

## **Chapter 8. ATTRIBUTE DATA INPUT AND MANAGEMENT**

### 8.1 Attribute Data in GIS

#### 8.1.1 Type of Attribute Table

#### 8.1.2 Database Management

#### 8.1.3 Type of Attribute Data

#### *Box 8.1* Categorical and Numeric Data

### 8.2 The Relational Model

#### 8.2.1 SSURGO: A Relational Database Example

#### 8.2.2 Normalization

#### 8.2.3 Types of Relationships

### 8.3 Joins, Relates, and Relationship Classes

#### 8.3.1 Joins

#### 8.3.2 Relates

#### 8.3.3 Relationship Classes

### 8.4 Attribute Data Entry

#### 8.4.1 Field Definition

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### 8.5 Manipulation of Fields and Attribute Data

#### 8.5.1 Adding and Deleting Fields

#### *Box 8.2* Add and Delete Fields in ArcGIS Desktop

#### 8.5.2 Classification of Attribute Data

#### 8.5.3 Computation of Attribute Data

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### Key Concepts and Terms

### Review Questions

### **Applications: Attribute Data Entry and Management**

Task 1: Enter Attribute Data of a Geodatabase Feature Class

Task 2: Join Tables

Task 3: Relate Tables

Task 4: Create New Attribute by Data Classification

Task 5: Use Advanced Method for Attribute Data Classification

Task 6: Create New Attribute by Data Computation

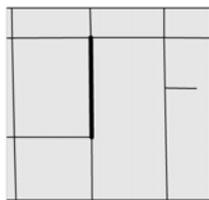
Task 7: Create Relationship Class

Challenge Question

References

# Attribute Data

- Attribute data are stored in tables.
- An attribute table is organized by row and column.
- Each row represents a spatial feature, each column describes a characteristic, and the intersection of a column and a row shows the value of a particular characteristic for a particular feature.



FEDIRP	FENAME	FETYPE	FRADDL	TOADDL	FRADDR	TOADDR	ZIPL	ZIPR
N	4th	St	6729	7199	6758	7198	83815	83815

**Figure 8.1**

Each street segment in the TIGER/Line files has a set of associated attributes. These attributes include street name, address ranges on the left side and the right side, as well as ZIP codes on both sides.

# Feature Attribute Table

- A feature attribute table has access to the spatial data. Every vector data set must have a feature attribute table.
- For the georelational data model, the feature attribute table uses the feature ID to link to the feature's geometry.
- For the object-based data model, the feature attribute table has a field that stores the feature's geometry.

Record	Soil-ID	Area	Perimeter
1	1	106.39	495.86
2	2	8310.84	508382.38
3	3	554.11	13829.50
4	4	531.83	19000.03
5	5	673.88	23931.47

**Figure 8.2**

As an example of the georelational data model, the soils coverage uses SOIL-ID to link to the spatial and attribute data.

OBJECTID	Shape	Shape_Length	Shape_Area
1	Polygon	106.39	495.86
2	Polygon	8310.84	508382.38
3	Polygon	554.11	13829.50
4	Polygon	531.83	19000.03
5	Polygon	673.88	23931.47

**Figure 8.3**

The object-based data model uses the Shape field to store the geometry of soil polygons. The table therefore contains both spatial and attribute data.

## Value Attribute Table

An integer raster has a value attribute table, which lists the cell values and their frequencies (count).

OBJECTID	Value	Count
0	160, 101	142
1	160, 102	1580
2	160, 203	460
3	170, 101	692
4	170, 102	1417

**Figure 8.4**

A value attribute table lists the attributes of value and count. The value field refers to the cell value, and the count field refers to the number of cells. A value attribute table differs from the feature attribute tables in Figures 8.2 and 8.3.

Label-ID	pH	Depth	Fertility
1	6.8	12	High
2	4.5	4.8	Low

→ Row

↓  
Column

**Figure 8.5**

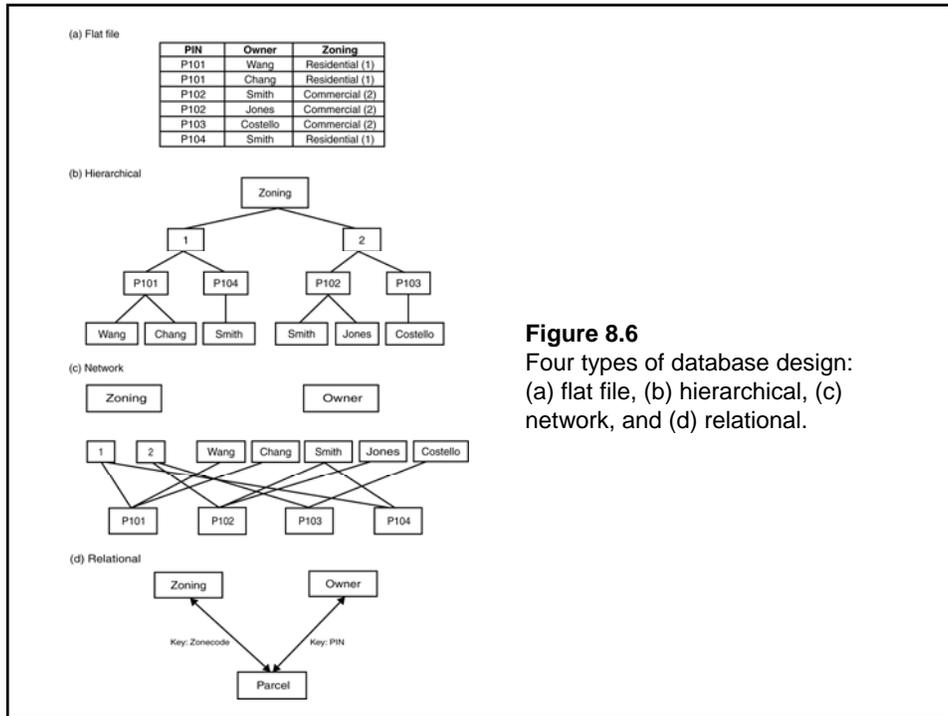
A feature attribute table consists of rows and columns. Each row represents a spatial feature, and each column represents a property or characteristic of the spatial feature.

## Type of Attribute Data

- One method for classifying attribute data is by data type. Common data types are number, text (or character), date, and binary large object (BLOB).
- Another method is to define attribute data by measurement scale. The measurement scale concept groups attribute data into nominal, ordinal, interval, and ratio data, with increasing degrees of sophistication.

## Type of Database Design

There are at least four types of database designs that have been proposed in the literature: flat file, hierarchical, network, and relational.



**Figure 8.6**  
Four types of database design:  
(a) flat file, (b) hierarchical, (c)  
network, and (d) relational.

# Normalization

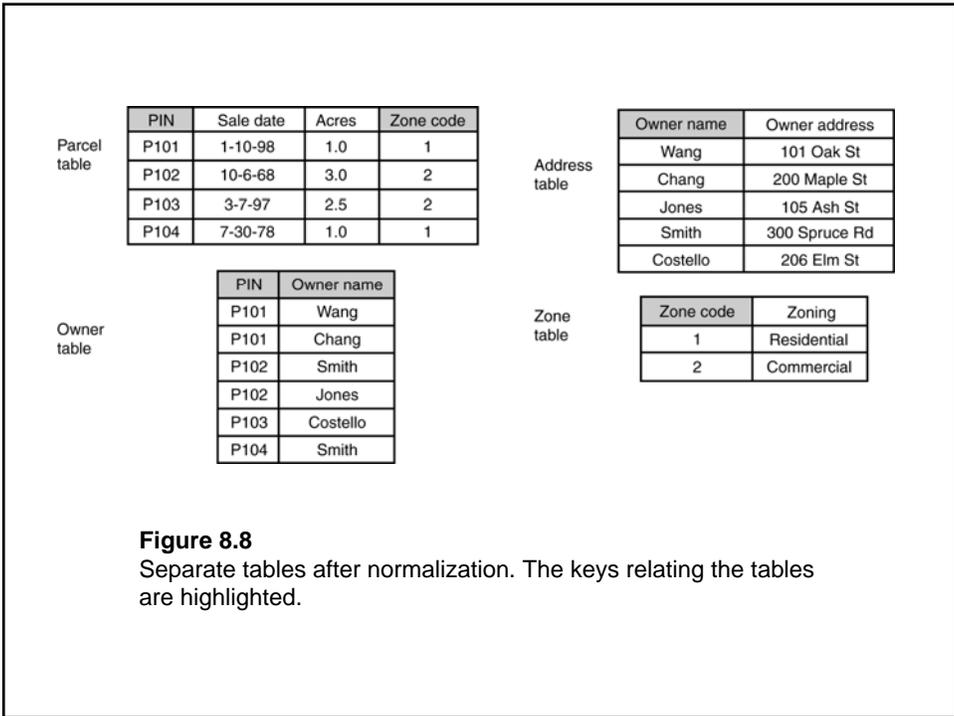
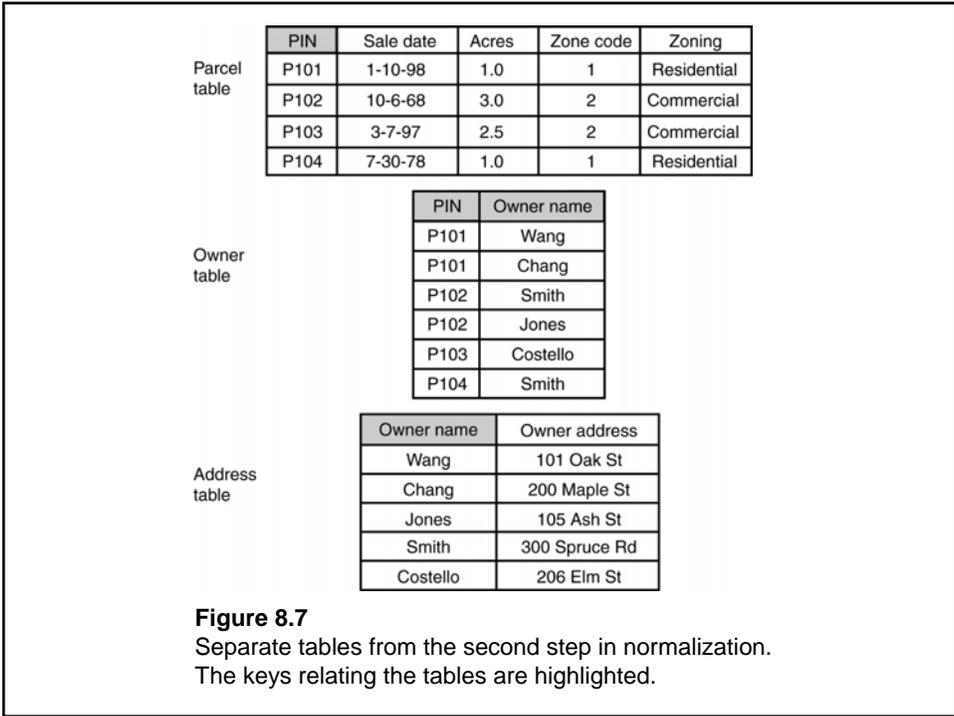
Designing a relational database must follow certain rules. An important rule is called normalization. Normalization is a process of decomposition, taking a table with all the attribute data and breaking it down to small tables while maintaining the necessary linkages between them .

<b>PIN</b>	<b>Owner</b>	<b>Owner address</b>	<b>Sale date</b>	<b>Acres</b>	<b>Zone code</b>	<b>Zoning</b>
P101	Wang	101 Oak St	1-10-98	1.0	1	residential
	Chang	200 Maple St				
P102	Smith	300 Spruce Rd	10-6-68	3.0	2	commercial
	Jones	105 Ash St				
P103	Costello	206 Elm St	3-7-97	2.5	2	commercial
P104	Smith	300 Spruce Rd	7-30-78	1.0	1	residential

**TABLE 8.1** An Unnormalized Table

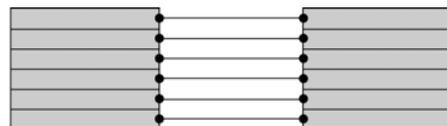
<b>PIN</b>	<b>Owner</b>	<b>Owner address</b>	<b>Sale date</b>	<b>Acres</b>	<b>Zone code</b>	<b>Zoning</b>
P101	Wang	101 Oak St	1-10-98	1.0	1	residential
P101	Chang	200 Maple St	1-10-98	1.0	1	residential
P102	Smith	300 Spruce Rd	10-6-68	3.0	2	commercial
P102	Jones	105 Ash St	10-6-68	3.0	2	commercial
P103	Costello	206 Elm St	3-7-97	2.5	2	commercial
P104	Smith	300 Spruce Rd	7-30-78	1.0	1	residential

**TABLE 8.2** First Step in Normalization

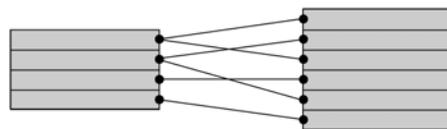


# Type of Relationship

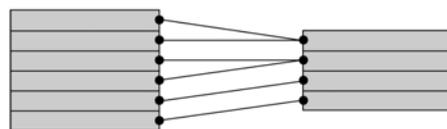
A relational database may contain four types of relationships (also called cardinalities) between tables, or more precisely, between records in tables: one-to-one, one-to-many, many-to-one, and many-to-many.



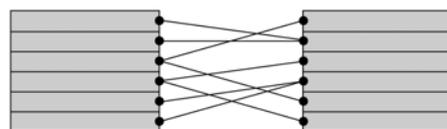
One-to-one relationship



One-to-many relationship



Many-to-one relationship

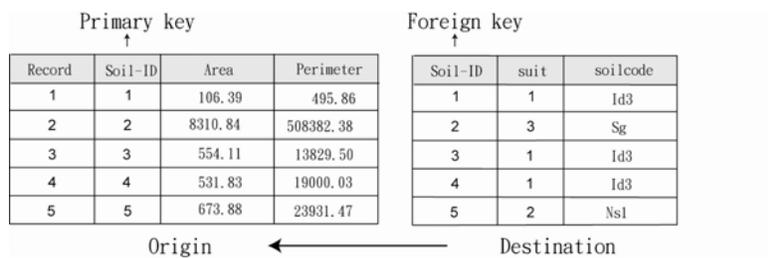


Many-to-many relationship

**Figure 8.9**  
Four types of data relationship between tables: one-to-one, one-to-many, many-to-one, and many-to-many.

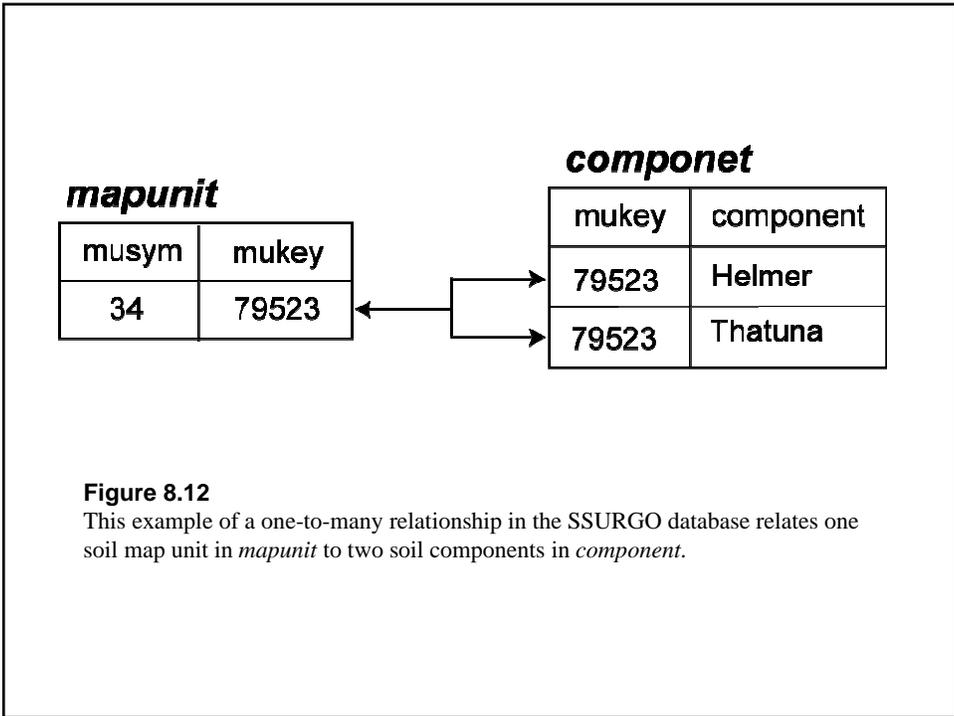
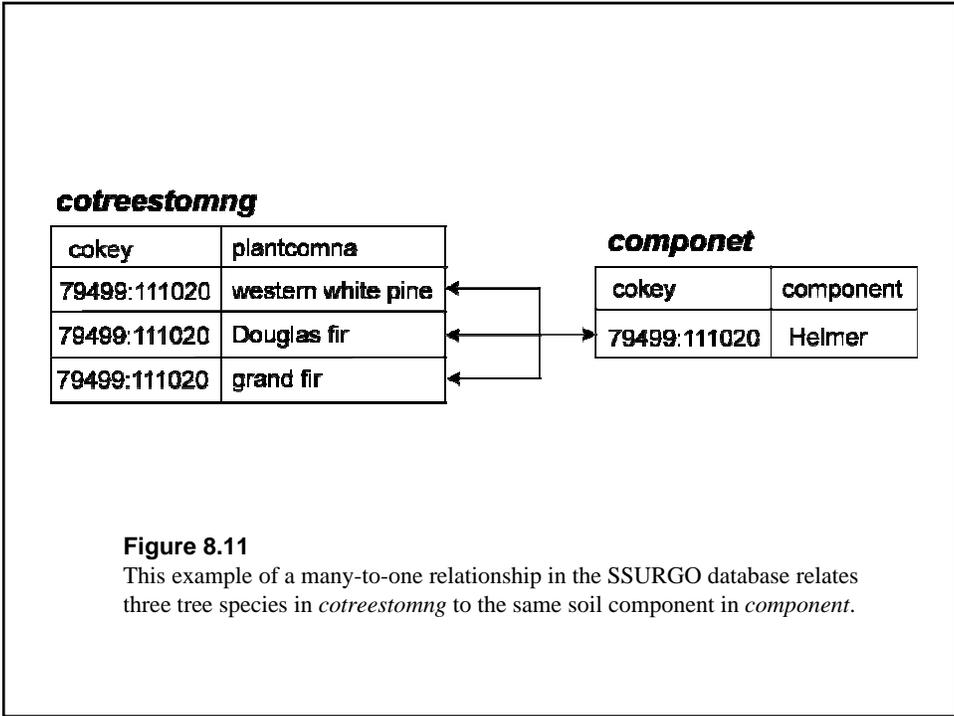
# Join and Relate

- Two common operations for linking tables in a relational database are join and relate.
- A join operation brings together two tables by using a key that is common to both tables.
- A relate operation temporarily connects two tables but keeps the tables physically separate.



**Figure 8.10**

Primary key and foreign key provide the linkage to join the table on the right to the feature attribute table on the left.



Natural Resources Conservation Service: SSURGO

<http://soils.usda.gov/>

SSURGO metadata

<http://soildatamart.nrcs.usda.gov/SSURGOMetadata.aspx>