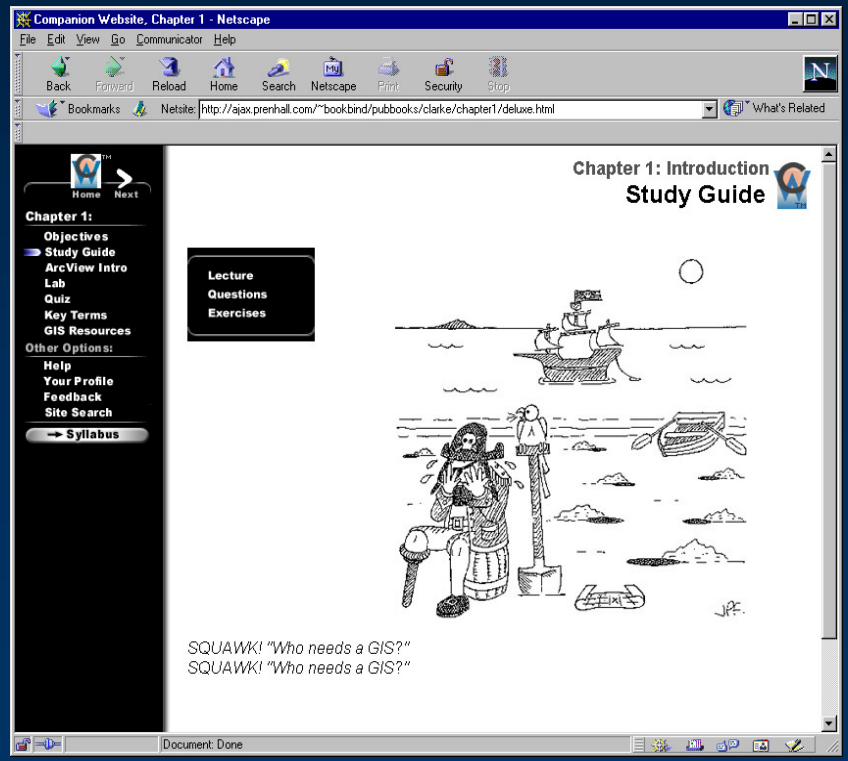
asprs THE IMAGING & GEOSPATIAL INFORMATION SOCIETY
asprs online
www.asprs.org

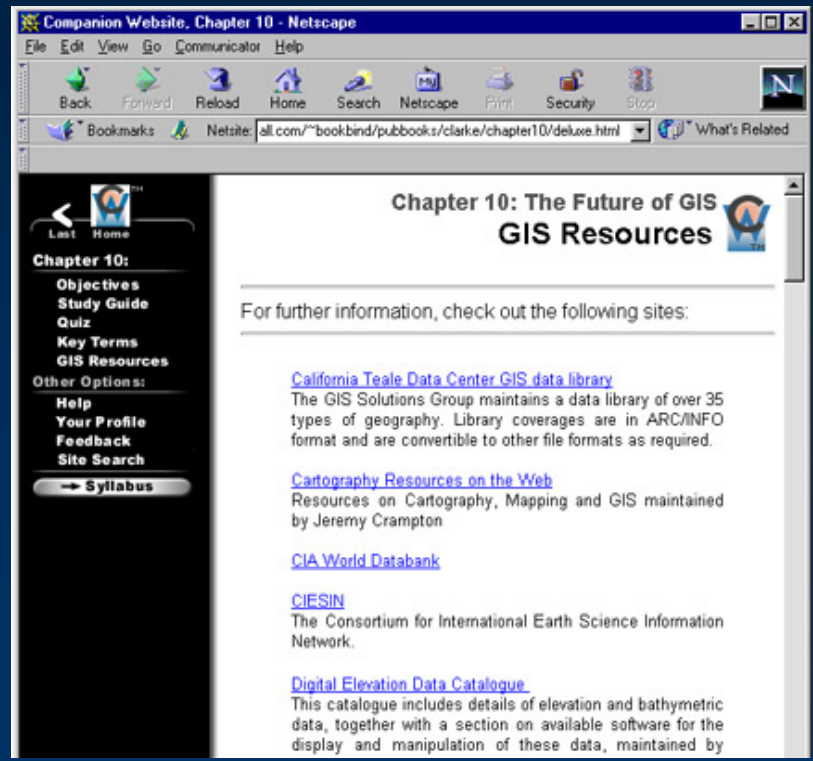
AMERICAN CONGRESS ON SURVEYING & MAPPING
1941

The Internet and the World Wide Web

- *http://www.usgs.gov/research/gis/title.html*
- *http://ncgia.ucsb.edu*
- *http://www.esri.com*
- *http://www.gis.com*
- *……*

WWW Resources: Textbook Pages





conferences

- Autocarto (International Symposium on Automated Cartography)
- GIS/LIS conference
- ACSM/ASPRS
- ICA
- **ISPRS XXth Congress 2004-Istanbul**
- **ISPRS XXIth Congress 2008-Beijing**

Some key terms and definitions

Ad hoc: For the particular case at hand

Analysis: The stage in science when measurements are sorted, tested, and examined visually for patterns and predictability.

Arc/node: Early name for the vector GIS data structure.

Arc: A line represented as a set of sequential points.

Area feature: A geographic feature recorded on a map as a sequence of locations or lines that taken together trace out an enclosed area or ring that represents the feature. Example: a lake, shoreline.

Some key terms and definitions

Attribute: A characteristic of a feature that contains a measurement or value for the feature. Attributes can be labels, categories, or numbers; they can be dates, standardized values, or field or other measurements. An item for which data are collected and organized. A column in a table or data file.

Choropleth map: A map that shows numerical data (but not simply ”counts’*) for a group of re ions by (1) classifying the data into classes and (2) shading each class on the map.

Database: The body of data that can be used in a database management system. A GIS has both a map and an attribute database.

Database manager: A computer program or set of programs that allows a user to define the structure and organization of a database, to enter and maintain records in the database to perform sorting, data reorganization, and searching, and to generate useful products such as reports and graphs.

Some key terms and definitions

Feature: A single entity that composes part of a landscape.
Format: the specific organisation of a digital record.
Fourth dimension: A common way of referring to time; the first three dimensions deter- mine location in space, the fourth dimension determines creation, duration, and destruction in time.
Geocoding: The conversion of analog maps into computer-readable form. The two usual methods of geocoding are scanning and digitizing.
Geographic information science: Research on the generic issues that surround the use of GIS technology, impede its implementation, or emerge from an understanding of its capabilities.
GUI (graphical user interface): The set of visual and mechanical tools through which a user interacts with a computer, usually consisting of windows, menus, icons, and pointers

Some key terms and definitions

Information system: A system designed to allow the user to be delivered the answer to a query from a database.

Isoline map: A map containing continuous lines joining all points of identical value.

Land-cover map: A map showing the type of actual surface covering at a given time. Categories could be grassland, forest land, cropland, bare rock, and so on.

Land-use map: A map showing the human use to which land is put at a given time. Categories could be pastured, national forestland, agricultural land, wasteland, and so on.

Line feature: A geographic feature recorded on a map as a sequence of locations tracing out a line. An example is a stream.

Map: A depiction of all or part of the earth or other geographic phenomenon as a set of symbols and at a scale whose representative fraction is less than 1: l. A digital map has had the symbols geocoded and stored as a data structure within the map database.

Some key terms and definitions

Node: At first, any significant point in a map data structure. Later, only those points with topological significance such as the ends of lines.

Point feature: A geographic feature recorded on a map as a location. Example: a single house.

Query: A question, especially if asked of a database by the user via a database manage- manage- system or GIS.

Record: A set of values for all attributes in a database. Equivalent to a row in a data table.

Spatial data: Data that can be linked to locations in geographic space, usually via features on a map.

Some key terms and definitions

Thematic map: A map designed primarily to show a ”theme,” a single spatial distribution or pattern, using a specific map type.

Topographic map: A map type showing a limited set of features but including at the minimum information about elevations or landforms. Example: contour maps. Topographic maps are common for navigation and for use as reference maps.

Topology: The numerical description of the relationship between geographic features, as encoded by adjacency, linkage, inclusion, or proximity. Thus a point can be inside a region, a line can connect to others, and a region can have neighbours.

Vector: A map data structure using the point or node and the connecting segment as the basic building block for representing geographic features.