Review:

- Elements of a map
- Different types of maps
  - Points
  - Lines
  - Areas
  - Volume (data has elevation values)
  - Points, lines and areas
  - Maps in time series
  - Spatialization
- Human cognitions in making maps
Review: normalization in maps

Sales of a product in US (non-normalized)

Sales of a product in US (normalized)
GEOG 176A: Introduction to Geographic Information Systems

Lecture 16: How to Pick a GIS I

(chapter 9)

Rui Zhu
Now, imagine that you are hired in a big organization, and on the first day of your work, your manager ask your advice on choosing a GIS software for the whole organization . . . what are you gonna do?
Choosing a GIS

- The first decision for a GIS analyst is often “Which GIS?”
  - What functions should this GIS have?
  - Commercial or Open Source GIS?
  - Do you need to develop your own GIS applications?
What functions should a GIS have?

Six critical perspectives:

- Data capture
- Storage
- Management
- Retrieval
- Analysis
- Display / Visualization
What functions should a GIS have?

Six critical perspectives:

- Data capture
- Storage
- Management
- Retrieval
- Analysis
- Display / Visualization
Data capture

• How do you get data into GIS?
  ○ Digitizing
  ○ Scanning
  ○ On-screen digitizing

• Data preprocessing
  ○ Topological cleaning
  ○ Dissolving
  ○ Mosaicing (zipping)
  ○ Rubber sheeting
  ○ Generalization
Dissolving

- Aggregate features based on specific attributes
Mosaicing

- A combination or merge of two or more images
Rubber sheeting

- Assign spatial reference to an image
  - The image does not have reference initially (e.g., remote sensing images or a scanned maps)
  - Assign spatial reference using **control points**
Generalization

- Line generalization
  - Example: reduce the number of points for a polyline
  - Types of line generalizations

![Diagram showing types of line generalizations: Eliminate, Combine, Simplify, Displace]
Generalization

Example:  http://mapshaper.org/
Generalization

- The subway map (network map) we learned is an example of map generalization!
What functions should a GIS have?

Six critical perspectives:

- Data capture
- Storage
- Management
- Retrieval
- Analysis
- Display / Visualization
Storage

- Data models
  - Vector only, raster only, TIN?
- Data formats
  - Shapefile, jpeg, dem, tiff, …
- Metadata handling
  - Can this GIS store metadata?
- **Data fusion**
  - Can the GIS integrate geospatial data from different sources?
Data fusion

- Solution: Geo-ontologies!
  - This is a hot topic in current GIS research
What functions should a GIS have?

Six critical perspectives:

- Data capture
- Storage
- Management
- Retrieval
- Analysis
- Display / Visualization
Data management

- Adding, deleting, updating
  - Attributes
  - Geometries / spatial coordinates

- Generating new data from existing
  - Address matching: creating coordinates from text address (geocoding)
  - **Masking**: define an area using a mask, and extract the data based on this mask
  - ...
Masking
What functions should a GIS have?

Six critical perspectives:

- Data capture
- Storage
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- Display / Visualization
Data retrieval

- Retrieval data from coordinates (select by location)
  - Clicking on the map
  - Using a buffer zone

- Retrieval data from attributes (select by attribute)
  - Attribute equals to a particular value
  - Attribute falls into a value range
Click on maps to retrieve data
Buffer zone to retrieve
What functions should a GIS have?

Six critical perspectives:

- Data capture
- Storage
- Management
- Retrieval
- Analysis
- Display / Visualization
Data analysis

● **General analysis:**
  ○ Descriptive analysis
  ○ Inferential analysis

● **Spatial analysis:**
  ○ Spatial pattern analysis
  ○ Clustering detection
  ○ Layer overlay
  ○ Terrain analysis
  ○ **Map algebra -> for raster**
Map algebra

- Local (per pixel)
- Focal (around entity)
- Zonal (by patch)
- Global (by the whole map)
Map algebra - local

E.g., sum/mean of population based on male and female

\[
\begin{array}{ccc}
1 & 4 & 5 \\
5 & 3 & 2 \\
2 & 5 & 2 \\
\end{array}
\quad + \quad
\begin{array}{ccc}
5 & 1 & 3 \\
1 & 2 & 1 \\
1 & 4 & 2 \\
\end{array}
\quad = \quad
\begin{array}{ccc}
6 & 5 & 8 \\
6 & 5 & 3 \\
3 & 9 & 4 \\
\end{array}
\]
Map algebra - focal

E.g., sum/mean of neighborhood operation (moving window)

- terrain analysis
Map algebra - zonal

E.g.

Example application
Zone layer – soil type
Value layer – vegetation type
Output table – Number of vegetation types associated with each soil type

Diagram from ESRI ArcGIS 9.3 Helpdesk
Map algebra - global

E.g., Euclidean distance tool - calculate the shortest distance between a cell and a source (labeled as 1)
Map algebra in ArcGIS
What functions should a GIS have?

Six critical perspectives:

- Data capture
- Storage
- Management
- Retrieval
- Analysis
- Display / Visualization
Data display

- Does this GIS automatically include **cartographic principles** for output maps?
- Does this GIS provide **cognitive suggestions** for output maps?
- What **formats** can this GIS export maps?
Some other considerations

- Does this GIS provide
  - good documentations for users to find helps?
  - an easy-to-use GUI?
  - "batching" commands?
  - a "language" for users to communicate with or program the system’s functions?
The more the better?

- Is a GIS with more functions always better for you? → Not necessarily!
  - More functions might confuse the end users
  - GIS with more functions are often more expensive
    - Many GISs are sold by modules
      - e.g., ArcGIS Extensions

- Choose a GIS based on the needs of your project / organization!