"Sec1"

1- Introduction

Overview

- Logistics
- Course content
- Introduction to GIS concepts

Teaching methods

- Lectures - Demos - Exercises
- Class materials : - Exercise book - Course CD

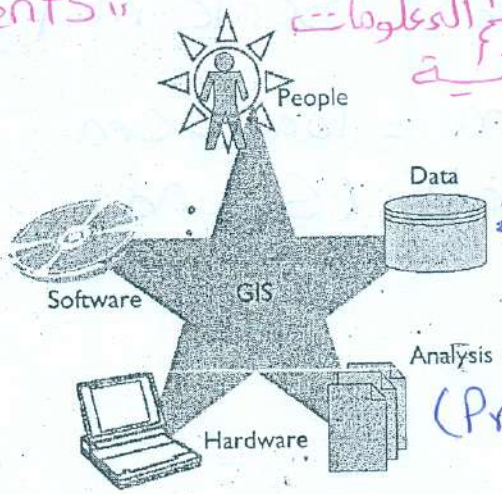
What is a GIS?

- An integration of five basic components

"GIS Components"

1- Software
2- Hard ware
3- People
4- Analysis
5- Data

مكونات نظم المعلومات الجغرافية



(Tabular) Attribute data

Spatial data

(Procedures)

GIS functions: وظائف
- Capture - Store - Query - Analyze - Display - Output
إدخال وجمع تخزين استعلام تحليل عرض إخراج

Capturing data طرق جمع البيانات
Paper maps – digital data – GPS – coordinates -…
من أين يتم الحصول على البيانات ؟

Storing data

- **Vector formats** متجهة
  - Use points , lines , area to model reality
- **Raster formats** مستمرة
  - Use square cells to model reality

لتقسيم وتخزين البيانات في

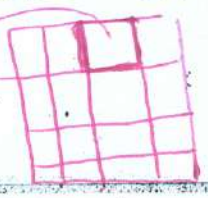
"Vector"

لتمثيل البيانات في ثلاثة أنواع من الأشكال الهندسية نقط ، خطوط ، مضلعات
Point, Line, Polygon

"Raster"

لتمثيل البيانات في صورة خلايا متساوية الأبعاد مثل معظم البيانات المتحصل عليها من المرئيات الفضائية مثل Elevation ، pH

Pixel



Feature → شئ موجود على الخريطة يقابله شئ موجود في الواقع

→ ① identify

selection (by attribute, by Location)

Query حرف البحث

① ▪ Identifying specific features (specific)

② ▪ Identifying features based on conditions

تحديد مظاهر معينة عن طريق المكان

تحديد مظاهر وصفات معينة بدون المكان

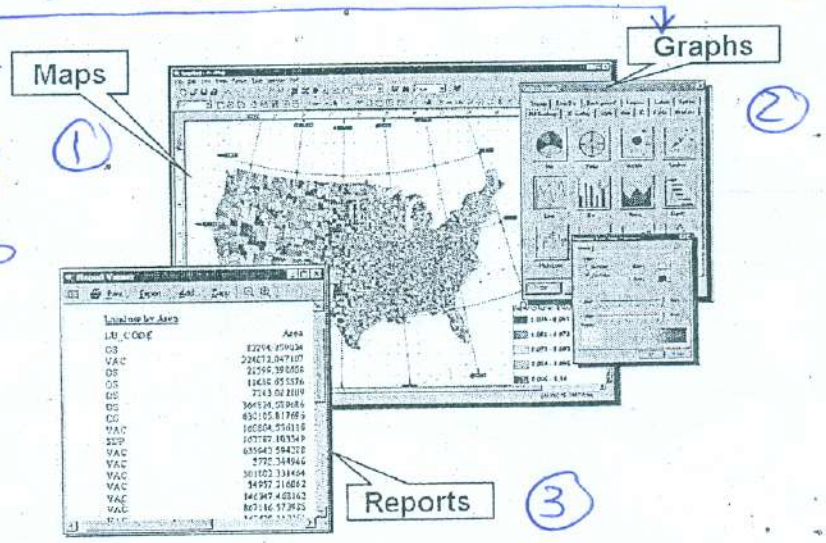
Analysis حرف التحليل

- Proximity - Overlay - Network

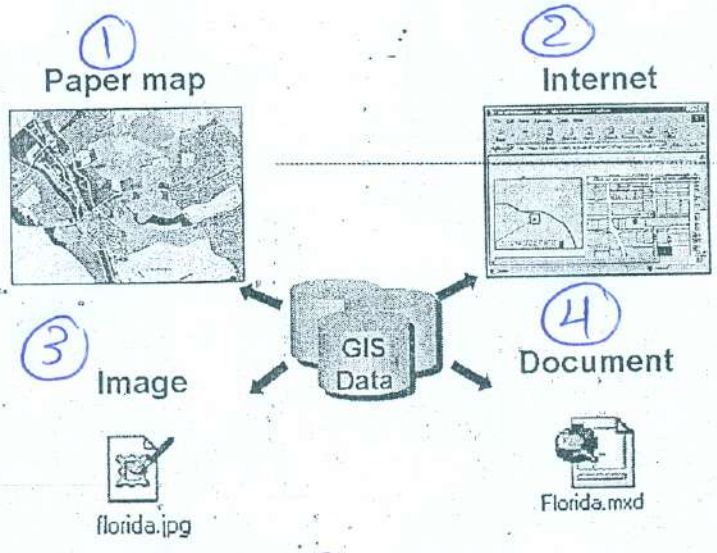
Display حرف العرض

شبكية طبقية إحصائية أى

علاقة المظاهم ببعضها أى تحديد مكان داخل منطقة



Output أشكال إخراج البيانات



مكونات البيانات الجغرافية

Components of geographic data

- Three general components to geographic information:
  - Attributes – Geometry - Behaviour (Rules)

① بيانات وصفية وصفية

② على الهندسة من ثلاث أماكن Point Line, area

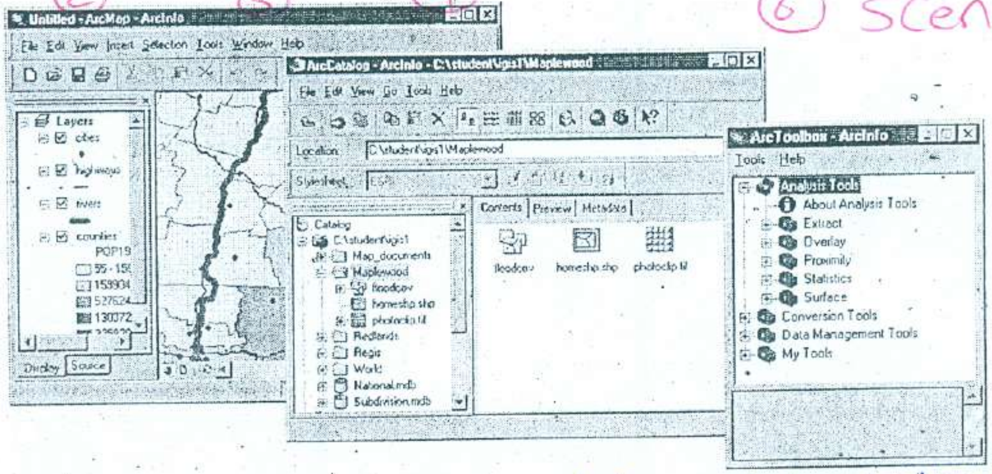
③ تحدد بواسطة القاعدة بإدخال البيانات streets and highways

Overview of applications
تطبيقات ووظائف ومكونات ArcGIS

- All ArcGIS products share common applications
- ArcMap, ArcCatalog, ArcToolbox

(1) (2) (3) (4)

(4) Arc Reader
(5) Globe
(6) Scene



Demonstration
- **Observe ArcCatalog** → يستخدم هذا البرنامج لتصنيع ملفات وإدارتها بشكل أسهل بالإضافة إلى عمل إرتباطات مع مصادر البيانات الأخرى مثل قواعد البيانات ومواقع الانترنت
  - Directory structure **and navigation**
  - Documentation
- **Observe ArcMap** → يستخدم لرسم الخرائط وإدخال البيانات ومعالجتها بالإضافة إلى الأدوات التي تقوم بكل الوظائف المتعلقة بالخرائط والبيانات
  - Add data
  - Display and query data
  - Zoom and pan tools
  - Save a map document
- **Observe ArcToolbox** → يستخدم للتحليل ويتكون من مجموعة من الأدوات المستخدمة في برنامج ArcMap ArcCatalog ويمكن بواسطته تشغيل أدوات من خارج البرنامج
  - Toolkits

Exercise overview
- Exercise A: Run the class database setup program
- Exercise B: Use the software to:
  - Start ArcMap
  - Examine some feature layers and their organization
  - Identify relationships between geographic features
  - Associate descriptive information with a layer
  - Identify specific features
  - Select geographic features based on certain conditions
  - Challenge step: More fun with queries

Arc Scene → عرض الملفات ثلاثية الأبعاد ويحوي أدوات للتعامل مع بيانات لعمل الخرائط الكنتورية ومناسيب النقاط وإظهار الخط

Arc Reader → عرض الخرائط والبيانات فقط ويمكن من خلاله فقط عرض الخرائط بدون إستخدام ArcMap

Arc Globe → عرض الخرائط في شكل مجسم وإجراء المعالجة على البيانات

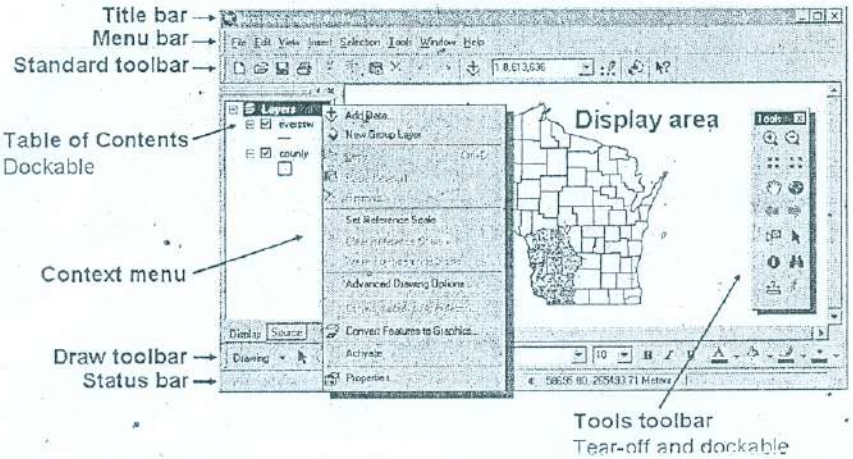
2- Displaying data

Overview

- The ArcMap interface and tools
- Data View and Layout View
- Layers, data frames, and map elements
- Layer properties for symbols and labels
- Scale dependant display
- Spatial bookmarks

مكونات واجهة برنامج ArcMap

The ArcMap interface



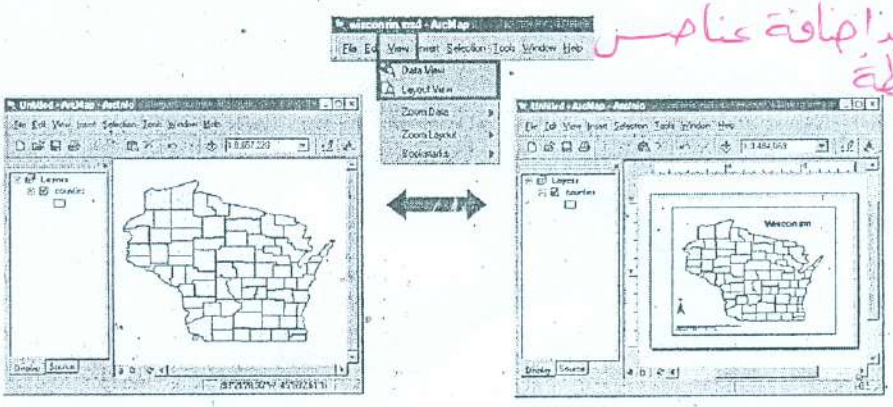
- Primary display application
- Perform map-based tasks
  - Displaying - Editing - Querying - Analyzing - Charting - Reporting

Data View or Layout View?

- Data view for display, queries, editing and analysis
- Layout view for creating map layouts

تعرض الخريطة في الطبقة بالشكل الذي نريده

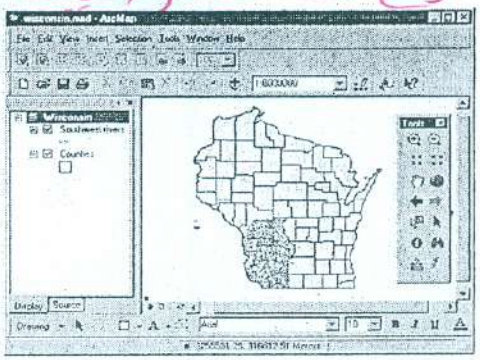
إخراج للطباعة بعد إضافة عناصر الخريطة



Layers, data frames, and maps

مجموعة من الخطاط مع البيانات الوصفية

- Layer
  - Represent symbolized spatial data



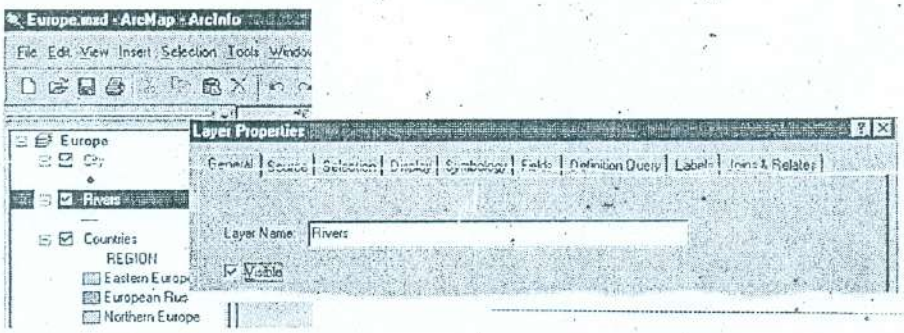
- Data frame
  - Organizes layers
- Map
  - Contains data frames, layers, and map elements

يقوم بتنظيم الطبقات

Feature

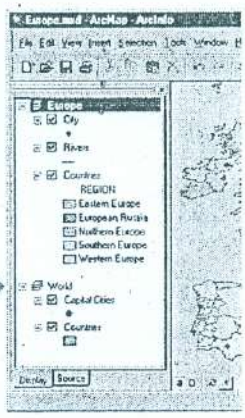
Layers

- Reference spatial data sources
- Set symbols, labels and other properties
- Manipulate through context menu



Data frames

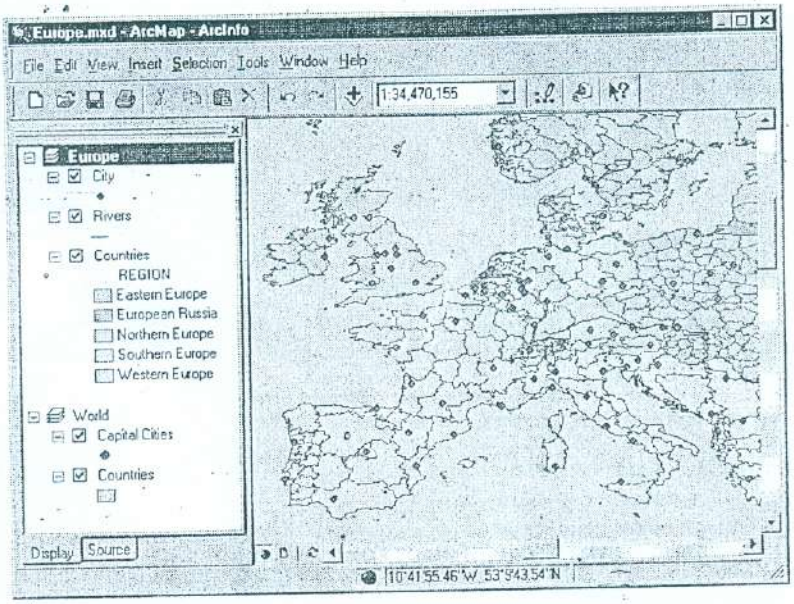
- Data frames are containers for layers
- Maps can have many data frames



- Activate data frames to view from context menu

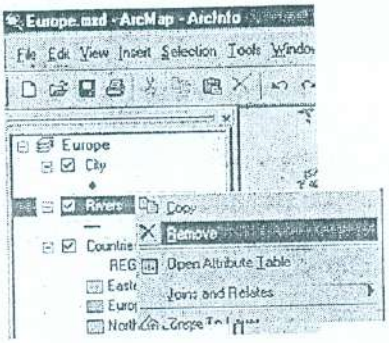
Maps

- Holds layers, data frames, graphics, map elements
- Stores information in a map document (.mxd) file

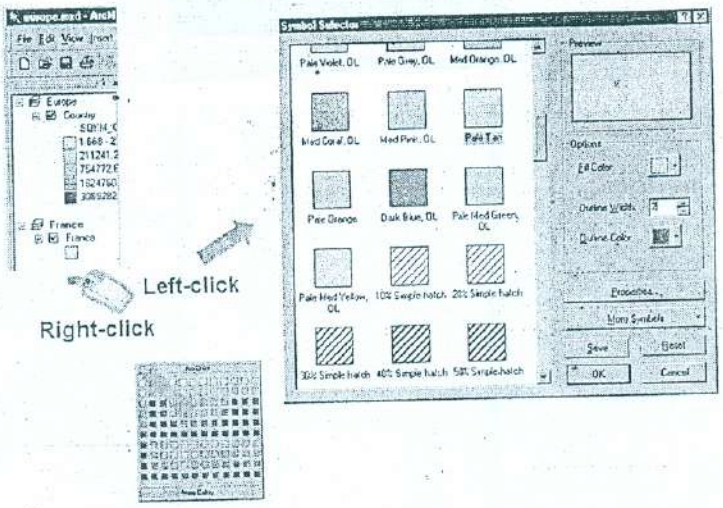


Managing the Table of Contents

1. Drag layers up or down to change display order
   - Smart defaults for layer draw order
     - Point, lines on polygons
   - Layers draw in the Table of Contents order, from the bottom-up
2. Rename data frames and layers
3. Remove layers
4. Display or Source tabs



Changing symbol properties

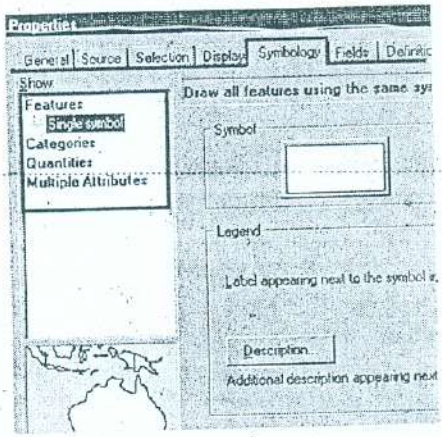


Scale-dependent display

- Reduces clutter
- Reduces drawing time
- Layer display property

Layer symbology in ArcMap

1. Features
   - Single symbol
2. By attribute value
   1. Categories
      - Unique values
      - Match to symbols in a style
   2. Quantities
      - graduated colors or symbols
      - proportional symbols
   3. Multiple attributes
      - quantity by category



Saving a layer file

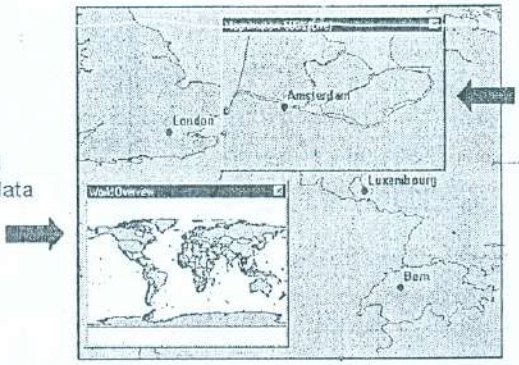
- Save symbology for use in other map documents
- Layer files : lyr extension
  - .lyr extension

Labeling features

- Label features dynamically using attribute values
- Layer properties control appearance and position
- Convert labels to annotation features

Magnifier and overview windows

- See more detail or overview without changing display



Move over display like a magnifying glass

Shows full extent of data

Exercise overview

- Add layers
- Change layer names
- Classify and symbolize spatial data
- Label features
- Create a map layout
- Set map scale
- Save map document
- Challenge: Save labels as annotation

3- Querying your database

Overview

- Tools for examining your data

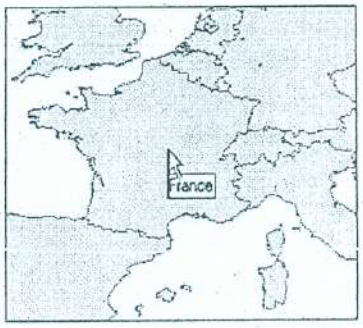
- Map tips, Identify, Find, Measure, Hyperlink

- Working with the selection tools
  - Why do you need a selection
- Available selection tools
- Selection methods and layers
- Spatial selection
- Attribute selection
- Calculating summary statistics

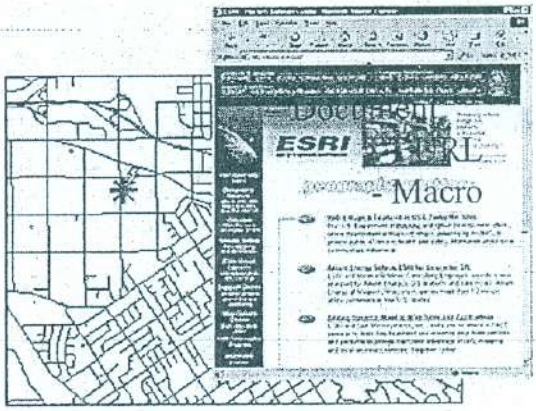
Map tips and hyperlinks

- Display property of a layer
- Map tips

- Pointer location displays specific attribute

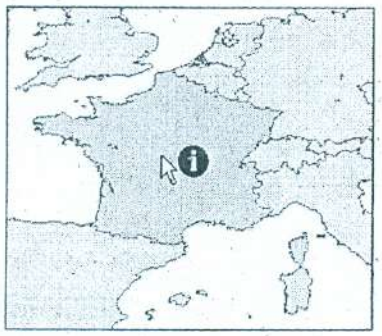


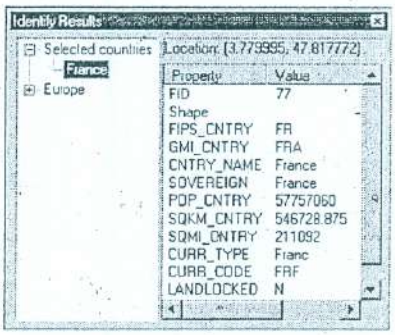
- Hyperlinks



Identifying

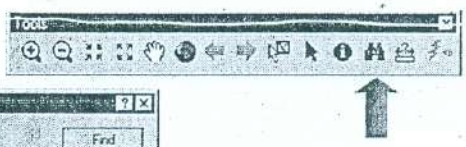
- Popup attributes for a specific feature

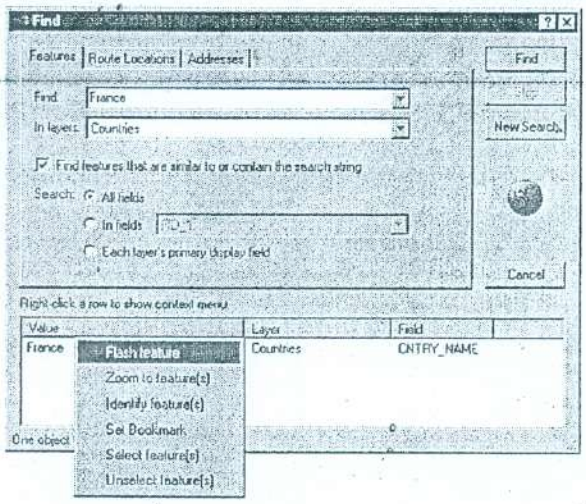




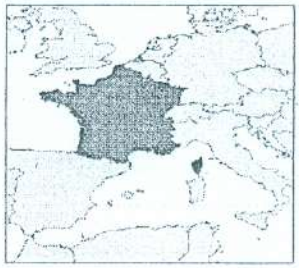
Finding

- Locate a specific feature or attribute



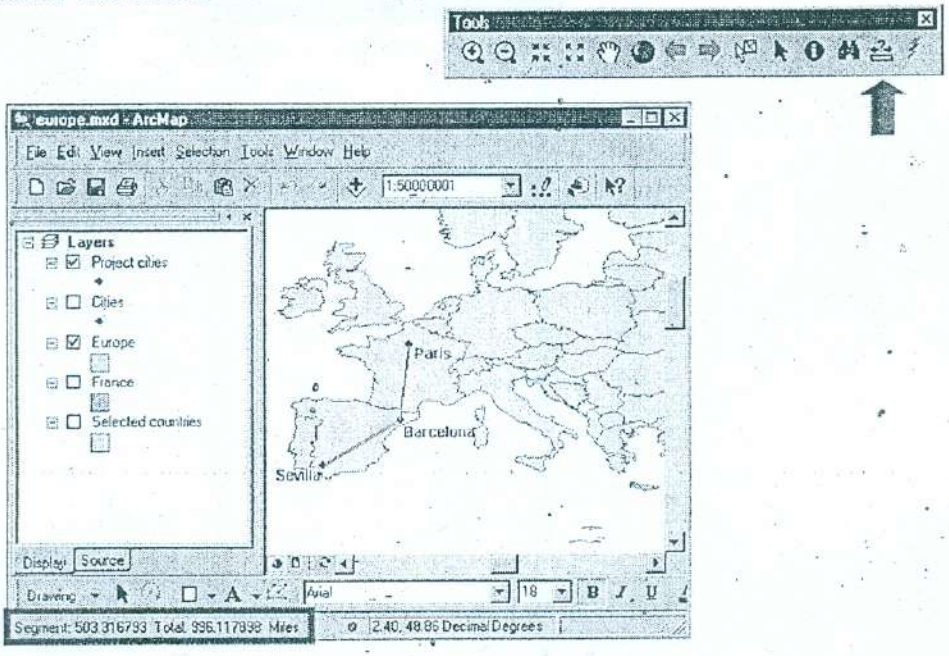


France flashes



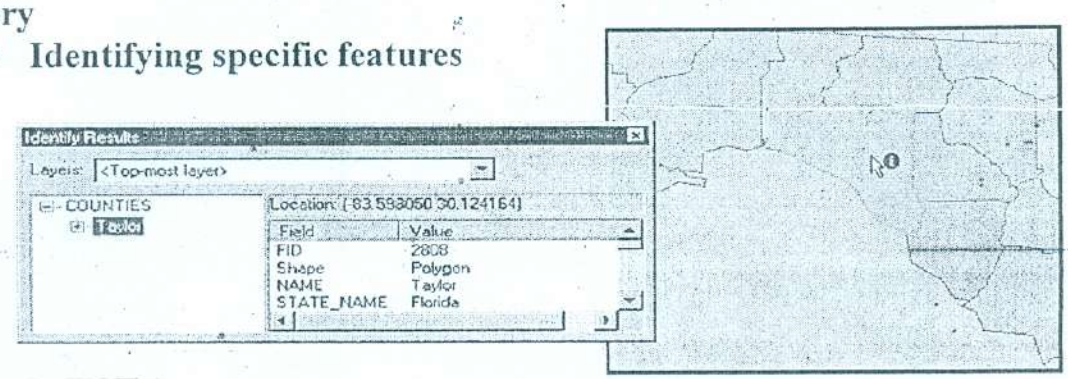
Measuring

- Find linear distances



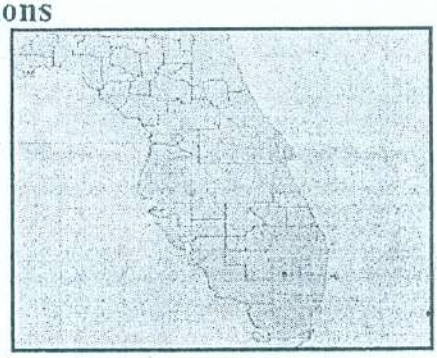
Query

- Identifying specific features



- Identifying features based on conditions

Florida counties with a population greater than 300,000



Using spatial relationships

- The relative position of features determines relationships

I-80 *connects* San Francisco and New York

San Francisco is *contained* in California

I-80 has *length* and *direction*

Analysis

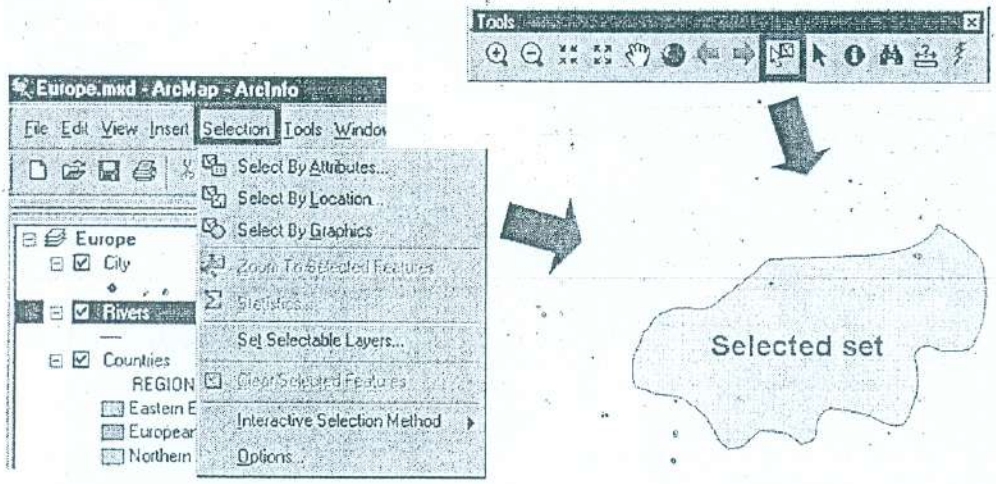
- Proximity - Overlay - Network

Why do you need a selection?

- Use to select other features
- Focused analysis
- Create a new layer
- Convert to graphics
- Edit
- Report
- Export
- Calculate statistics

Available selection tools

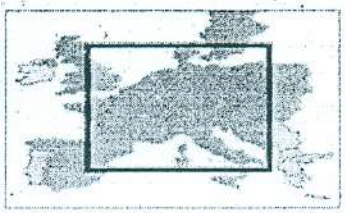
- Interactive, attributes, location, graphics



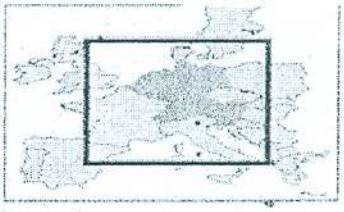
Interactive selection options

- Options from Selection menu

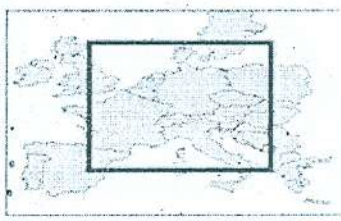
- Select features partially or completely within the box or graphic(s)



- Select features completely within the box or graphic(s)



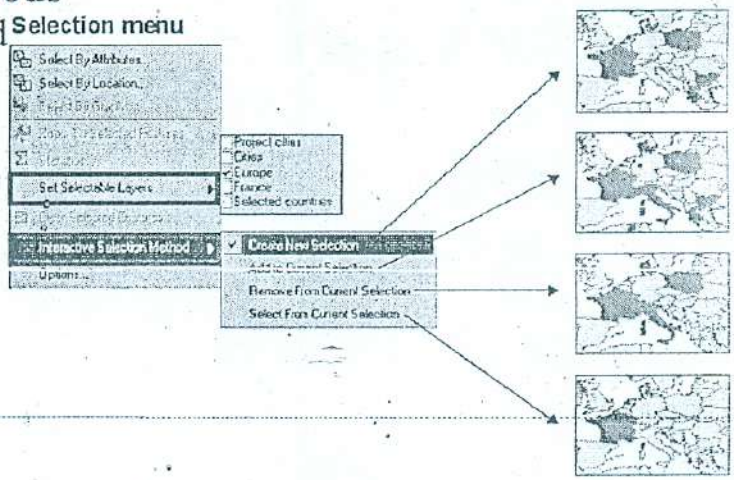
- Select features that the box or graphic are completely within



Interactive selection methods

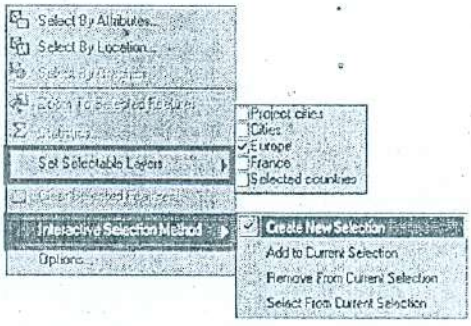
- Specify selection method

- Create New Selection
- Add to Current Selection
- Remove From
- urrent Selection
- Select from Current Selection



Selection methods and layers

- Specify from Selection menu
  - Layer(s) to select from
  - Selection method



Create new selection

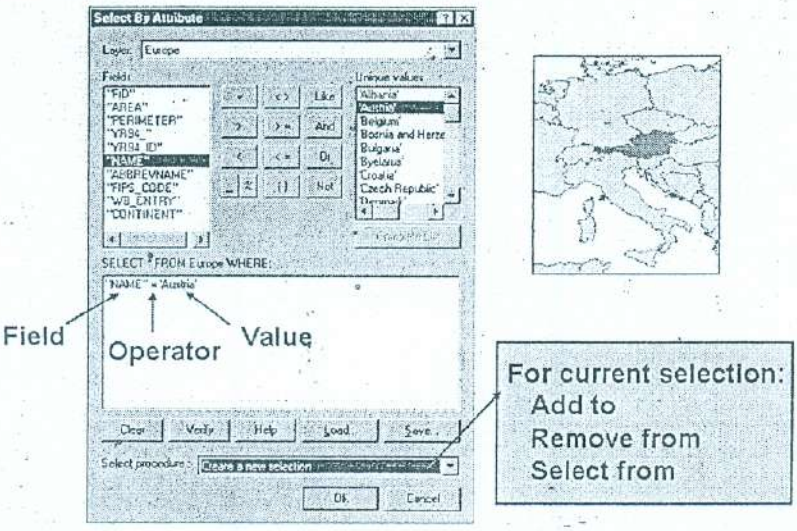
Add to the selection

Remove from the selection

Select from selection

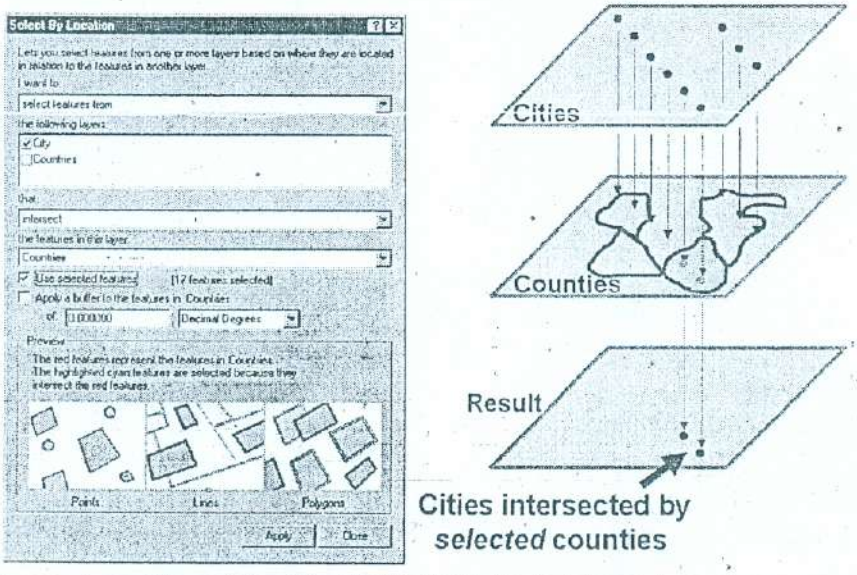
Attribute selection

- Use an SQL statement to select features
- Save and reload selection expressions



Select by location (spatial query)

- Use features in one layer to select features in another



Location selection methods

- Select by Location offers many selection methods

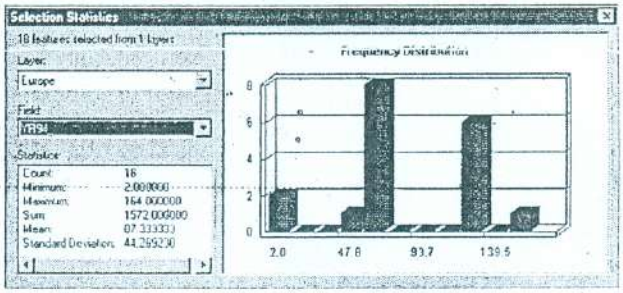
- Intersects
- Are contained by
- Shares a point
- Are identical
- Contain
- Shares a line segment
- Within a distance
- Others…

Selection by graphics

- Draw a graphic to select features
- Works with interactive selection methods

Calculating summary statistics

- Select
  - Features



  - layer
  - Field

Exercise overview

- Add map tips and identify features
- Find a specific feature
- Take measurements
- Make a spatial query
- Examine your selection in the tables
- Calculate statistics for your selection
- Create a selection layer
- Explore other selection methods
- Making attribute selections
- Challenge: Export a layer to a separate file

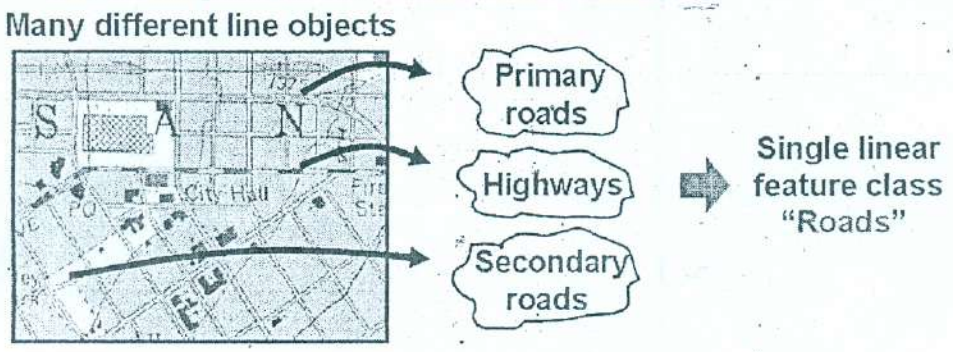
4- Working with spatial data

Overview

- Linking features and attributes
- Data formats
- Metadata
- Geography Network

Introducing feature classes

- Collections of features with the same type of geometry
- Can create point, line, or area feature classes



Spatial data formats:

- ArcGIS can work with spatial data in multiple formats

Data format: Shapefile

- Single feature class
- Attributes stored in dBASE table

Data format: Coverage

- A folder containing multiple feature classes
- Can store point, line, polygon feature classes, and more
- Attributes stored in a separate INFO table

Data format: Geodatabase

- Stores spatial features and their attributes in the same RDBMS
- Feature classes can be stand-alone or grouped in a feature dataset
- Feature datasets model spatial relationships

Data format: CAD files

- Computer Aided Design files (DXF, DWG, DGN)
- Edit after conversion to coverage or geodatabase feature class

Tabular locations
- Table to point feature class

Images and grids

Introducing metadata

- What is metadata?
- Metadata tab: - Description - Spatial - Attributes
- Create and edit metadata
- Display metadata using different formats:
  - FGDC - ESRI - XML

Using Geography Network data

- Map or Data services
- Data clearinghouses
- Geoservices and solutions
- The Geography Network Explorer

Exercise overview

- **Exercise A**

- Create a new folder connection in ArcCatalog
- Examine shapefiles, coverages, geodatabases, CAD, and raster formats
- Optional Exercise B
- Online Geography network exercise

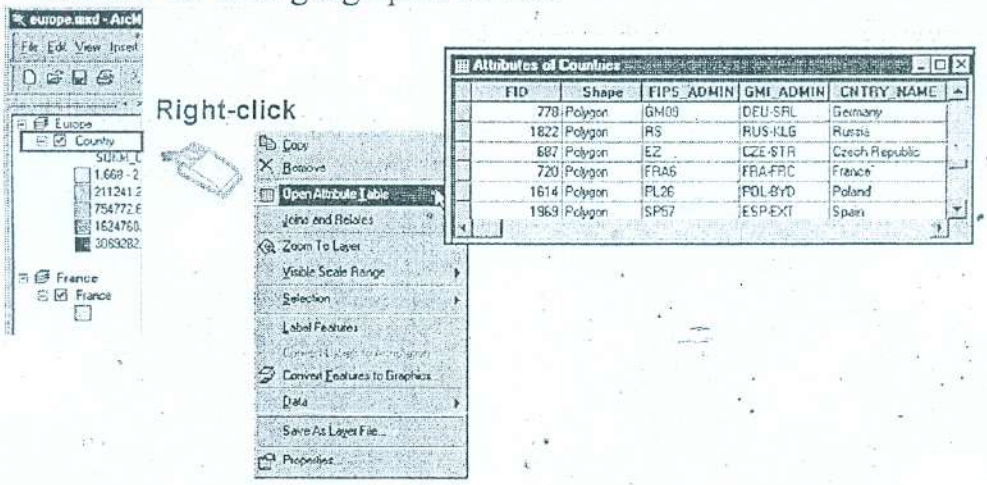
5- Working with tables

Overview

- Table structure
- Data types
- Table manipulation
- Connecting tables
- Working with graphs and reports

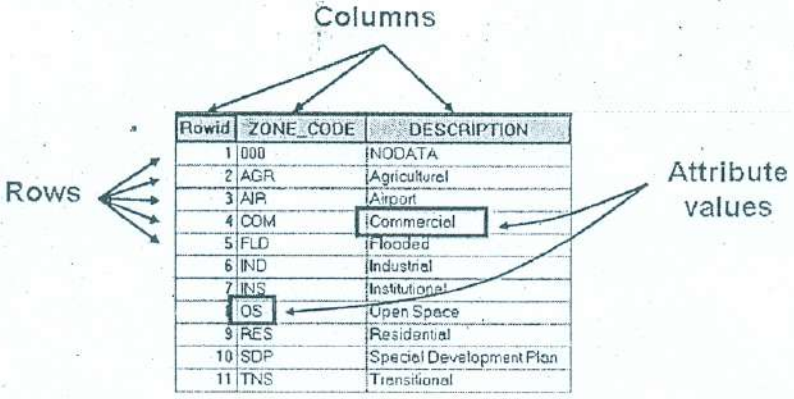
Tables

- Descriptive information about features
- Each feature class has an associated table
- One row for each geographic feature



Understanding table anatomy

- Basic table properties
  - Records/rows and fields/columns
  - Column types can store numbers, text, dates
  - Unique column names



Tabular data field types

- Different field types store different kinds of values
- Choose the right field type for the right value
- Field types vary according to table format

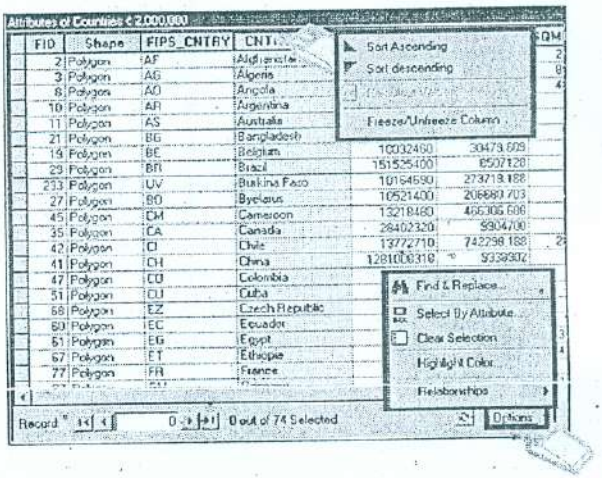
Date of Comet Shoemaker-Levy impact: 7/16/1994

Text	Date	Short	Long	BLOB	Float
Jupiter	7/16/1994	16	142984		9.8

Table manipulation

- Open table in ArcMap or preview in ArcCatalog

- Sort ascending or descending
  - Freeze/Unfreeze columns
  - Statistics
- In ArcMap
  - Select records
  - Modify table values



Associating tables

- Can store attributes in feature table or separate table
- Associate tables with common column key values
- Must know table relationships (cardinality)

Feature attribute table

FID	Shape	AREA	PERIMETER	ZONE#	ZONE-ID	ZONE_CODE
29	Polygon	139761.1	3436.182685761	29	31	RES
30	Polygon	19311.13	1227.994790069	30	25	AIR
31	Polygon	1394.393	269.1550402356	31	35	IND
32	Polygon	10618.85	433.2512163686	32	33	RES
33	Polygon	9529.783	418.2222455404	33	34	RES
34	Polygon	16141.69	812.9035032412	34	38	000
35	Polygon	44579.73	879.9199925836	35	36	IND
36	Polygon	74082.59	1254.269129168	36	37	SDP
37	Polygon	11033.96	439.7286402905	37	39	RES
38	Polygon	9639.264	428.0301261116	38	41	RES
39	Polygon	63731.44	4448.706737875	39	40	AGR

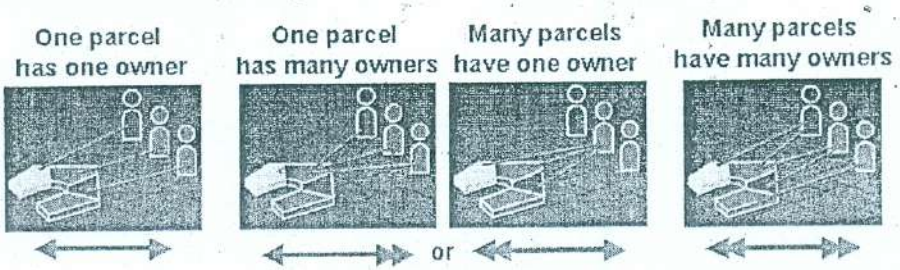
Additional attribute table

Rowid	ZONE_CODE	DESCRIPTION
1	000	NODATA
2	AGR	Agricultural
3	AIR	Airport
4	COM	Commercial
5	FLD	Flooded
6	IND	Industrial
7	INS	Institutional
8	OS	Open Space
9	RES	Residential
10	SDP	Special Development Plan
11	TNS	Transitional

Table relationships

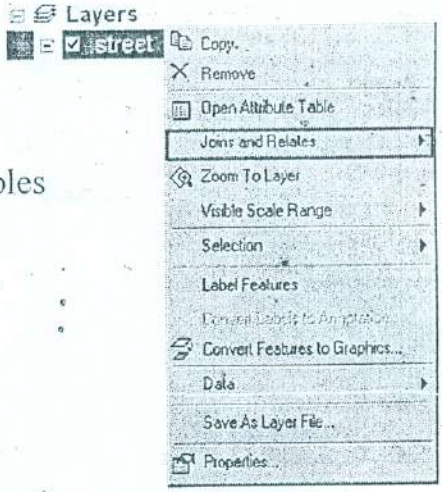
- How many A objects are related to B objects?
- Types of cardinality

  One-to-one, one-to-many or many-to-one, and many-to-many
- Must know cardinality before connecting tables



Joins and relates

- Two methods to associate tables in ArcMap
- Join appends the attributes from one onto the other based on a common field
- Relates define a relationship between two tables



Connecting tables with joins

- Physical connection between two tables
- Appends the attributes of two tables
- Assumes one-to-one or many-to-one cardinality
-

Soil

Attributes of soil

OBJECTID*	Shape*	SOIL_CODE
1	Polygon	41
2	Polygon	26

Soil_desc

Attributes of soil_desc

OBJECTID*	SOIL_CODE	SOIL_DESC
1	41	Quary-Gravel pit
2	26	Psamments and Fluvents (freq-flooded)

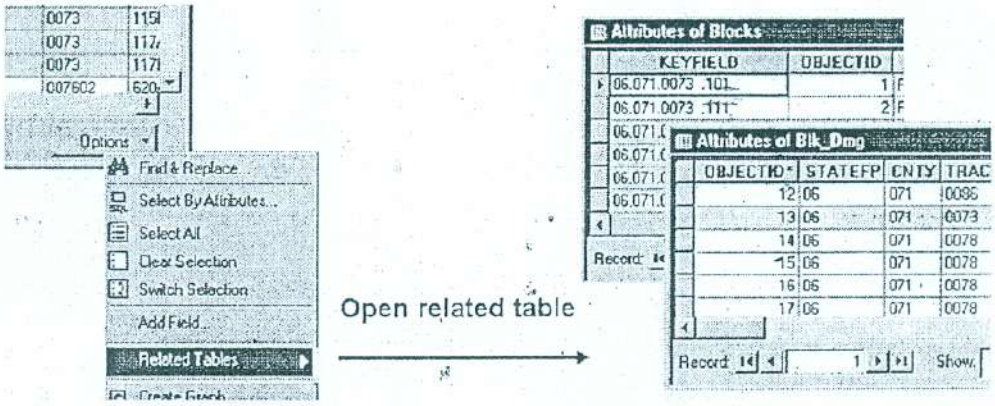
Soil

Attributes of soil

OBJECTID	Shape	soil.SOIL_CODE	soil_desc.SOIL_CODE	soil_desc.SOIL_DESC
1	Polygon	41	41	Quary-Gravel pit
2	Polygon	26	26	Psamments and Fluvents (freq-flooded)
3	Polygon	26	26	Psamments and Fluvents (freq-flooded)
4	Polygon	26	26	Psamments and Fluvents (freq-flooded)
5	Polygon	34	34	Soboba stony loamy sand
6	Polygon	50	50	Water

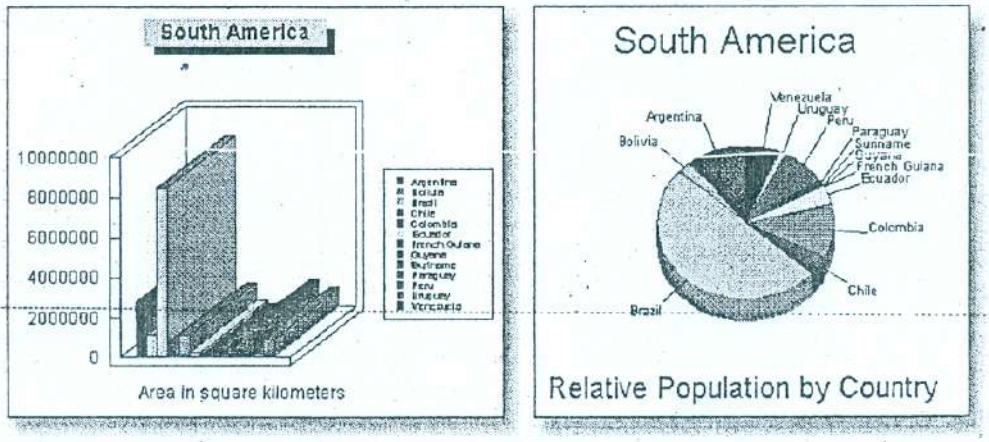
Connecting tables with relates

- Define relationship between two tables
- Tables remain independent
- Additional cardinality choices : One-to-many, many-to-many



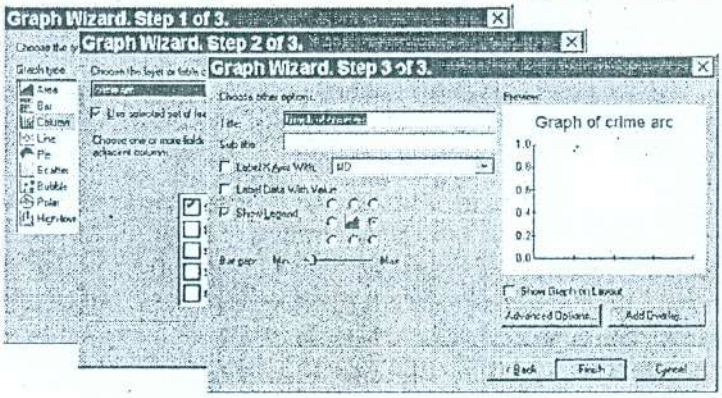
Graphs

- Summarize tabular information in a graph
- A variety of graph formats
- Add to a map



Graph creation

- Graph Wizard is a high-end professional graphing and plotting utility



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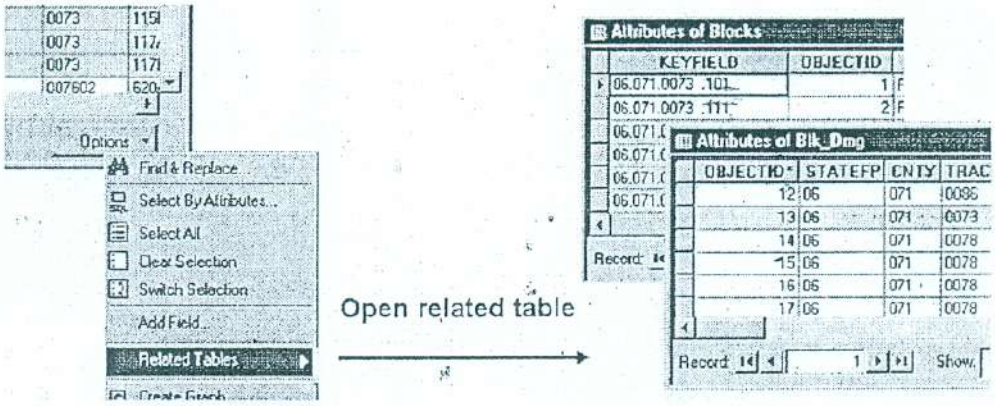

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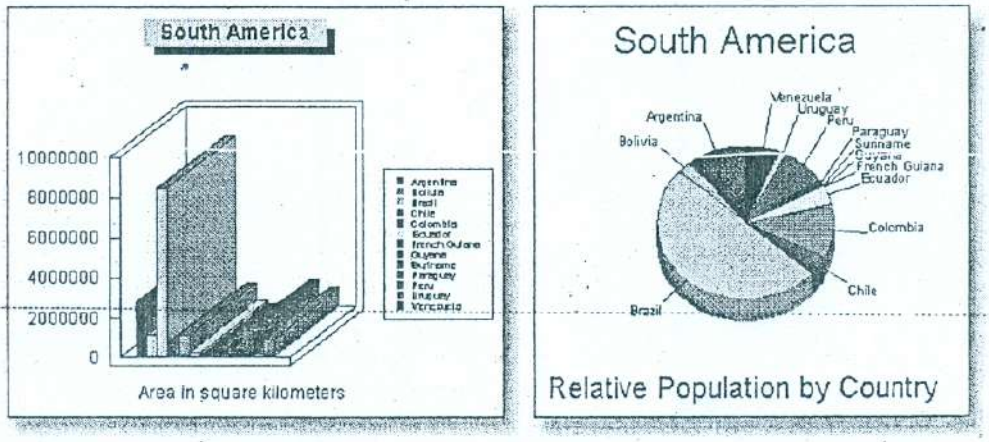

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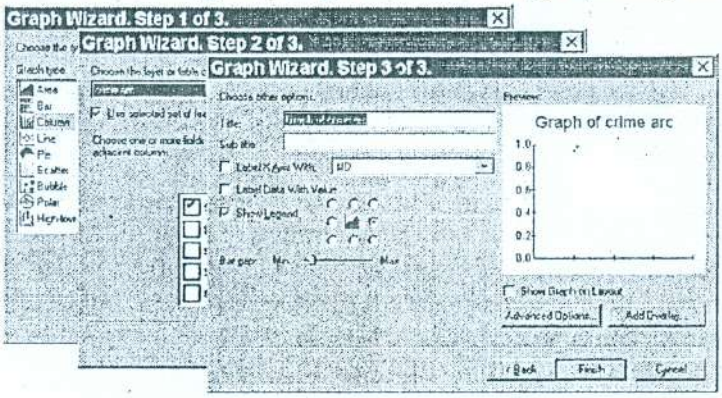


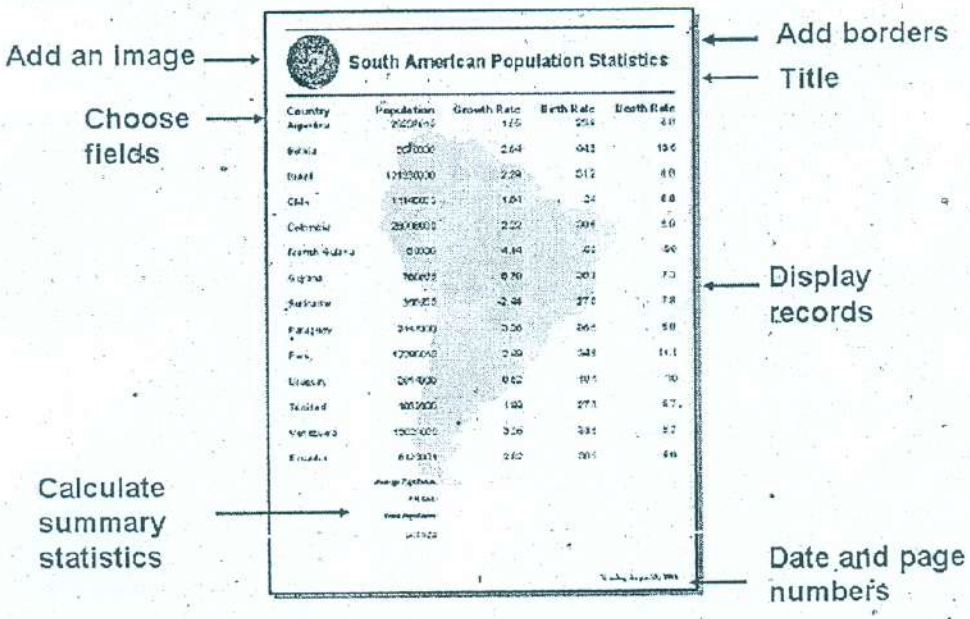
Reports

- Organizes and displays tabular data
- Group and format data
- Save and export
- Two reporting tools

- Report Writer
- Crystal Reports

The ArcMap Report Writer

- Quick, easy, professional report creation



Exercise overview

- **Exercise A**

- Relate and join tables based on common fields

- **Exercise B**

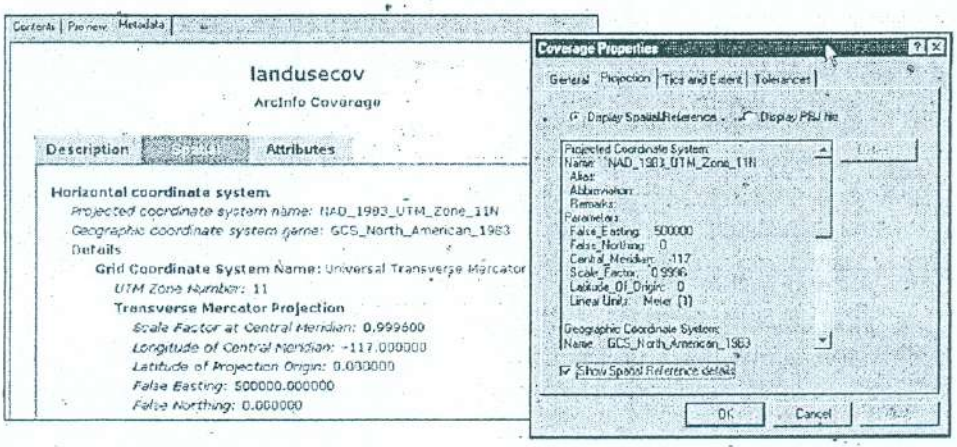
- Create a graph
- Create a report
- Embed the graph in the report
- Add the report to a layout

Storing projection information

- Many spatial data formats store the projection details along with the data

Viewing projection information

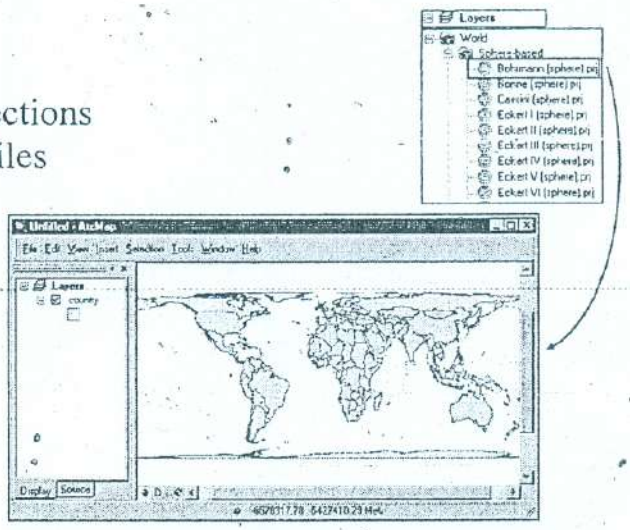
- Examine the feature class' metadata or properties



- Use the Define Projection Wizard to assign projection

ArcMap and projections

- Over 60 supported projections
- Pre-defined projection files
- On-the-fly projection



Changing projections

- Change the way features (or coordinates) are projected
- Use the Project Wizard in ArcToolbox

Exercise overview

- Experiment with data at different scales
- Experiment with data in different projections