



GEO 447 PRINCIPLES OF GIS

- Types of Relationships
- Topology: What it is and Isn't
- Database & Quick RDMS

Created by JDG 2000

Class slides are based on readings, the current NCGIA Core Curriculum for GIS(ystems) and GIS(cience), Kemp & Goodchild (1991), the NCGIA Core Curriculum Project at UBC, and Foote & Heubner's *The Geographer's Craft*

Types of Relationships

- Relationships between primitives which comprise a single real real world object
 - points on a line
 - lines in a polygon
- Relationships between real world objects which can be computed
 - intersecting lines
 - overlapping polygons
 - points within an area
- Relationships between objects which can not be computed
 - attributed relationships (“direction”)



GEO 447 PRINCIPLES OF GIS

Why do we care about relationships?

- Spatial relationships are the key to spatial operations in both raster & vector environments
 - however, total raster relationships are limited by the geometry of space-filling cells

GEO 447 PRINCIPLES OF GIS

Point-Point

- How many points are within 1 mile of point “X”?
- Which point is nearest to point “X”?

GEO 447 PRINCIPLES OF GIS

Point-Line

- This line ends at point “X”
- This line is nearest point “X”

GEO 447 PRINCIPLES OF GIS

Point-Area

- Is this point contained within area “A”?
- Can area “A” be seen from point “X”?

GEO 447 PRINCIPLES OF GIS

Line-Line

- “intersects”
- "within”
- "flows into”-networks



GEO 447 PRINCIPLES OF GIS

Line-Area

- “intersects”
- “borders”

Created by JDG 2000

Class slides are based on readings, the current NCGIA Core Curriculum for GIS(ystems) and GIS(cience), Kemp & Goodchild (1991), the NCGIA Core Curriculum Project at UBC, and Foote & Heubner's *The Geographer's Craft*

GEO 447 PRINCIPLES OF GIS

Area-Area

- “overlaps”
- “nearest”
- “within”

Created by JDG 2000

Class slides are based on readings, the current NCGIA Core Curriculum for GIS(ystems) and GIS(cience), Kemp & Goodchild (1991), the NCGIA Core Curriculum Project at UBC, and Foote & Heubner's *The Geographer's Craft*

Coded Relationships

- These relationships can be expressed as coded attributes when features are not necessarily present
 - ‘flows into’
 - “contained within”

GEO 447 PRINCIPLES OF GIS

Object Pairs: Coded Attributes, too

- Object Pairs are like statistical crosstabs and express relationships between objects, such as
 - Flows between objects
 - Distance between objects

GEO 447 PRINCIPLES OF GIS

Distance	A	B
B	5k	0k
C	10k	15k

Created by JDG 2000

Class slides are based on readings, the current NCGIA Core Curriculum for GIS(ystems) and GIS(cience), Kemp & Goodchild (1991), the NCGIA Core Curriculum Project at UBC, and Foote & Heubner's *The Geographer's Craft*

GEO 447 PRINCIPLES OF GIS

Key Terms To Understanding Relationships

- Point:
 - a single X,Y coordinate not in a chain
- Node (or Junction):
 - a single X,Y coordinate that represents the beginning or end of a chain
 - a coordinate that represent the intersection between two lines or chains
- Vertex:
 - A single X, Y coordinate in a chain that does not provide information about any relationship

GEO 447 PRINCIPLES OF GIS

Key Terms To Understanding Relationships

- Edge:
 - The ‘polygon-side’ of an arc
 - Arc/Line/Chain in a polygon layers has two ‘edges’
 - either side of a shared boundary
 - left & right
- Sliver:
 - overlapping ‘edges’
 - a mis-digitized boundary
 - occurs when planar enforcement does not

GEO 447 PRINCIPLES OF GIS

Topology refers to....

- Relationships that do not change after distortion
- Non-Constant properties include:
 - area
 - distance
 - shape
 - angles, etc. . .
- Constant properties include:
 - within
 - next to
 - contains, etc. . .

GEO 447 PRINCIPLES OF GIS

Topology in GIS. . .

- Refers to spatial databases which encode ‘connectedness’, adjacency, and order sets of lines (polygons)
 - sometime referred to as Arc-Node topology
- Allows for manipulation and analysis of entire layers
- Databases without these relationship types preserved are cartographic
 - individual, not entire layers, can be manipulated

GEO 447 PRINCIPLES OF GIS

Planar Enforcement

- Key to preservation of topology & real world digital representation
- One thing:One Space
- Attribution is Appropriate and Consistent



GEO 447 PRINCIPLES OF GIS

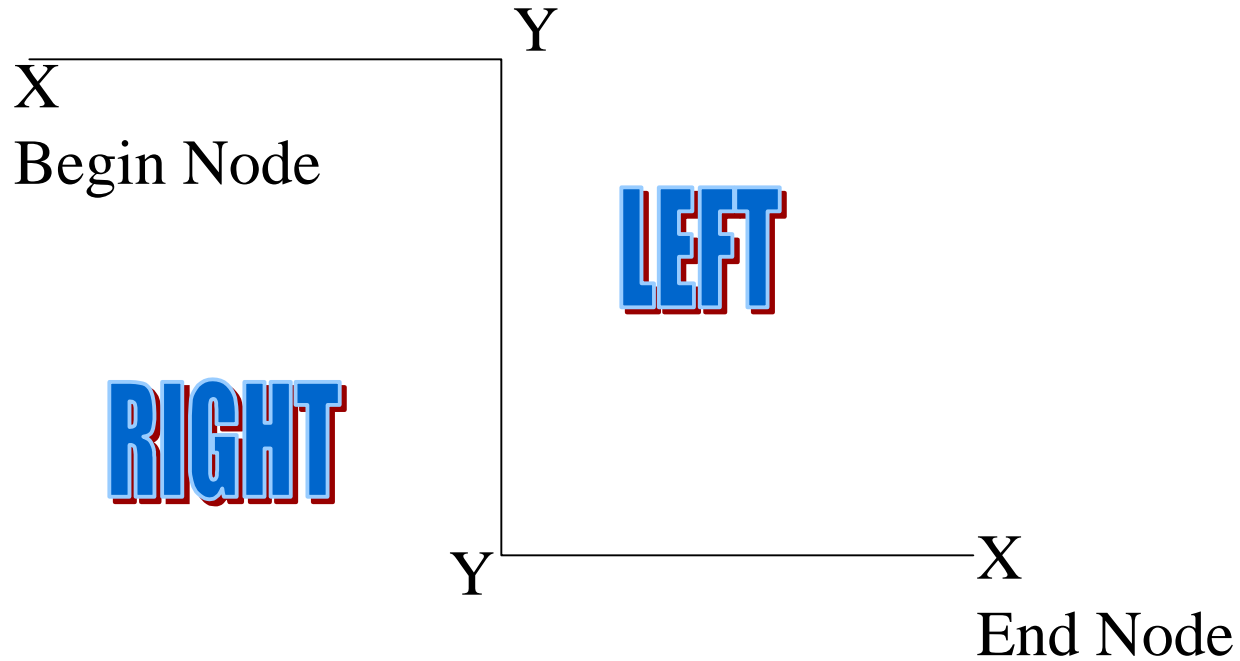
How does It All Work

- Through the digitizing process
- Complex combination of attributing spatial data

Created by JDG 2000

Class slides are based on readings, the current NCGIA Core Curriculum for GIS(ystems) and GIS(cience), Kemp & Goodchild (1991), the NCGIA Core Curriculum Project at UBC, and Foote & Heubner's *The Geographer's Craft*

GEO 447 PRINCIPLES OF GIS



Created by JDG 2000

Class slides are based on readings, the current NCGIA Core Curriculum for GIS(ystems) and GIS(cience), Kemp & Goodchild (1991), the NCGIA Core Curriculum Project at UBC, and Foote & Heubner's *The Geographer's Craft*

GEO 447 PRINCIPLES OF GIS

X Begin Node

Y



XX

Y

Close
Polygon

Created by JDG 2000

Class slides are based on readings, the current NCGIA Core Curriculum for GIS(ystems) and GIS(cience), Kemp & Goodchild (1991), the NCGIA Core Curriculum Project at UBC, and Foote & Heubner's *The Geographer's Craft*

GEO 447 PRINCIPLES OF GIS

Database Essentials

- Entity=phenomena of interest in real world
 - city, road, state
- Object=Digital representation of all or a spatial piece of a real world object
 - pt, line, poly
- Attributes=information about a single entity
 - income, direction, distance

GEO 447 PRINCIPLES OF GIS

Conceptual Database

Name	Attribute	Object Class
1qr2	100	Poly



**This attribute could be inputted (average daily income in county 1qr2)
or calculated based on spatial operator (100 wells in County 1qr2)**

GEO 447 PRINCIPLES OF GIS

RDMS

- Relational Database Management System recognizes and joins spatial-attribute, attribute-attribute, and spatial-spatial relationships
- The key to preserving these relationships is a unique identifier for each spatial object, planar enforcement, and consistent attributing

GEO 447 PRINCIPLES OF GIS

Shopping Centers (points):

	Parking spaces	Stores
1	1,000	45
2	800	25
3	2,000	90

Neighborhoods (areas):

	Population	Average income
1	3,500	45,000
2	4,000	40,000
3	6,000	35,000
4	5,500	30,000
5	5,000	35,000

Trips (point-area object pairs):

Origin	Center	Trips	Distance
1	1	36,000	2
1	2	4,000	5
1	3	7,000	7
2	1	8,000	5
2	2	10,000	3
2	3	75,000	2
3	1	70,000	2
3	2	120,000	1
3	3	30,000	3
4	1	3,000	8
4	2	10,000	4
4	3	35,000	4
5	1	25,000	3
5	2	3,000	6
5	3	5,000	9

Data: information on shopping centers, residential neighborhoods of consumers, and trips made per year from neighborhoods to shopping centers.

GEO 447 PRINCIPLES OF GIS

Ideal Databases are...

- Contemporaneous
- Updated
- Positionally Accurate
- Detailed Inversely to Scale
- Mathematically & Spatially compatible with overlay data
 - same value type