

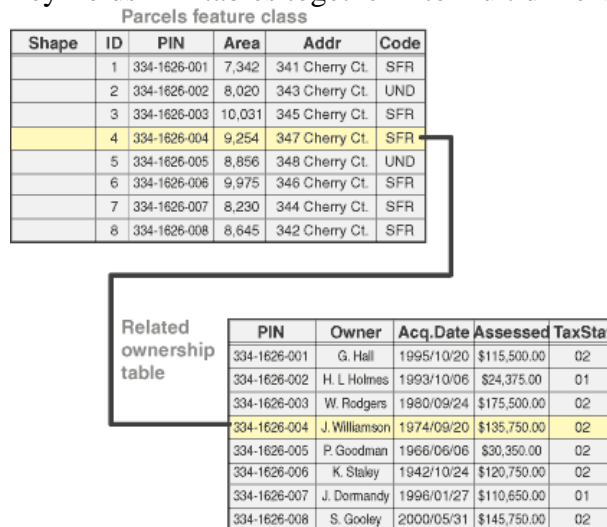
Database Management and Attribute Data in GIS

- I. Introduction
 - a. Spatial Data – geometry and positions of map features
 - i. E.g. line layer representing county roads
 - b. Attribute Data – characteristics of features
 - i. E.g. information attached to roads including street name, address ranges, zip codes, road type, etc.
 - c. Georelational Data Model – attributes and map elements are stored separately and linked by index of a common feature ID code.
 - i. Synchronized indexing between feature and attribute files allows:
 - 1. Queries – questions of data and multiple groups of data and how they relate
 - 2. Storing of data, retrieval
 - d. Raster Model – attributes are attached to grid cells directly, and stored in the same file (i.e. no multiple files)
- II. Definitions
 - a. Data Tables – matrix of rows and columns
 - i. Rows = records
 - ii. Columns = fields
 - b. Feature Attribute Table – connected to map elements and spatial information
 - i. Map elements linked to table attributes by Feature ID
 - c. Nonspatial Data Table – isolated matrix of information not attached to map elements or spatial information
 - d. Type of Attribute Data
 - i. Categorical Data
 - 1. Nominal data-categories or classes
 - 2. Ordinal data – ranking information (low, moderate, high)
 - ii. Numeric Data
 - 1. Interval data – ranges of numerical values
 - 2. Ratio data – numerical values
- III. Geodatabase-attributes are managed in tables based on a series of simple yet essential relational data concepts;
 - a. Tables contain rows (records), All rows in a table have the same columns.
 - b. Each column (fields) has a data type, such as integer, decimal number, character, and date.
 - c. A series of relational functions and operators (such as SQL) is available to operate on the tables and their data elements.
 - d. Attribute data types in the geodatabase**
 - i. **Numbers:** Can be one of four numeric data types:
 - 1. short integers-numbers without decimals (e.g. 2, 3, 4; range -32,768 to 32,767)
 - 2. long integers-numbers without decimals (e.g. 12,345,678; range 2,147,483,648 to 2,147,483,647)
 - 3. single-precision floating-point numbers (often referred to as floats; decimal-based numbers, e.g. 3.456; range = Approximately -3.4E38 to 1.2E38),
 - 4. double-precision floating-point numbers (commonly called doubles; range = Approximately -2.2E308 to 1.8E308).
 - 5. Number Field Definitions
 - a. “Precision” = field length (number of characters in field)
 - i. Single Float: precision = 1-6
 - ii. Double Float: precision = 7+

- b. "Scale" = No. of decimal places
 - i. Short integer scale = 0
 - ii. Long integer scale = 0
 - iii. Single Precision Float = 1-6
 - iv. Double Precision Float 0+
- ii. **Text (strings):** Any set of alphanumeric characters of a certain length.
- iii. **Date:** Holds date and time data.
- e. Field Definitions
 - i. When creating new fields in a database, one must define the field type:
 - 1. Field name (column title)
 - 2. Width – number of spaces reserved for the field (precision)
 - 3. Data type (numeric or string)
 - 4. Number of decimal digits (scale)

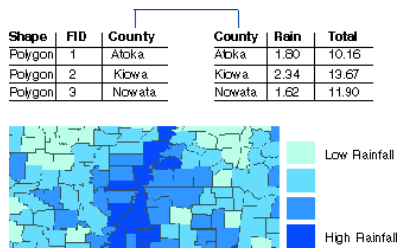
IV. Database Management System (DBMS)

- a. Software package that builds and manipulates databases
 - i. Tools: data input, search, query, retrieval, manipulation, output
 - 1. E.g. Microsoft Access, ORACLE
- b. Geodatabase – a software system that stores both the spatial (map elements) and attribute data tables in a single database
 - i. ArcGIS employs the geodatabase model
- c. Relational Database Model
 - i. Flat file = all data contained in 1 table matrix
 - ii. Hierarchical Data – data organized at many levels so that one-to-many associations can be determined
 - iii. Relational Database – a collection of tables linked by relations; allows modular design and data management
 - iv. Key Fields – one or more attribute fields whose values uniquely identify a record in a table
 - 1. Key fields link tables together into multidimensional, hierarchical models



V. Types of Database Relationships

- a. One to one relations – one record from one table directly related to one record from another table



b. One to many relations – one record in a table related to many records in another table

Shape	FID	LU_Code	LU-Code	Description
Polygon	1	2	1	Single Family
Polygon	2	1	2	Agriculture
Polygon	3	1	3	Commercial



c. Many to many relations – many records of one table related to many records of another

VI. Joining and Relation Tables (linking multiple tables together)

a. Join – operation combines tables together via a key field; physical merging on tables.

i. One to one or many to one relationships

ii. Spatial Join – associating data based on overlapping positions in space

1. The closest feature to another feature
2. What's inside a feature
3. What intersects a feature
4. How many points fall inside each polygon

b. Relate – temporarily connects two tables, but keeps them physically separate

- i. Unlike joining tables, relating tables simply defines a relationship between two tables. The associated data isn't appended to the layer's attribute table like it is with a join. Instead, you can access the related data when you work with the layer's attributes.

VII. Database Manipulation

- a. Adding / removing fields
- b. Adding / removing records
- c. Computation of attribute data (arithmetic manipulation; field algebra; statistical summaries)
- d. Sorting fields (ascending, descending)