GEOL 452/552

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GIS for Geoscientists I

Lecture 10 - chapter 5

Today

- Voting "quiz" on chapter 4
- Chapter 5: Queries
- today: attribute/SQL queries - some advanced cases
- Follow along: copy data\follow along \ch5A_class_ex folder in your student folder. Reconnect Usdata/states?
- Saving selections in layers and exporting to a file
- Definition query
- Interactive selection

Find the **WRONG** statement:

The result of a select-by-attribute SQL query on a **standalone** *table is:*

a single number

a selection of records

Some light blue stuff

a selection of features

"Statistics" operation vs. "Summary" operation - which statement is **wrong**?

Summary uses one field to group and shows group member statistics

Statistics shows statistics only for a single field

Statistics creates a COUNT_ field

Summary only creates a new standalone table

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USA **county** data
for each county you have:
(county) NAME,
POP and STATE_NAME

O	Shape *	NAME	STATE_NAM	POP
1	Polygon	Lake of the	Minnesota	4651
2	Polygon	Ferry	Washington	7199
3	Polygon	Stevens	Washington	4065
4	Polygon	Okanogan	Washington	3864
5	Polygon	Pend Oreille	Washington	175
6	Polygon	Boundary	Idaho	1006
7	Polygon	Lincoln	Montana	1885
8	Polygon	Flathead	Montana	7343

Select by
Attribute?   Statistics?   Summarize?

Hot to use Attribute (SQL) query, Statistics or Summarize
(and possibly combine them?) to:

- **Find all counties with > 7000 people?**

- **Find total number of people in each state?**

- **Total number of people in US?**

- **Number of counties with > 5000 people per state**

SQL (Select by Attribute) Queries

- class exercise data in data\follow along\ ch5A_class_ex (Iowa cities as polygons)

- select/query means: "grab only those records for which **<statement>** is true"

- Result: new selection (light blue)

- Note the Selection Methods (New, Add, Remove, Select) Default: new selection

- Check for correct syntax first (Verify), then Apply

- Click Help to get examples of more complex queries
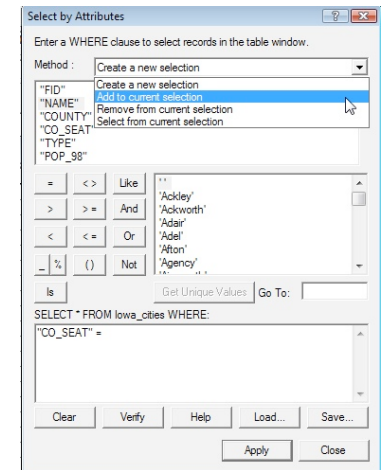
Notes on SQL syntax differences

- Syntax for **Shapefile** is:
    - " as Field delimiter "Age"
    - NOT Case sensitive: 'bob', 'BOB', 'bOB' are all equal
    - Wildcards: % for many, _ for only one

- Syntax for **Geodatabases** (i.e. your Usdata Geodb!) is:
    - [] as Field delimiters [Age]
    - Case **sensitive**: 'BOB' is different from 'Bob' !
    - Wildcards: * for many, ? for only one

Elements of a SQL query

- **<Field> <Relation> <Value>**

- Field in **double quotes**: "POP2000"

- Relation: >, =, <=, <>, LIKE, AND, OR, ...

- Value:
    - Strings (words) : **'Iowa'** (in **single quotes**!)
    - Floating point: 1.2353245 (no quotes)
    - Integer: 1984 (no quotes)

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- Math with Fields and/or Values (+, -, *, /,=, <>)

  "POP2000" – "POP1990" > 10000

  "POP2000" – 10000 > "POP1990"

  "POP2000" > "POP1990" * 1.2

  "POP1990" <> 9646

  "POP1990" = 7174

Attributes of Counties_standalone_table

OID	RANK	ST_CO_FIPS	COUNTYNAME *	STATE	POP1990	POP2000	POP_CH
0	1	08035	Douglas County	CO	60391	175766	115375
1	2	13117	Forsyth County	GA	44083	98407	54324
2	3	08039	Elbert County	CO	9646	19872	10226
3	4	13151	Henry County	GA	58741	119341	60600
4	5	08093	Park County	CO	7174	14523	7349
5	6	51107	Loudoun County	VA	86129	169599	83470
6	7	13223	Paulding County	GA	41611	81678	40067
7	8	49043	Summit County	UT	15518	29736	14218
8	9	16015	Boise County	ID	3509	6670	3161
9	10	08037	Eagle County	CO	21928	41659	19731
10	11	48085	Collin County	TX	264036	491675	227639
11	12	49053	Washington County	UT	48560	90354	41794
12	13	32003	Clark County	NV	741459	1375765	634306
13	14	08007	Archuleta County	CO	5345	9898	4553

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- Boolean math (AND, OR) for combining expressions:

  - AND: **both** expressions need to be true

  - OR: just **one** true expression is enough

  - What's Wrong with? "POP" < 100 AND > 200

  - "POP2000" > 1000 **AND** "POP2000" < 10000
    "POP" < 55 **OR** "AREA" < 234.4

- More than three expressions: use ( ) to group:
  ("POP" > 10 **AND** "POP" < 100) **AND** "AREA" > 2.3

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Gotcha Warning: AND vs OR

Incorrect	Correct

"…. get all features for CO and for IA …"

Incorrect	Correct
"State" = 'CO'	"State" = 'CO'
AND	OR
"State" = 'IA'	"State" = 'IA'

"… get all counties that have between 50,000 and 90,000 people …"

Incorrect	Correct
"POP2000" ≥ 50000	"POP2000" ≥ 50000
OR	AND
"POP2000" < 90000	"POP2000" < 90000

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String ("word") queries

- String values (words) need to be in **single** quotes

- Use *Get Unique Values* for an overview of possible values

- *Exactly:* "ZIP" = '50010' , "Capital" = 'Y'

- *Anything but (not) '50010':* "ZIP" <> '50010' ('50010 ') ?

- Partial matches using wildcards (only with LIKE !) :

  - **% or *** means: **one or more letters**

  - ex: "COUNTY_NAME" **LIKE** 'Q%'

P	o	l	k		
Q	u	a	k		
Q	u	i	n	c	y

  - _ (underscore) or ? means: **exactly one** letter

  - "Name" LIKE '_ob': => **Rob, Bob** but not **Bobby**

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N	e	w		H	a	v	e	n	
N	e	w		Y	o	r	k		
O	o	m	p	a	l	o	o	m	p
A	m	e	s						
B	o	o	n	e					
M	e	s	a						
L	a		l	a		l	a	n	d

SQL queries on the names in this **Geodatabase** table (field is NAME)

- Names starting with N or with M?
- Names, where 2. letter is e?
- Names with Two words? (separator?)
- Names with 2 Os   i.e. oo ?
- 4-letter names?
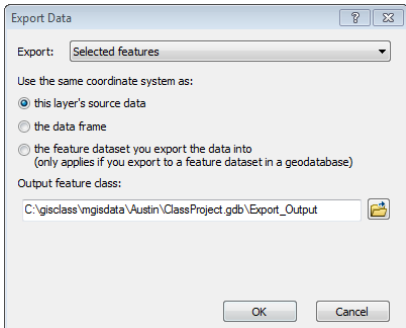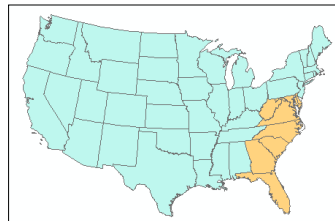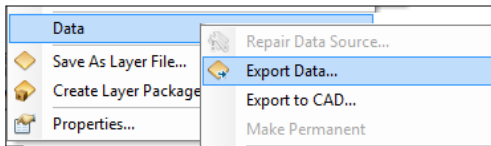- Names where second word is 2 letters long?

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Make Layer from selection

- Common operation following a query
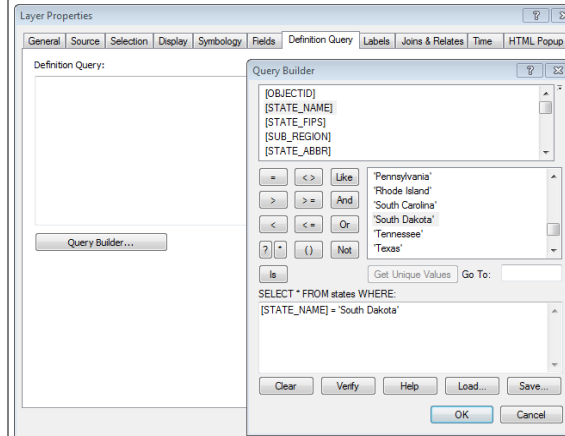- Creates a new layer with only the selected features
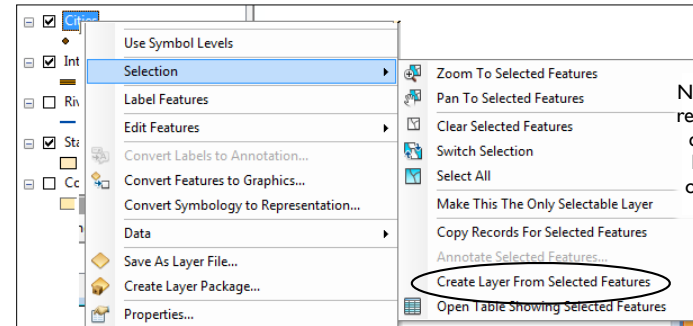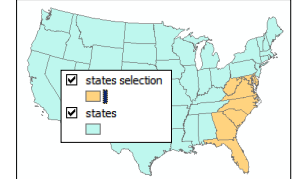
Note that the new layer still refers to the original feature class with all the features. But it appears to contain only the selected features.

Selection menu items:
- Use Symbol Levels
- Selection ►
  - Zoom To Selected Features
  - Pan To Selected Features
  - Clear Selected Features
  - Switch Selection
  - Select All
  - Make This The Only Selectable Layer
  - Copy Records For Selected Features
  - Annotate Selected Features…
  - **Create Layer From Selected Features**
  - Open Table Showing Selected Features
- Label Features
- Edit Features ►
- Convert Labels to Annotation…
- Convert Features to Graphics…
- Convert Symbology to Representation…
- Data ►
- Save As Layer File…
- Create Layer Package…
- Properties…

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Exporting selection

- Data
  - Repair Data Source…
  - Save As Layer File…
    - Export Data…
  - Create Layer Package
    - Export to CAD…
  - Properties…
    - Make Permanent

Export Data dialog:
Export: Selected features
Use the same coordinate system as:
- this layer's source data
- the data frame
- the feature dataset you export the data into (only applies if you export to a feature dataset in a geodatabase)
Output feature class:
C:\gisclass\mgisdata\Austin\ClassProject.gdb\Export_Output

OK   Cancel

Creates new feature class "file" inside a GeoDB, or a new DBase (dbf) file in a folder

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Definition query

Layer Properties
General | Source | Selection | Display | Symbology | Fields | Definition Query | Labels | Joins & Relates | Time | HTML Popup

Definition Query:

Query Builder
[OBJECTID]
[STATE_NAME]
[STATE_FIPS]
[SUB_REGION]
[STATE_ABBR]

= <> Like 'Pennsylvania' / 'Rhode Island' / 'South Carolina' / 'South Dakota' / 'Tennessee' / 'Texas'
> >= And
< <= Or
_ % ( ) Not
Is   Get Unique Values Go To:

SELECT * FROM states WHERE:
[STATE_NAME] = 'South Dakota'

Clear Verify Help Load… Save…
OK Cancel

Query Builder…

- Very important: The result is **not** a selection but a subset
- think: "hide some feature for a while"
- "Show me **only** where <expression> is true"
- Layer: Properties > definition query
- Only selected features appear on map and in table
- Temporarily treats a layer as being smaller than it actually is

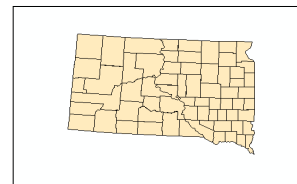Effect: counties from all other states are hidden

Table of content mode: List By Selection

All layers selectable

Only States selectable

Table Of Contents
- Selected
  - States ☑ ☑ 1
  - Kansas
- Selectable (no features selected)
  - Capitals ☑ ☑ 0
  - Interstates ☑ ☑ 0
  - Cities ☑ ☑ 0
- Not Selectable
  - Rivers ☑ ☑ 0
  - Counties ☑ ☑ 0

Clear selected features

Click to toggle selectability

Click to toggle visibility

Interactive Selection

Insert Selection Geoprocessin
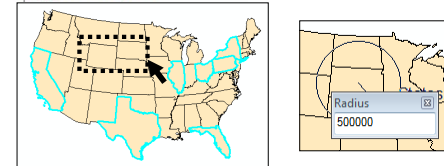
- Select by Rectangle
- Select by Polygon
- Select by Lasso
- Select by Circle
- Select by Line

Select Features tool

Default selection method: new selection
But: you can add, remove or sub-select later

Radius
500000

Click on feature to select via a shape
Features inside (intersect) the shape are selected.

Hold down **Shift key** to select more than one feature

Select by Graphics

Drawing ▾ Arial

Selection Geoprocessing Customize Windows Help
- Select By Attributes...
- Select By Location...
- Select By Graphics
- Zoom To Selected Features
- Pan To Selected Features
- Statistics...
- Clear Selected Features
- Interactive Selection Method
- Selection Options...

1) Use Drawing toolbar to create graphic (polygon)

2) Then Select by Graphics

Table Of Contents
- Selected
  - states ☑ ☑ 8
    - Colorado
    - Kansas
    - Minnesota
    - Montana
    - Nebraska
    - North Dakota
    - South Dakota
    - Wyoming
- Selectable (no features selected)
  - volcanos ☑ ☑ 0
- Not Selectable
  - Iowa_cities ☑ ☑ 0

Lab

- test: map S: drive to \\geol552\delphi\students
- find your student folder
- R-click - New - Text Document
- Let me know if you don't have write access
- Finish HW4
- Tutorial ch 5: 1 - 19