Contents of Lecture

- Backgrounds
- Definitions & Overviews of GIS
- Implementations of GIS
- Applications of GIS
- GIS Job Markets
- GIS Future

Basic Backgrounds

- Since mid-1970s, specialized computer system developed to process geographical data
  - Technologies to input data, converting data to digital form, for storing data
  - Methods for automated analysis of data to search patterns, to make measurements, find optimal sites or routes ...
  - The collective name for such system is called GIS

GIS Definition

- **GIS: Geographic Information Systems (Sciences)**
  - A computer system for storing, manipulating, analyzing, and displaying geographically referenced data
    - Spatial data has spatial component
    - Almost everything on the Earth can be referenced by latitude and longitude (x, y coordinates)
    - A digital representation of the earth's surface (a site, region or country) that can be used to describe landscape features (roads, boundaries, mountains, rivers) and can support analysis of these features
  - A special case of information systems
Geographic Information Systems

- "Geographic"
  - Earth + Geographic Space
  - Earth: all data in the system are pertinent to Earth's features and resources including human activities
  - Geographic space: the commonality of both the data and the problems is geography (location, distribution, pattern, and relationship within a specific geographic reference)

- "Information"
  - Knowledge of geographic space
  - Data -> information -> knowledge

- "Systems"
  - Software + Hardware component
  - Linking software, hardware, data

GIS Power

- For example, GIS combines layers of information about a place to give a better understanding of that place.
  - A bridge between real world and computer

GIS Components

1. Data
   - Words, charts, graphs, tables, maps, images, GPS ...
2. Technology
   - Hardware & Software
3. People
   - GIS Users
     - Data Creators and Managers (GIS technicians): Data Input/Data Modeling, Database Management
     - Data Users (GIS analyst, Spatial data users): Data analysis, manipulation, visualization
   
  → Therefore data, technology, people itself is not GIS

GIS Functions

- Data Input: Spatial, Attribute data
  - scanner, digitizer, GPS, keyboard
- Data Storage
  - database
- Data Analysis
- Data Output
  - printer, plotter

GIS Data

- GIS combines data from many sources
GIS Operations

- Spatial data input
- Attribute data management
- Data display
- Data exploration
- Data analysis
- GIS analysis
- GIS modeling

GIS Applications

- Visualization
  - Overlay (Figure 1)
  - Mapping (Figure 6, 5)
  - 3D Mapping (Figure 13)
  - ...
- Analysis
  - Shortest path (Figure 4)
  - Buffering (Figure 7)
  - Query (Figure 12)
  - ...

GIS Applications: Transportation

GIS Applications: Environment

GIS Applications: Geology

GIS Applications: Natural Science
GIS Applications: Environmental Monitor

GIS Applications: Business

GIS Applications: Demographic Model

GIS Applications: GPS

GIS Applications: Simulation

GIS Uniqueness

- The ability of GIS to handle and process geographically referenced data distinguishes GIS from other information systems and established GIS as a technology important to a wide variety of applications
  - Spatial data analysis
Who studies and utilizes GIS?
- Geography
- Earth and environmental sciences
- Natural resource management
- Business administration
- Urban and regional planning (Figure 10)
- Computer Science
- Geomatics
- Civil engineering
-...

GIS Explosion of Implementation
- Wherever spatial data analysis is needed!
- Both Private and Public sectors
  - Public Sectors
    - Governments; Demographic profiles
    - Local, State, Federal
    - Law enforcement agencies
    - Hot spots
    - Emergency services
    - Fire station
    - Railways
    - Trafﬁc analysis
    - Detailed information
  - Political campaigns (Figure 11); Potential voters
  - Hazard, disaster mapping
  - Education
    - Research, Teaching, Administration

GIS Explosion of Implementation
- Both Private and Public sectors
  - Private Sectors
    - Business
      - Site location
      - Delivery systems
    - Logistics: warehouse, trucking
    - Market shares
    - Industry
    - Transportation
    - Communication

What GIS provides us?
- Interdisciplinary bridge
  - GIS provides important tool to almost all areas
- Spatial decision support systems to planning and decision procedure
  - Visualization and analysis

What they ask for GIS jobs?
- GIS concepts
- GIS techniques
  - GIS software packages
    - ArcGIS: ARCVIEW and ARCINFO
    - MAPINFO
    - MAPTITUDE
    - TRANSCAD
    - ERDAS IMAGINE
    - ...

Practical GIS!
- Easy to learn
- Easy to implement
- GIS classes make students ready to find a job in real world throughout lecture (concepts) and lab (techniques)
GIS Link to Economy

- From 1980-2000, GIS jobs grew at 30%
- Furthermore, the outlook for GIS jobs appears promising

Homework

- Read Chapter 1 & 2
Figure 7
RIVER BUFFERING 5 miles

Query (Figure 12)
Condition 1: 353/4,080 Population (year 2000) >= 2,000
Condition 2: 191/353 Female >= Male
Condition 3: 19/191 Age 65 up >= 500

3D Visualization (Figure 13)
Hispanic Population Population Density

Figure 11
Political Campaign

SPOT87 (Figure 8)

SPOT92 (Figure 9)