Geoinformatics Center
Asian Institute of Technology

Database Management

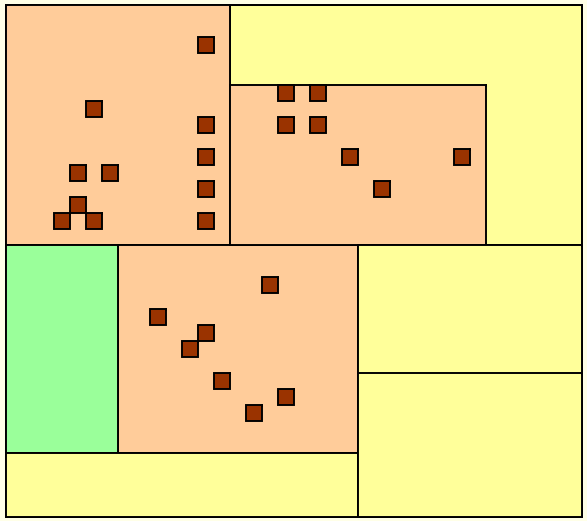
A Handbook on Database Management

Database Management

- *Attribute Data*
- *Entering and Coding Attribute data*
- *Linking Digital Map and Attribute Information*
- *Database and Database Management System*
- *Relational Database structure*

Attribute data

-location , various descriptions of the object and dating



Building map

Identity : building number
Location: Address
Representative coordinates

Description: Builder/owner
Status
Type
Function
water Supply
Available area
Date: Year built

Attribute data

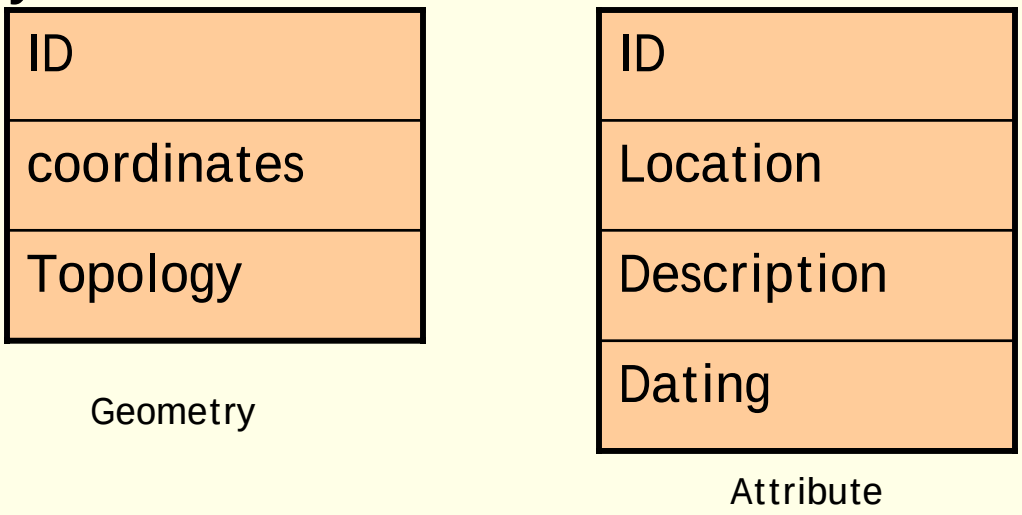
Entering and Coding Attribute data

-Establish an ID code between geometry and attribute

-Conserve computer memory

-Ease input work

-Simplify the searches for data



Entering and Coding Attribute data

Level1	Attribute	Level2	Attribute	Level3	Attribute
100	Built-up	110	Industry	111	Light
				112	Heavy
				113	Others
		120	Transportation	121	Railway
				122	Airport
				123	Parking
				124	Terminal
200		210	Coniferous	211	Fir
				212	Pine
		220	Decedious	221	Oak
				222	Beech
		230	……..	231	….
				…….	….

Entering and Coding Attribute data

-Easily stored in tabular form - called tabular data

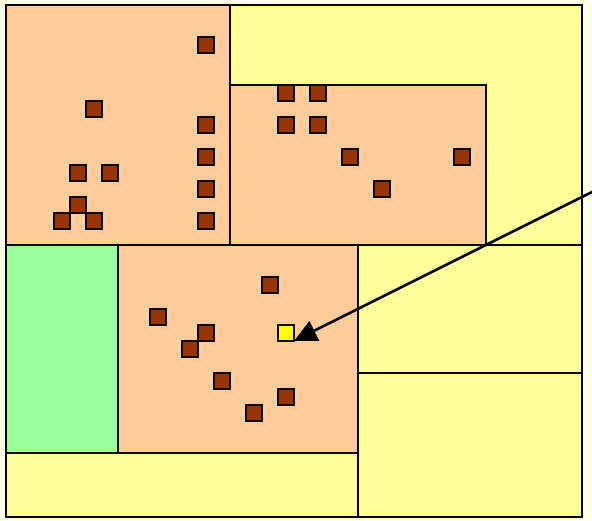
-Different data types stored in different table

-Number of column extended by linking another table using common assess key or entering data to same table.

-Table design independent of geometric data type

ID	Landuse	Area	Township
1	123	22.67	0914
2	111	1.45	0916
...	321	46.80	0923

Linking Digital Map and Attribute Information



Digital map database

Polygon no	Building	X coordinate	Y coordinate
125	589	.....	.....

building database

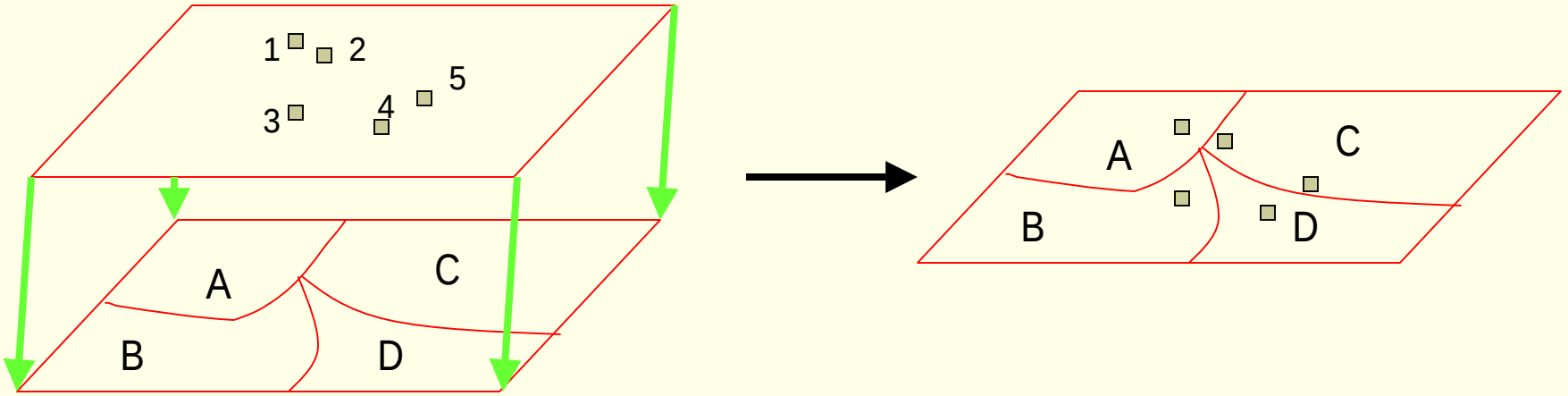
Polygon no	Lot no	Owner	Year built
125	44/113	Peter	1995

Land Register

Lot no	Property owner	Land area	Property address
44/113	Jerry	Peter	1/1099, Anthill..

Linking by ID

Linking Digital Map and Attribute Information



ID	Building no.	Polygon	Property
1	559	A	44/110
2	600	C	44/95
3	610	B	44/121
4	156	D	44/81
5	642	C	44/78

Linking by geometry

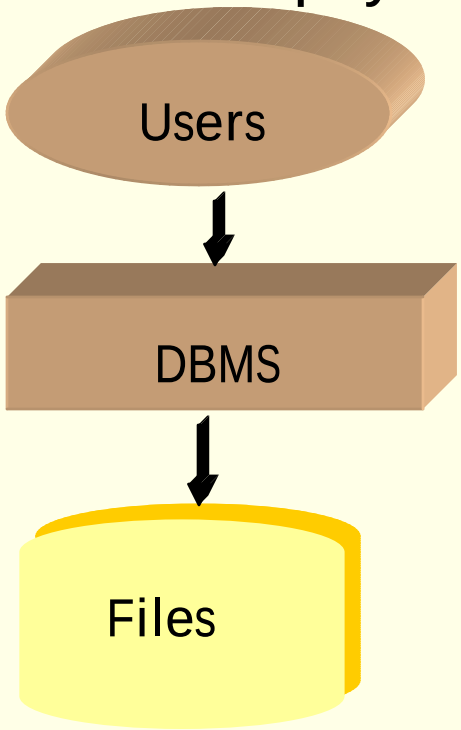
Database and Database Management System

Database :

-Sets of collection of information

-files structured by DBMS and accessed through it

-DBMS located between the physical storage and the user.



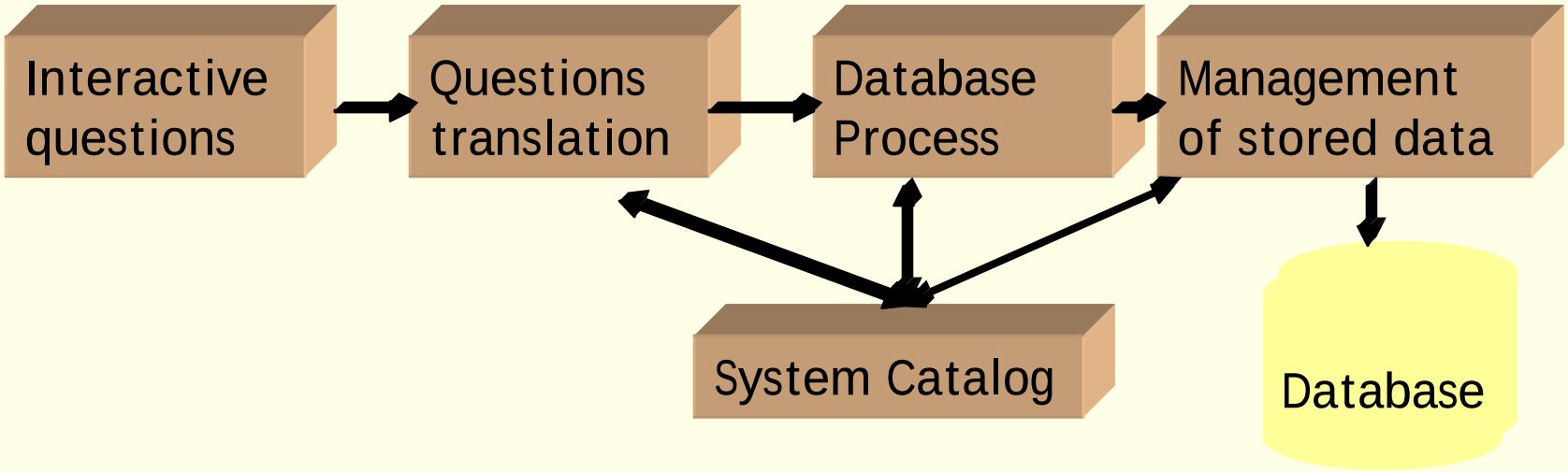
Database and Database Management System

DBMS :

- Software package for storage, manipulation, retrieval of data from a database.

-To handle complex task of multiple files

-Located between the physical storage and the user.



Relational Database structure

Building ID	property	Owner	Year	Type
234	44/110			
256	44/50			
298	44/19			

property	Owner	Area	Address
44/50			
44/110	John	6400	33 ...
44/19			

Relational Database structure

-Geographical object in a record

-Attribute in in a set of fields

-Three basic attributes

primary key

relational join

normal forms

-most frequently used for attribute data

-simple, flexible structures

Relational Database structure

-search time is longer

-collection of large number of table for complex relationships

-Stores single value for each cell

Exercise

1. Database file handling
2. Selection
3. Preparation of Sub-Set
4. Database query
5. Calculation

1.Database file handling

1.1 Loading existing data

1.2 Creating point data

1.3 Input / Edit attribute data

1.4 Join tables

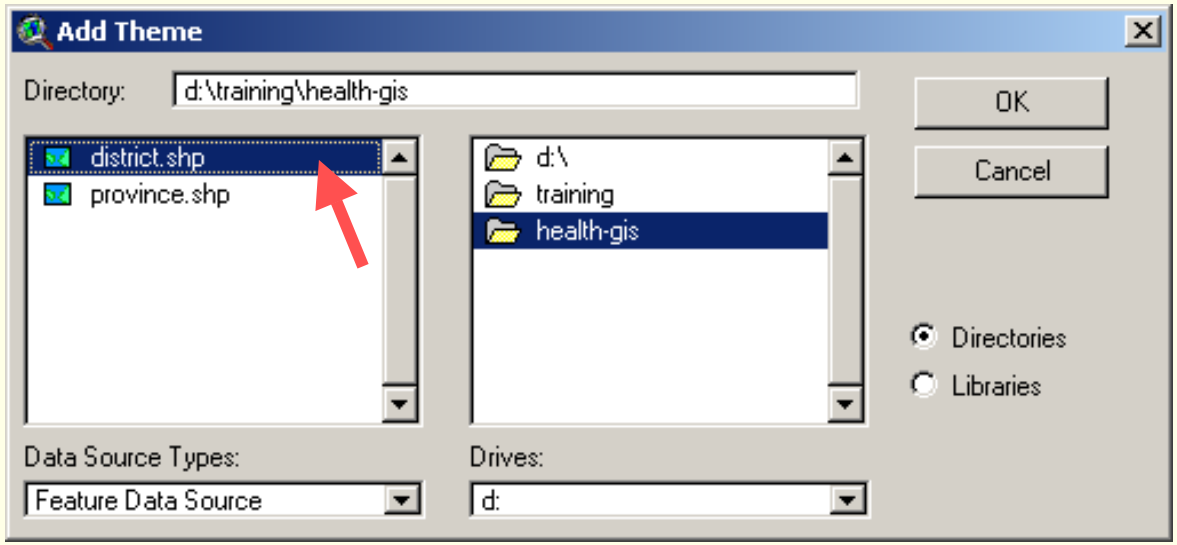
1.5 Link tables

1.1 Loaded existing data

-Double click the  icon or go to Menu Start menu

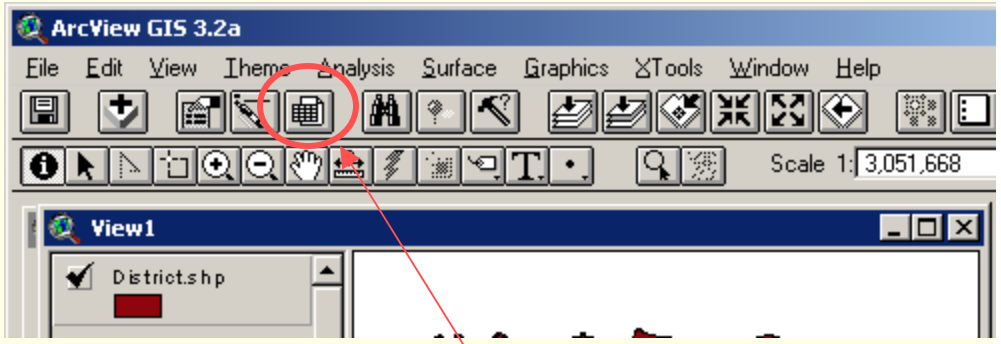
-Click at Add Theme icon 

-Select theme name “district.shp” then click OK.



-Open attribute table of theme “District.shp”

Activate theme



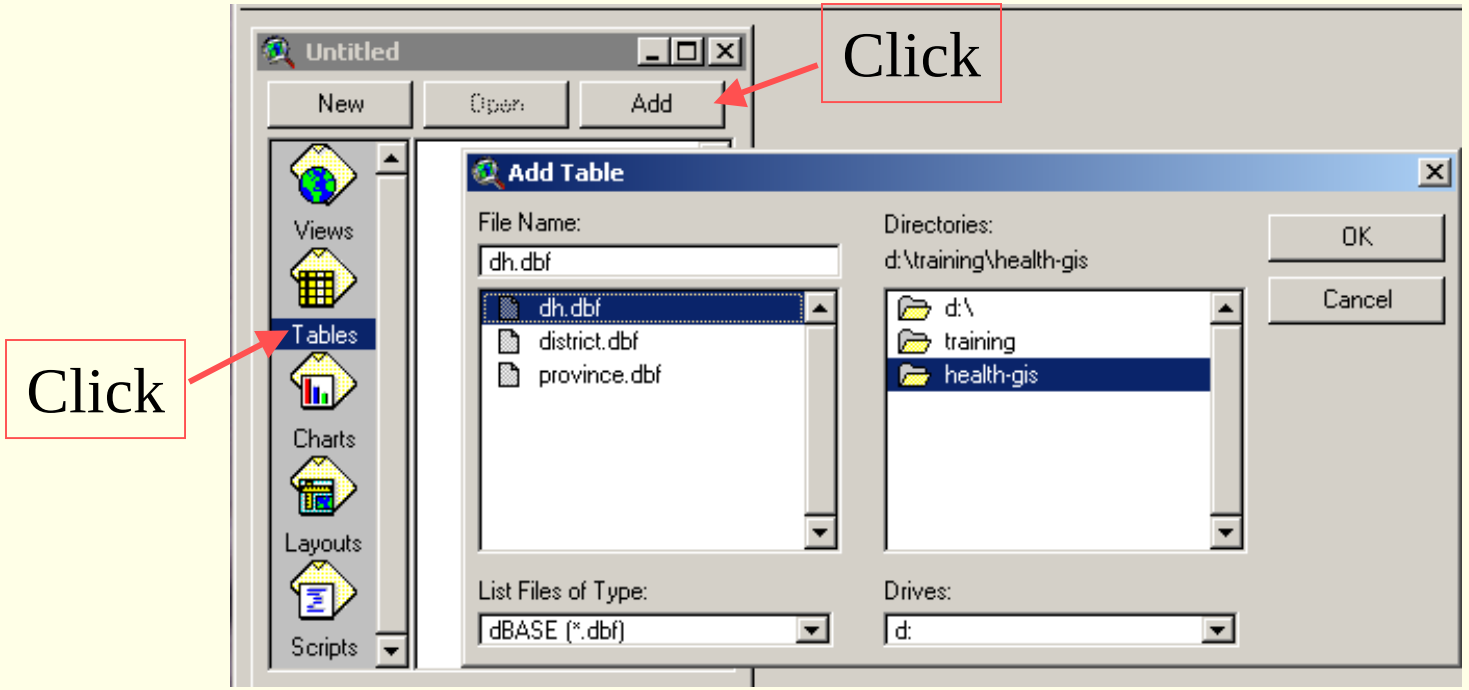
Click

Attributes of District.shp

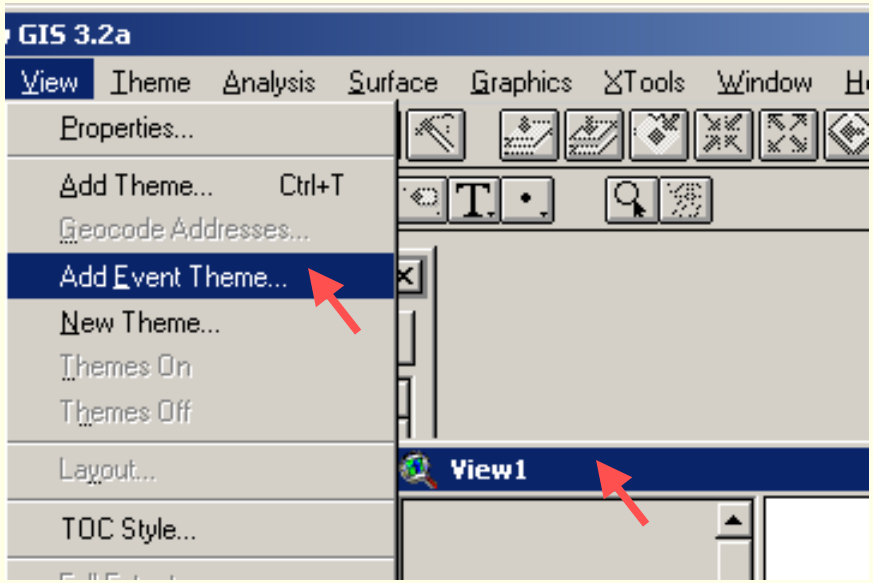
Shape	Pcode	Dcode	Dname	Sq_m	Sq_km	
Polygon	13	1312	Vilabouri	1765107479.680	1765.107	S
Polygon	13	1311	Xaibouri	895945602.959	895.946	S
Polygon	13	1313	Atsaphon	1452316064.602	1452.316	S
Polygon	13	1305	Xepon	2266782030.519	2266.782	S
Polygon	13	1302	Outhoumphon	1082417234.996	1082.417	S
Polygon	13	1315	Phalanxai	998076585.390	998.077	S
Polygon	13	1303	Atsaphangthong	700937798.695	700.938	S
Polygon	13	1304	Phin	3372124542.212	3372.125	S
Polygon	13	1301	Khanthabouri	681611273.958	681.611	S
Polygon	13	1309	Champhon	1049758789.065	1049.759	S
Polygon	13	1306	Nong	1700596082.260	1700.596	S
Polygon	13	1310	Xonbouri	1205959535.145	1205.960	S

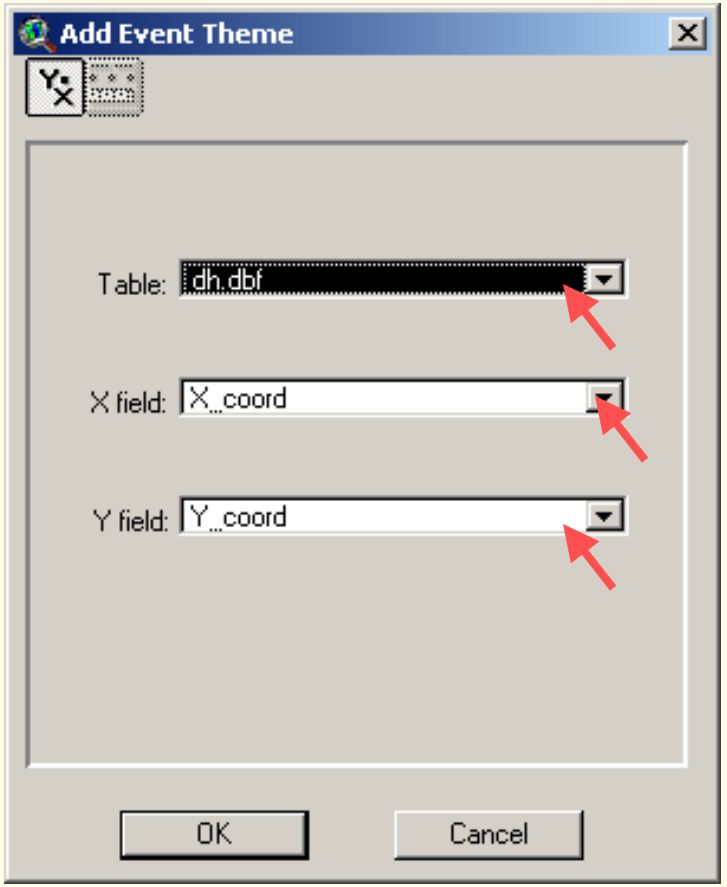
1.2 Creating point data

- Click at Table icon then click Add button
- Select a table file name “dh.dbf”

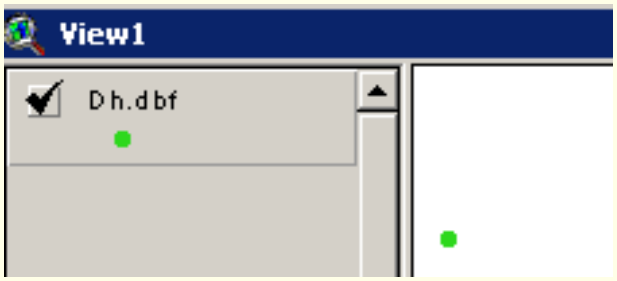


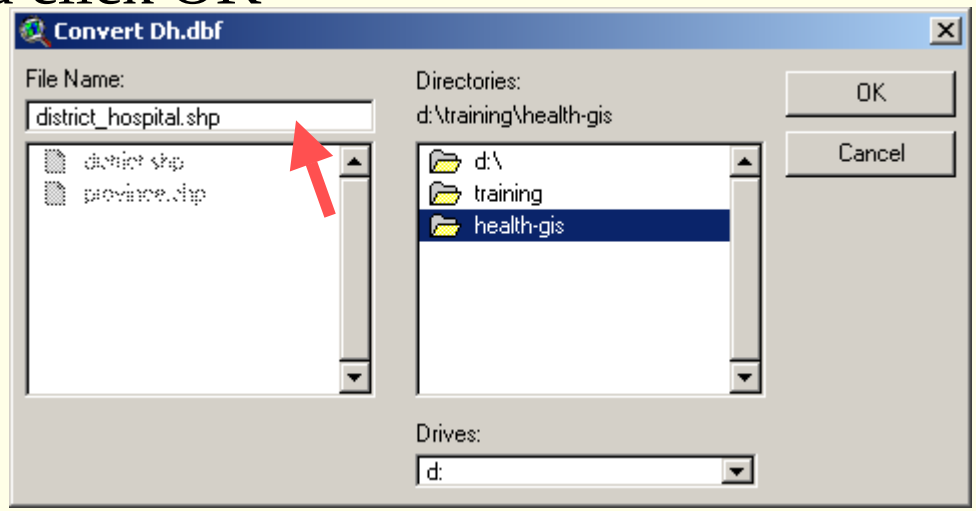
- Activate View window
- Go to View menu and select Add Event Theme
- Choose table name“dh.dbf” and X,Y coordinate

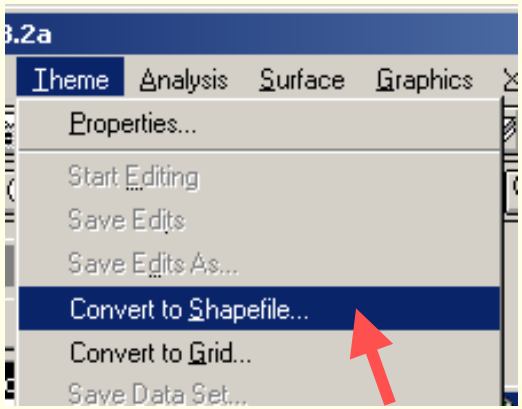


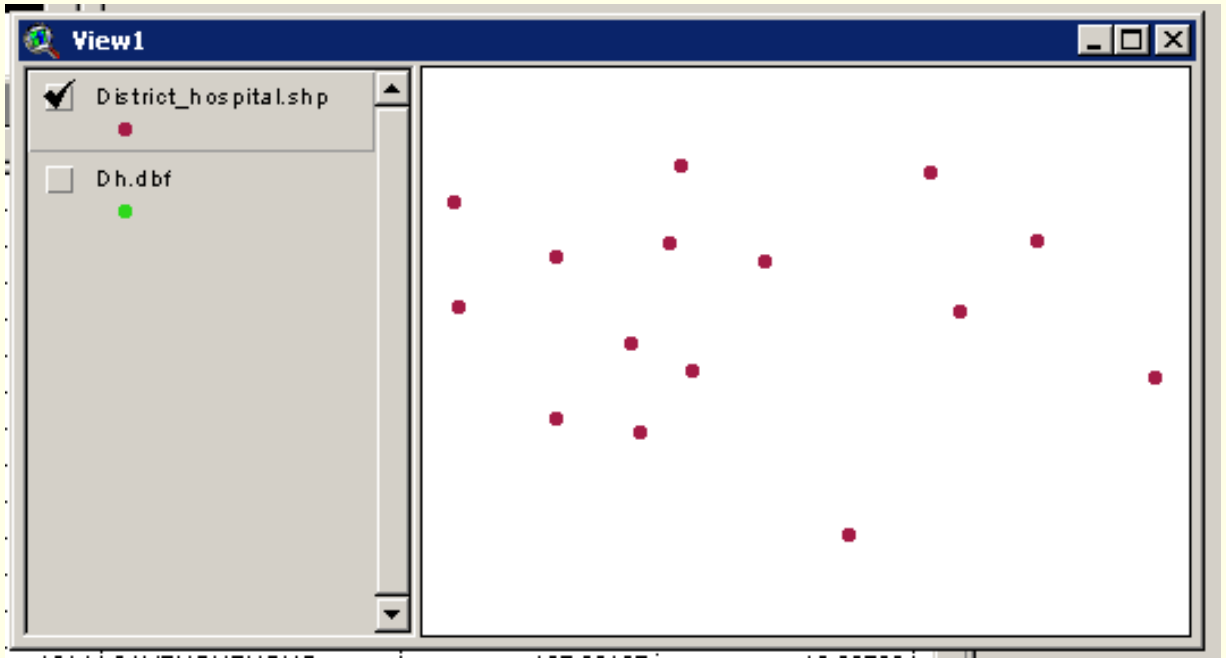


- Go to Theme menu and select Convert to Shapefile
- Navigate the working directory and set a new name “district_hospital” and click OK









1.3 Input / Edit attribute data

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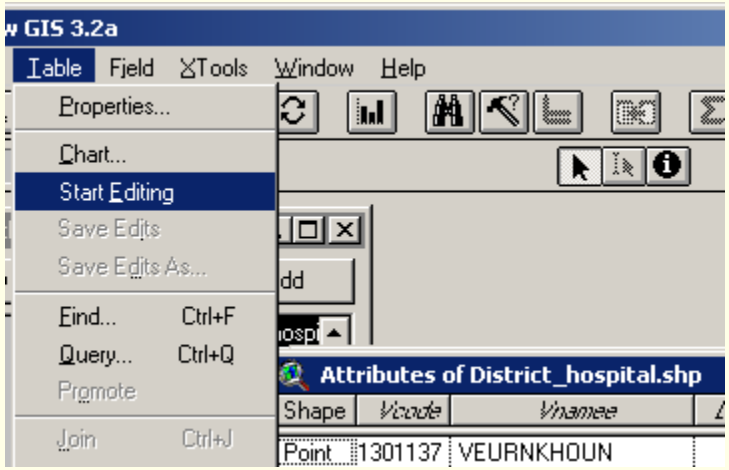
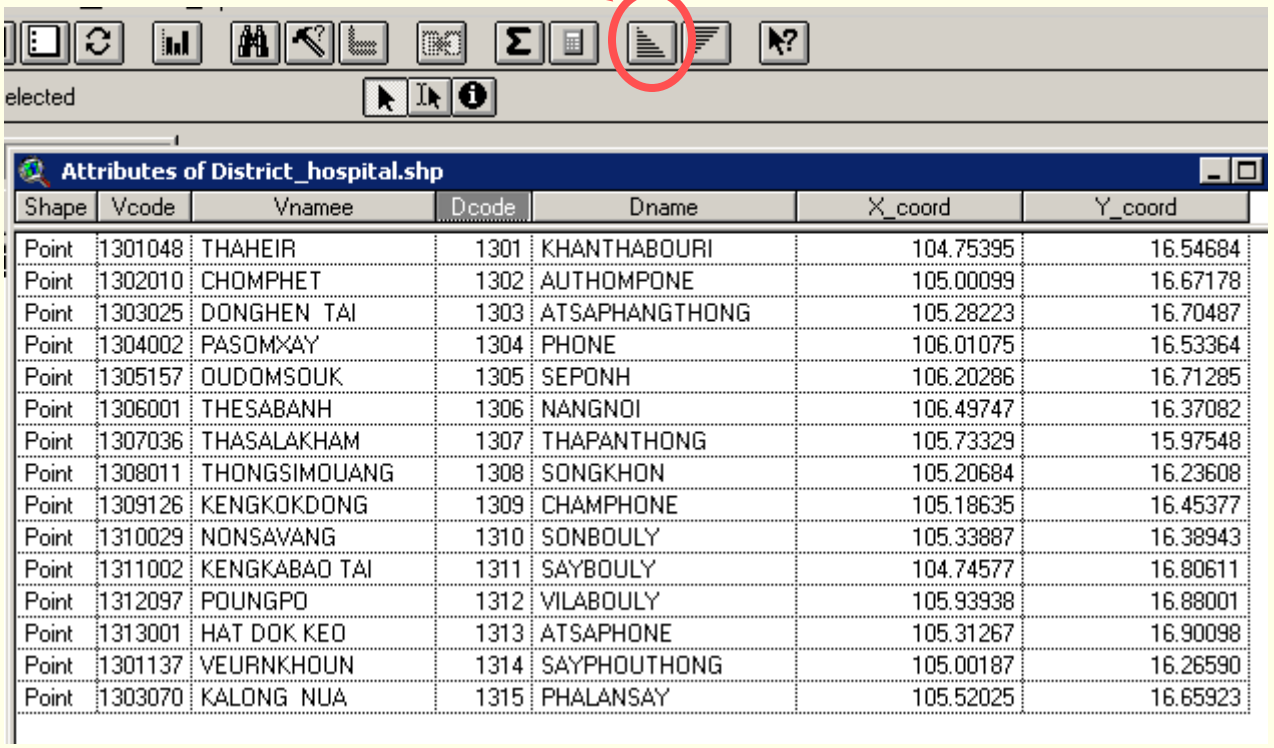
- Open table of “District_hospital.shp”
- In Table menu, select Start Editing

- Click at field name “Dcode”
- Then click Sort Ascending button



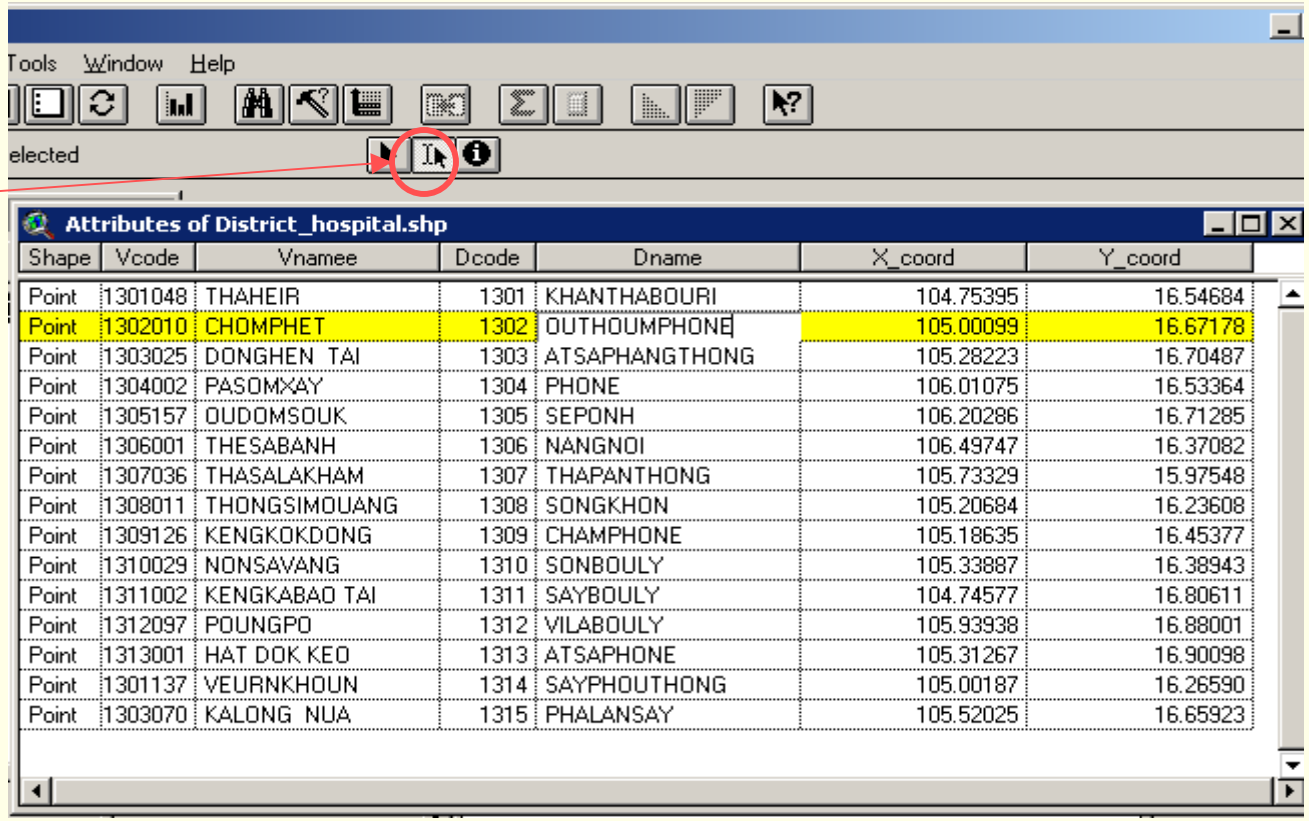


Attributes of District_hospital.shp

Shape	Vcode	Vnamee	Dcode	Dname	X_coord	Y_coord
Point	1301048	THAHEIR	1301	KHANTHABOURI	104.75395	16.54684
Point	1302010	CHOMPHET	1302	AUTHOMPONE	105.00099	16.67178
Point	1303025	DONGHEN TAI	1303	ATSAPHANGTHONG	105.28223	16.70487
Point	1304002	PASOMXAY	1304	PHONE	106.01075	16.53364
Point	1305157	OUDOMSOUK	1305	SEPONH	106.20286	16.71285
Point	1306001	THESABANH	1306	NANGNOI	106.49747	16.37082
Point	1307036	THASALAKHAM	1307	THAPANTHONG	105.73329	15.97548
Point	1308011	THONGSIMOUANG	1308	SONGKHON	105.20684	16.23608
Point	1309126	KENGKOKDONG	1309	CHAMPHONE	105.18635	16.45377
Point	1310029	NONSAVANG	1310	SONBOULY	105.33887	16.38943
Point	1311002	KENGKABAO TAI	1311	SAYBOULY	104.74577	16.80611
Point	1312097	POUNGPO	1312	VILABOULY	105.93938	16.88001
Point	1313001	HAT DOK KEO	1313	ATSAPHONE	105.31267	16.90098
Point	1301137	VEURNKHOUN	1314	SAYPHOUTHONG	105.00187	16.26590
Point	1303070	KALONG NUA	1315	PHALANSAY	105.52025	16.65923

- Select Edit button and click in Dname at Dcode = 1302
- Type new Dname to “OUTHOUMPHONE”

Edit button



Shape	Vcode	Vnamee	Dcode	Dname	X_coord	Y_coord
Point	1301048	THAHEIR	1301	KHANTHABOURI	104.75395	16.54684
Point	1302010	CHOMPHET	1302	OUTHOUMPHONE	105.00099	16.67178
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Point	1306001	THESABANH	1306	NANGNOI	106.49747	16.37082
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Point	1308011	THONGSIMOUANG	1308	SONGKHON	105.20684	16.23608
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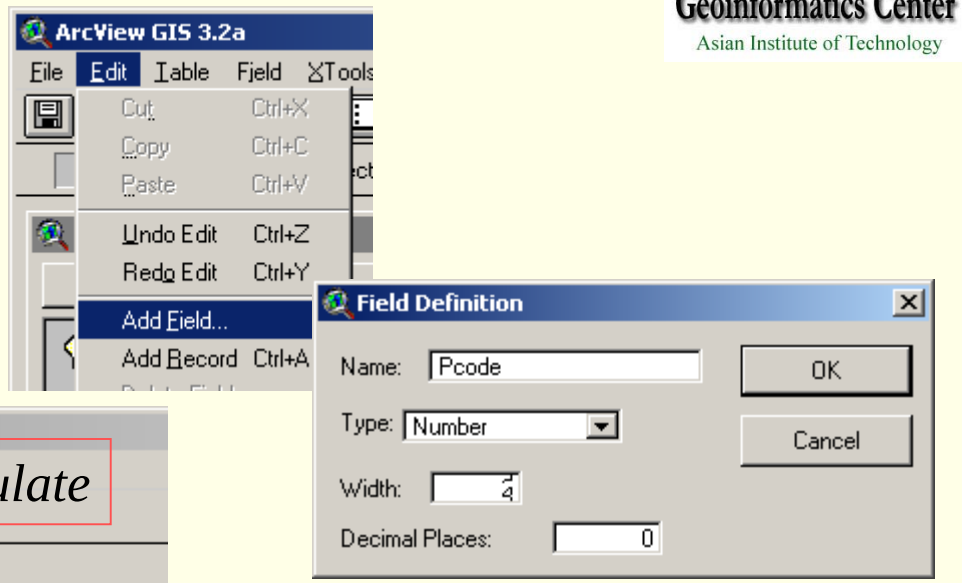
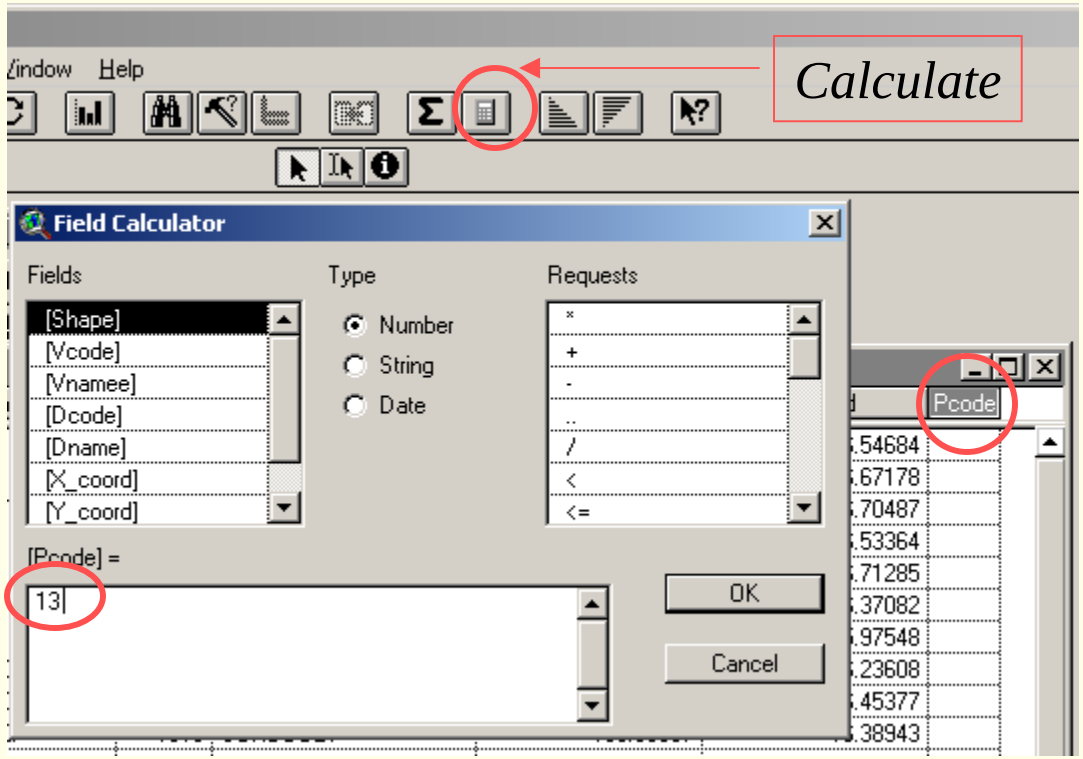
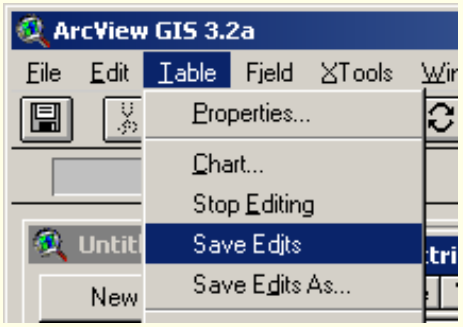
Point	1312097	POUNGPO	1312	VILABOULY	105.93938	16.88001
Point	1313001	HAT DOK KEO	1313	ATSAPHONE	105.31267	16.90098
Point	1301137	VEURNKHOUN	1314	SAYPHOUTHONG	105.00187	16.26590
Point	1303070	KALONG NUA	1315	PHALANSAY	105.52025	16.65923

- Select Add Field in Edit menu
- Select Name and Type of Field
- Click OK





- **Click at Pcode field name**
- **Select Calculate button**
- **In Field Calculator window type “13” then Click OK**



- **Save Edits and Stop Editing in Table menu**

1.4 Join tables

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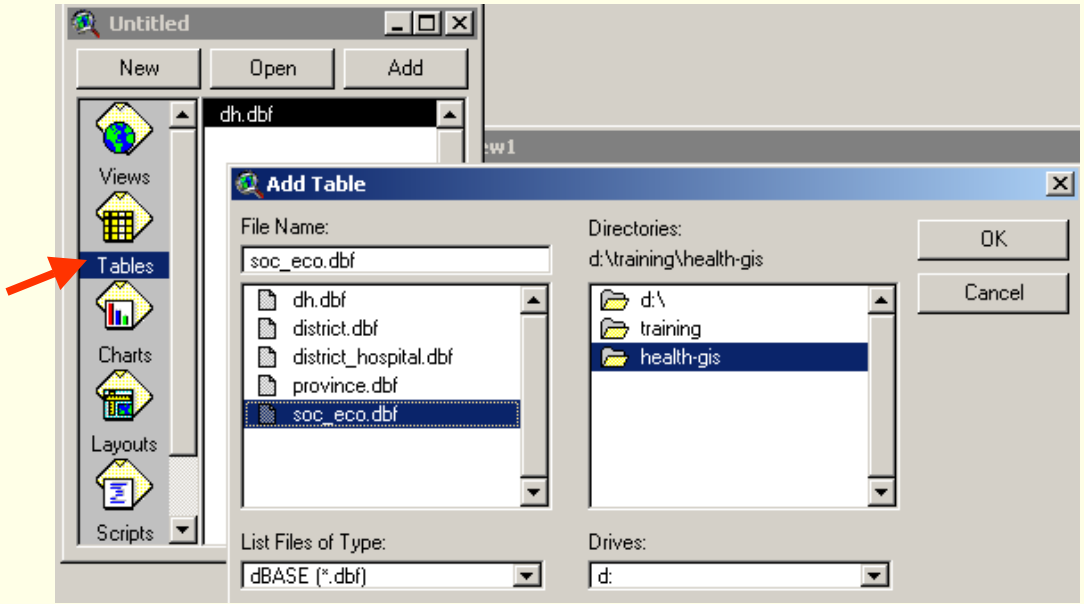
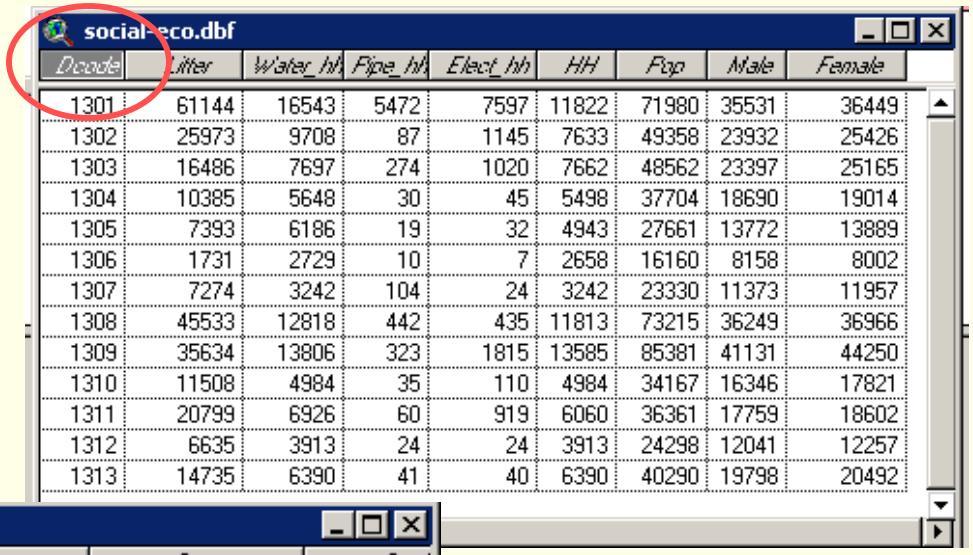
- Select Table icon
- Click Add button
- Select a table file name “soc-eco.dbf”
- Click OK



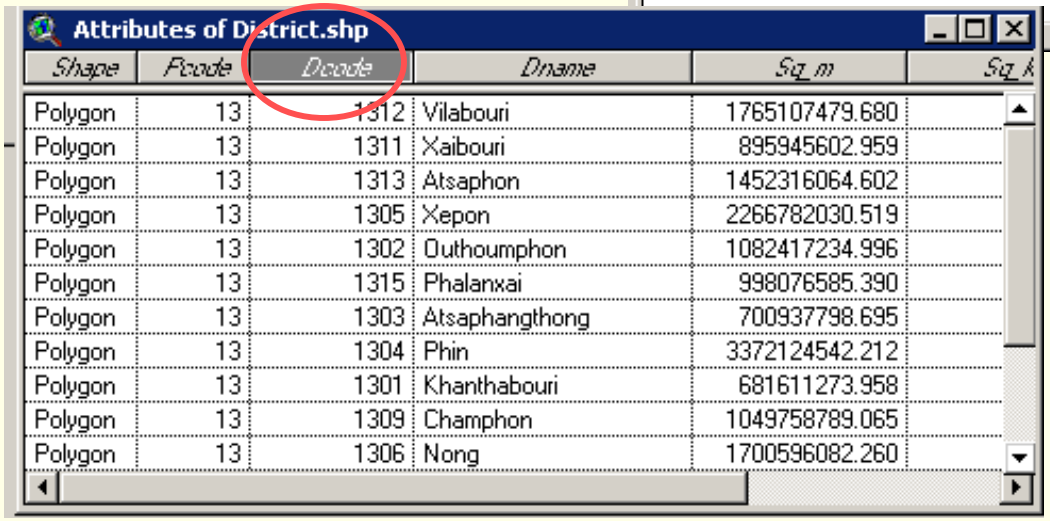
social-eco.dbf

Dcode	Litter	Water_hh	Pipe_hh	Elect_hh	HH	Pop	Male	Female
1301	61144	16543	5472	7597	11822	71980	35531	36449
1302	25973	9708	87	1145	7633	49358	23932	25426
1303	16486	7697	274	1020	7662	48562	23397	25165
1304	10385	5648	30	45	5498	37704	18690	19014
1305	7393	6186	19	32	4943	27661	13772	13889
1306	1731	2729	10	7	2658	16160	8158	8002
1307	7274	3242	104	24	3242	23330	11373	11957
1308	45533	12818	442	435	11813	73215	36249	36966
1309	35634	13806	323	1815	13585	85381	41131	44250
1310	11508	4984	35	110	4984	34167	16346	17821
1311	20799	6926	60	919	6060	36361	17759	18602
1312	6635	3913	24	24	3913	24298	12041	12257
1313	14735	6390	41	40	6390	40290	19798	20492

-Open attribute table of theme “District.shp”
-Click Dcode filed name of “Soc-eco.dbf” then Click Dcode filed name of “District.dbf”

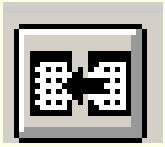


Dcode	Water	Water_hh	Pipe_hh	Elect_hh	HH	Pop	Male	Female
1301	61144	16543	5472	7597	11822	71980	35531	36449
1302	25973	9708	87	1145	7633	49358	23932	25426
1303	16486	7697	274	1020	7662	48562	23397	25165
1304	10385	5648	30	45	5498	37704	18690	19014
1305	7393	6186	19	32	4943	27661	13772	13889
1306	1731	2729	10	7	2658	16160	8158	8002
1307	7274	3242	104	24	3242	23330	11373	11957
1308	45533	12818	442	435	11813	73215	36249	36966
1309	35634	13806	323	1815	13585	85381	41131	44250
1310	11508	4984	35	110	4984	34167	16346	17821
1311	20799	6926	60	919	6060	36361	17759	18602
1312	6635	3913	24	24	3913	24298	12041	12257
1313	14735	6390	41	40	6390	40290	19798	20492



Shape	Pcode	Dcode	Dname	Sq_m	Sq_k
Polygon	13	1312	Vilabouri	1765107479.680	
Polygon	13	1311	Xaibouri	895945602.959	
Polygon	13	1313	Atsaphon	1452316064.602	
Polygon	13	1305	Xepon	2266782030.519	
Polygon	13	1302	Outhoumphon	1082417234.996	
Polygon	13	1315	Phalanxai	998076585.390	
Polygon	13	1303	Atsaphangthong	700937798.695	
Polygon	13	1304	Phin	3372124542.212	
Polygon	13	1301	Khanthabouri	681611273.958	
Polygon	13	1309	Champhon	1049758789.065	
Polygon	13	1306	Nong	1700596082.260	

- To join two table , Click Join button

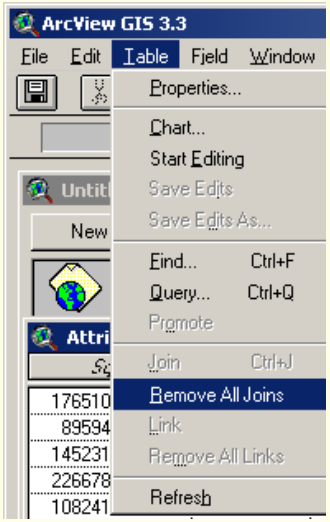


- Check attribute table of “District.shp” with new joined table

Attributes of District.shp

Pcode	Dcode	Dname	Sq_m	Sq_km	Pname	Litter	Water_hh	Pipe_hh	Elect_hh	HH
13	1312	Vilabouri	1765107479.680	1765.107	SAVANNAKHET	6635	3913	24	24	3913
13	1311	Xaibouri	895945602.959	895.946	SAVANNAKHET	20799	6926	60	919	6060
13	1313	Atsaphon	1452316064.602	1452.316	SAVANNAKHET	14735	6390	41	40	6390
13	1305	Xepon	2266782030.519	2266.782	SAVANNAKHET	7393	6186	19	32	4943
13	1302	Outhoumphon	1082417234.996	1082.417	SAVANNAKHET	25973	9708	87	1145	7633
13	1315	Phalanxai	998076585.390	998.077	SAVANNAKHET					
13	1303	Atsaphangthong	700937798.695	700.938	SAVANNAKHET	16486	7697	274	1020	7662
13	1304	Phin	3372124542.212	3372.125	SAVANNAKHET	10385	5648	30	45	5498
13	1301	Khanthabouri	681611273.958	681.611	SAVANNAKHET	61144	16543	5472	7597	11822
13	1309	Champhon	1049758789.065	1049.759	SAVANNAKHET	35634	13806	323	1815	13585
13	1306	Nong	1700596082.260	1700.596	SAVANNAKHET	1731	2729	10	7	2658
13	1310	Xonbouri	1205959535.145	1205.960	SAVANNAKHET	11508	4984	35	110	4984
13	1314	Xaiphouthong	454822663.925	454.823	SAVANNAKHET					
13	1308	Songkhon	1635816839.466	1635.817	SAVANNAKHET	45533	12818	442	435	11813
13	1307	Thapangthong	2115852184.956	2115.852	SAVANNAKHET	7274	3242	104	24	3242

- To cancel joined table, click Remove All Joins in Table Menu.



1.5 Link tables

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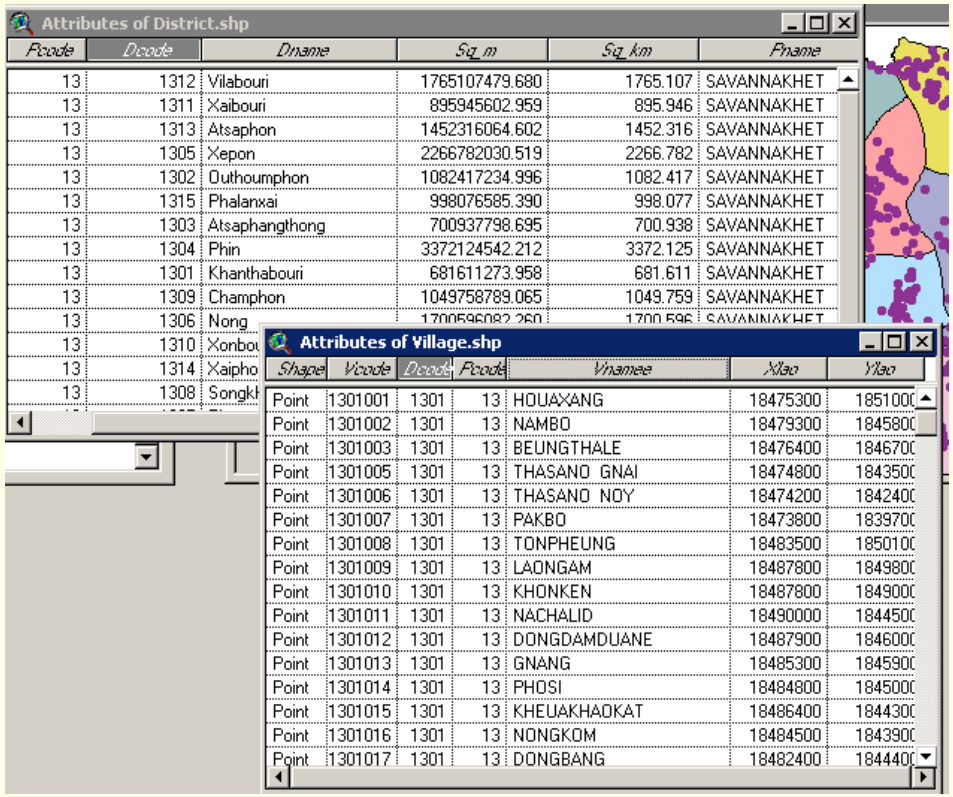
Linking option is used in case of one-to-many relationship.
For example we want to link to database of district boundary to village coverage weather to know the village information by district.

-Add table of “District.shp” and “Village.shp”



-Click on field name “Dcode” of Village’s table first
-Then click field name “Dcode” of district’s table

- Select “Link” in Table menu

Attributes of District.shp

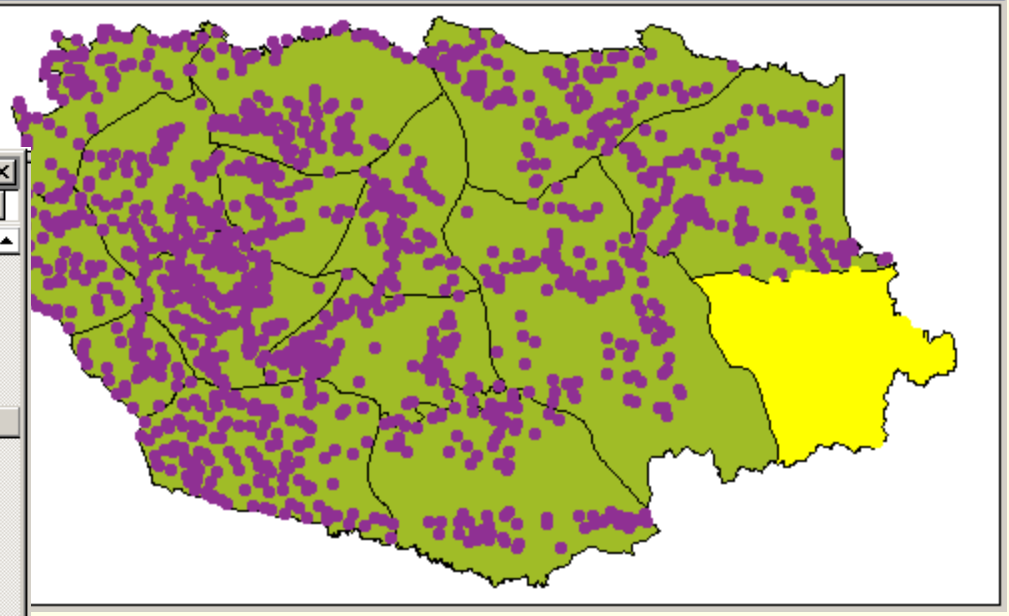
Pcode	Dcode	Dname	Sq_m	Sq_km	Pname
13	1301	Khanthabouri	681611273.958	681.611	SAVANNAKHET
13	1302	Outhoumphon	1082417234.996	1082.417	SAVANNAKHET
13	1303	Atsaphangthong	700937798.695	700.938	SAVANNAKHET
13	1304	Phin	3372124542.212	3372.125	SAVANNAKHET
13	1305	Xepon	2266782030.519	2266.782	SAVANNAKHET
13	1306	Nong	1700596082.260	1700.596	SAVANNAKHET
13	1307	Thapangthong	2115852184.956	2115.852	SAVANNAKHET
13	1308	Songkhon	1635816839.466	1635.817	SAVANNAKHET
13	1309	Champhon	1049758789.065	1049.759	SAVANNAKHET
13	1310	Xonbouri	1205959535.145	1205.960	SAVANNAKHET
13	1311	Xaibouri	895945602.959	895.946	SAVANNAKHET
13	1312	Vilabouri	1765107479.680	1765.107	SAVANNAKHET
13	1313	Atsaphon	1452316064.602	1452.316	SAVANNAKHET
13	1314	Xaiphouthong	454822663.925	454.823	SAVANNAKHET

Two tables are linked together
then we can select a record of district
-Click Dcode = 1306 in district's table
-Automatically select to records of Village which use same district's code

View1

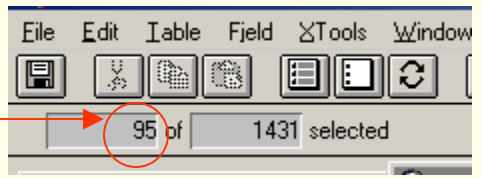
Village.shp

District.shp



Attributes of Village.shp

Shape	Vcode	Dcode	Pcode	Vnamee	Xlao	Ylao
Point	1306005	1306	13	PALOGNAM	18680300	1820300
Point	1306004	1306	13	OI	18683000	1817800
Point	1306003	1306	13	TANHTIB	18680800	1818600
Point	1306008	1306	13	LA-OU	18650000	1830100
Point	1306002	1306	13	PALOGBOK	18679800	1820700
Point	1306006	1306	13	PALOGBOUAK	18679500	1819200
Point	1306010	1306	13	SALOY MAI	18655900	1831500
Point	1306011	1306	13	SALOY KAO	18658200	1831400
Point	1306007	1306	13	CHAN	18654800	1831900
Point	1306009	1306	13	SANGPHOU	18654600	1830400
Point	1306014	1306	13	HOUB	18659500	1831200
Point	1306015	1306	13	NALONG KAO	18659800	1825500
Point	1306016	1306	13	LADER	18663500	1828000
Point	1306012	1306	13	TAMLOUANG	18656600	1829300
Point	1306018	1306	13	SENE	18666400	1827900
Point	1306019	1306	13	ASINGSALI	18668500	1828000



Number of villages fall in Nong's district

2. Selection

2.1 Identify features

2.2 Select features

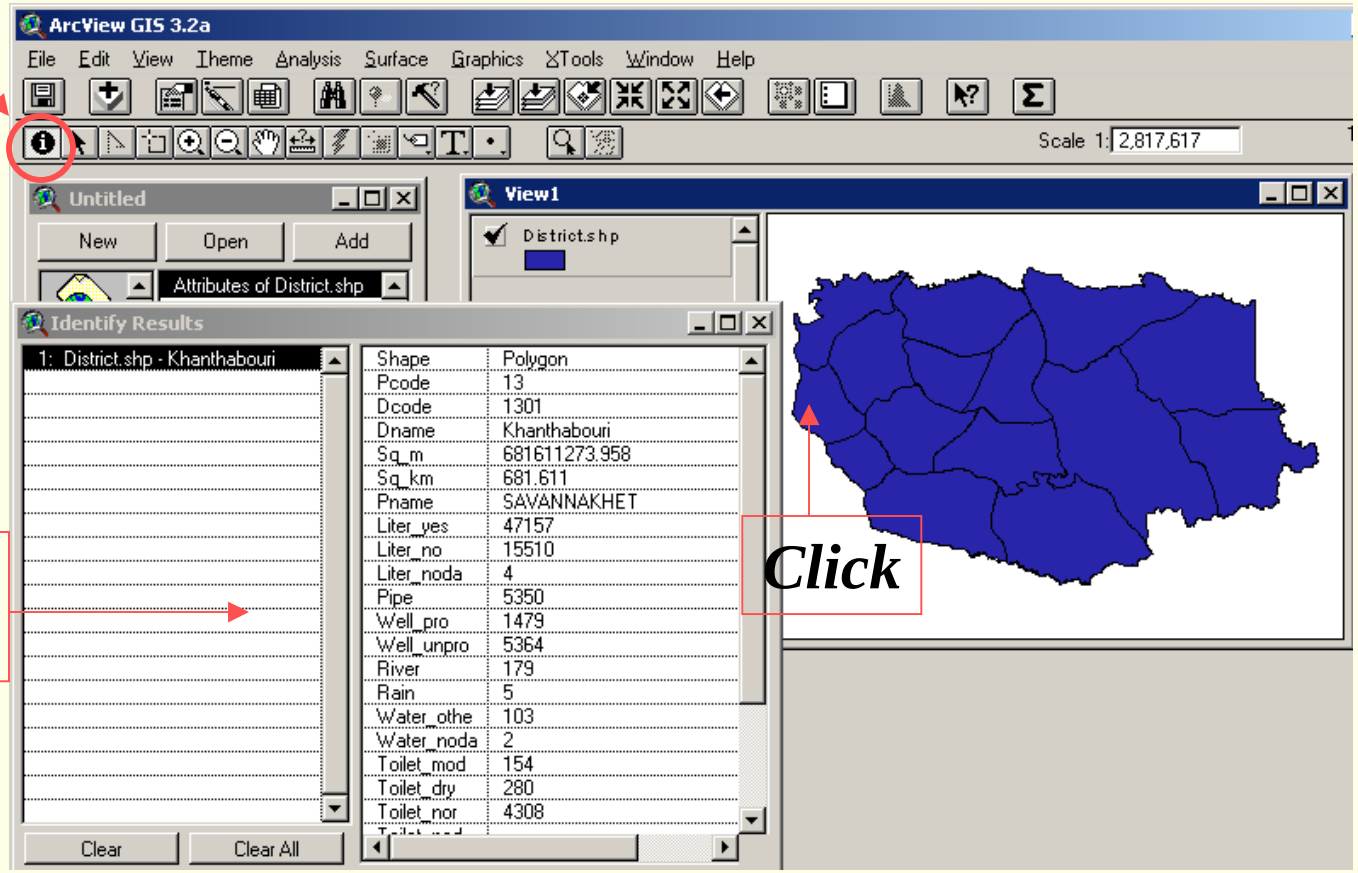
2.3 Select records

2.4 Select by themes

2.1 Identify features

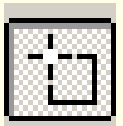
-Activate theme name “District.shp”

-Click Identify button then click on a feature of district theme



All information included joined data

2.2 Select features

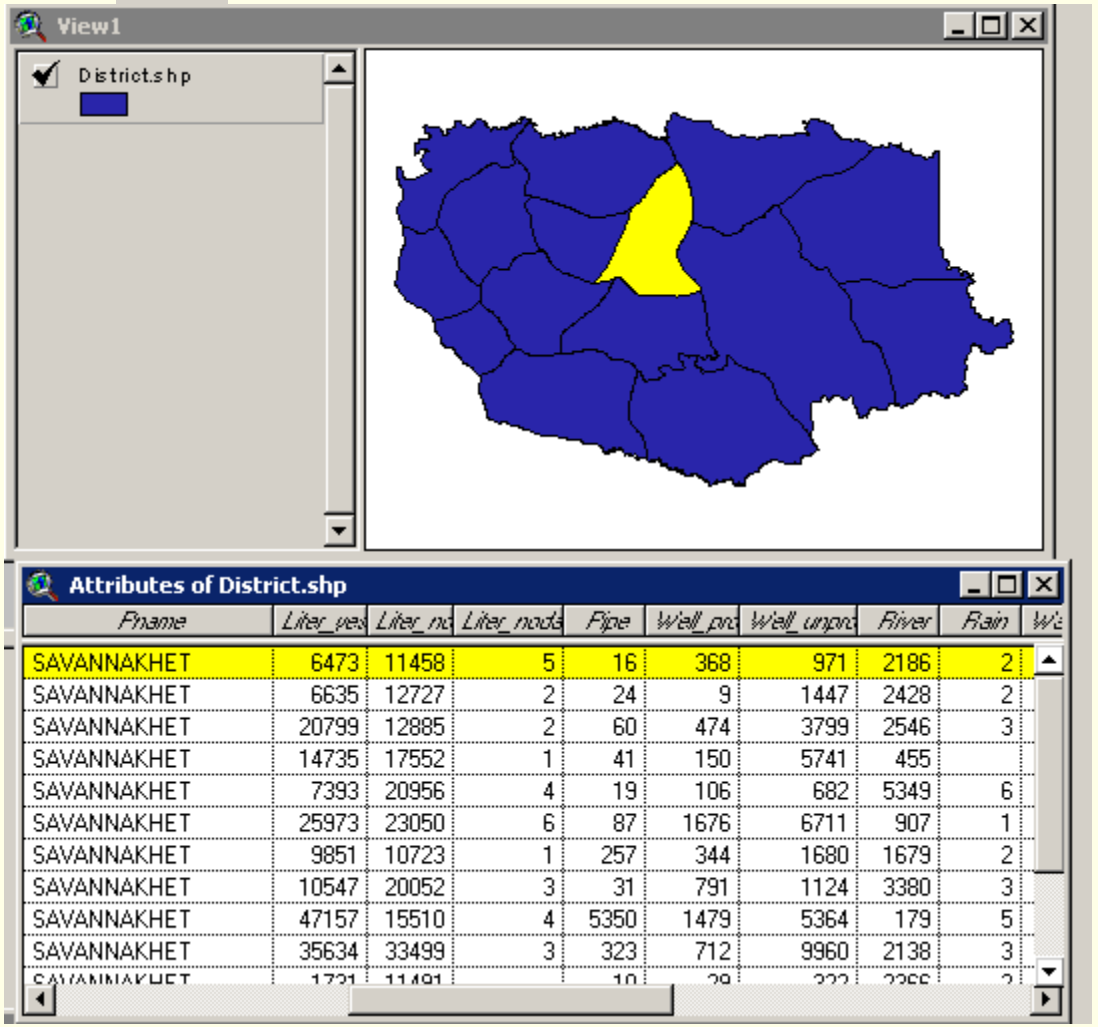
-Click Select Feature button 

-Clicking on a feature of district theme

-Open table of district.shp

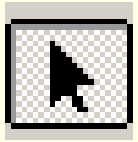
-Click Promote button

 to make the selected record shows on top.



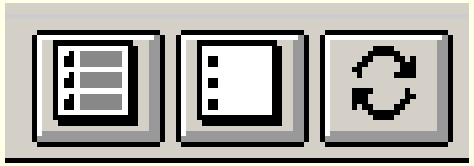
2.3 Select records

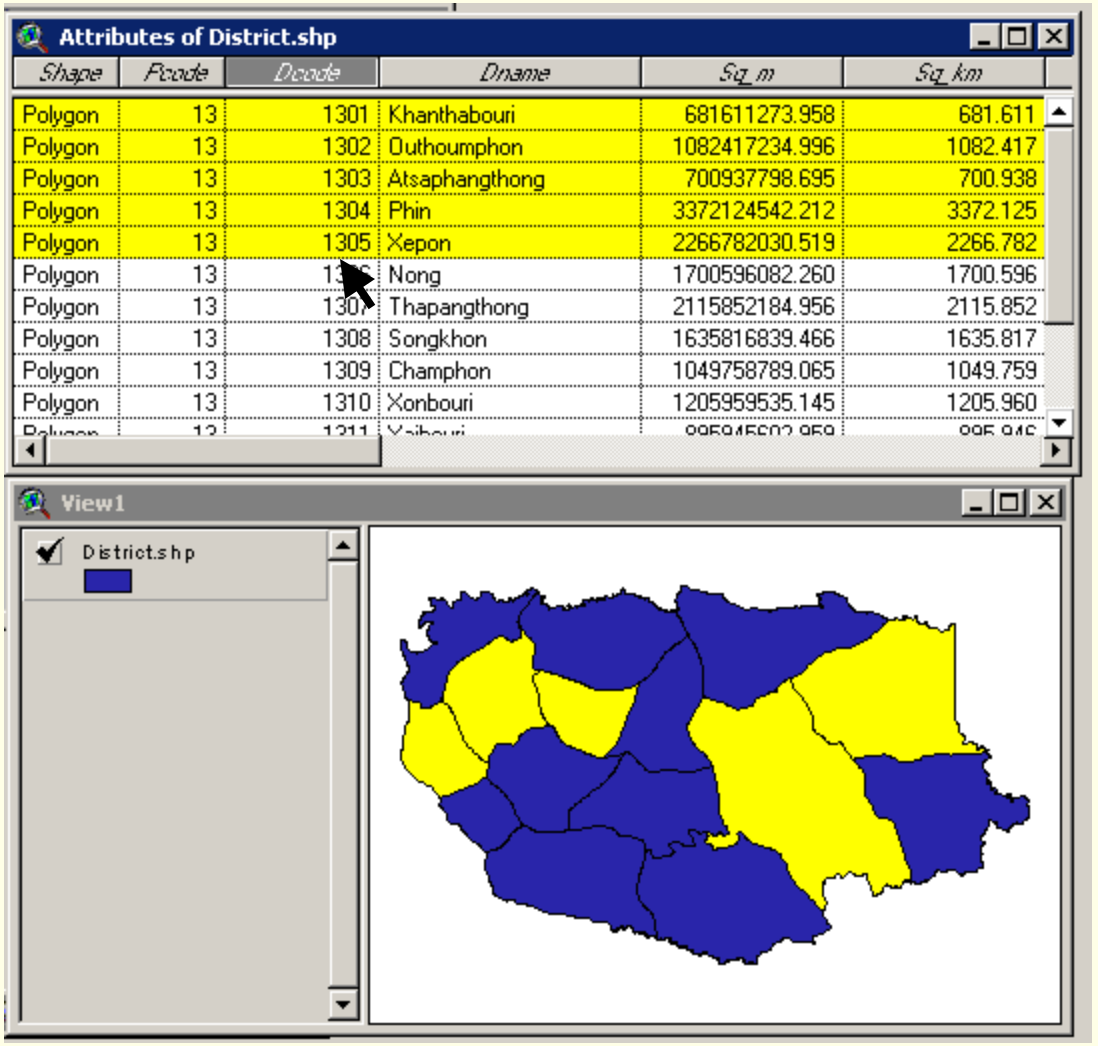
-Activate “District.shp” Table

-Click Select button 

-Clicking on records which Dcode = 1301 to 1305. Hold SHIFT key to select many records

-Try a set of Selection Tool

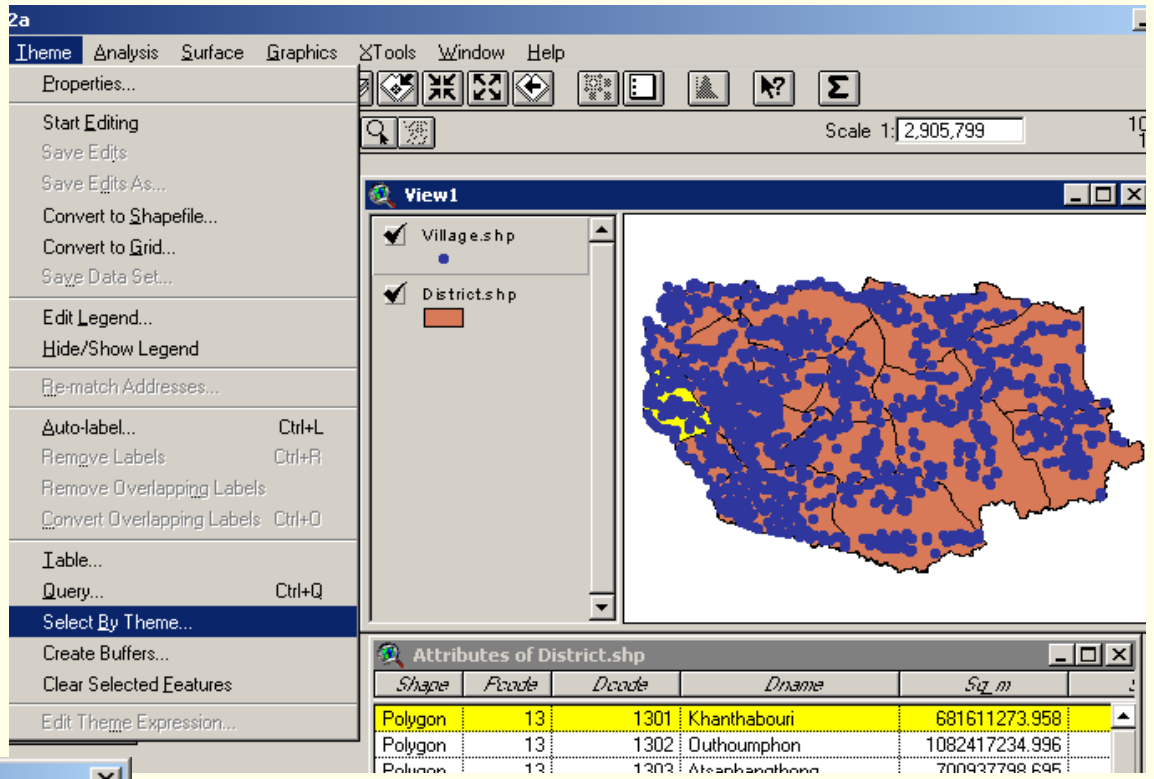


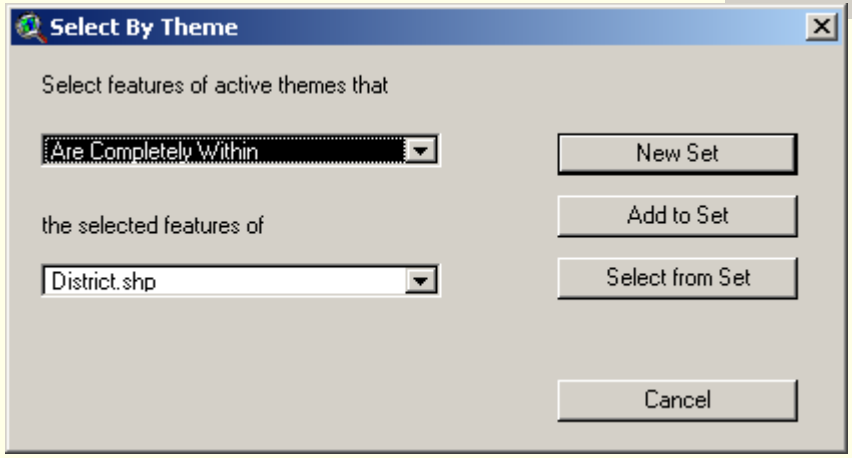


2.4 Select by themes

-Select district name "Khanthabouri"
-Add theme"Village.shp"
-Go to theme menu, Select By Theme

-Activate "Village" theme
-Choose input options as below





-Then click New Set
-Open table of "Village" and check number of villages within the district

3. Preparation of Subset

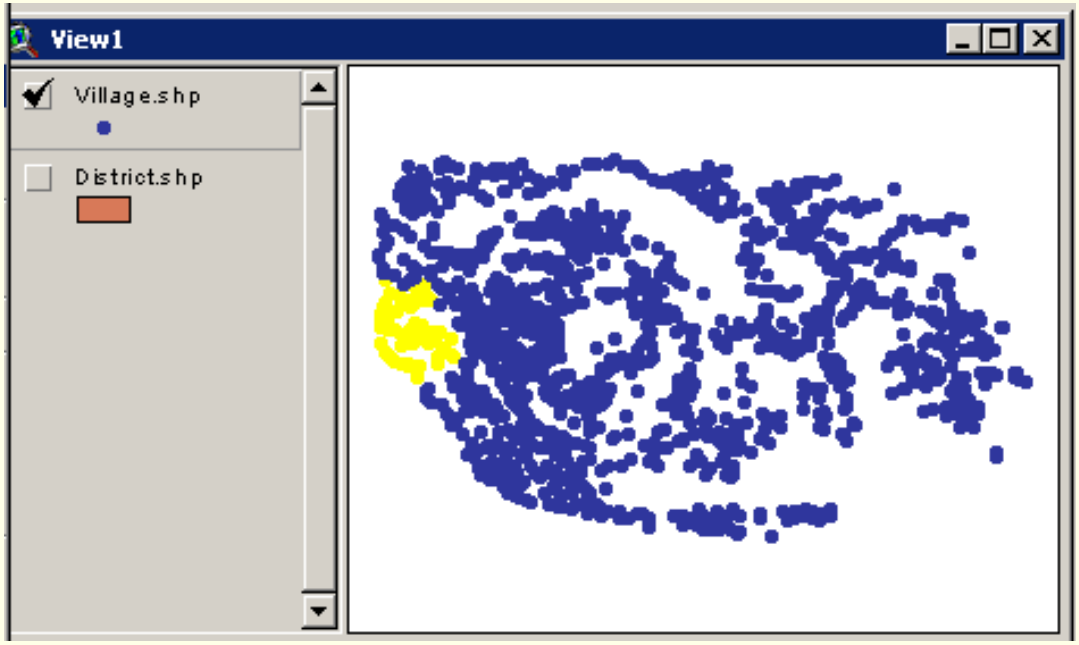
3.1 Creating subset shapefiles

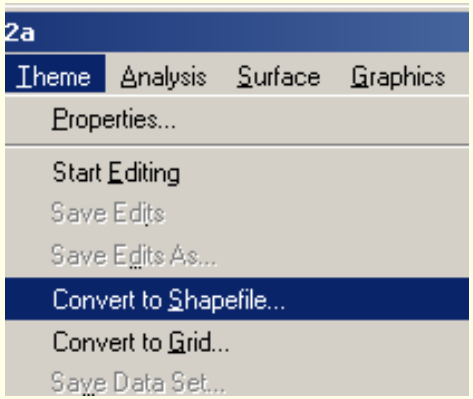
3.2 Creating subset databasefiles

3.1 Creating subset shapefiles

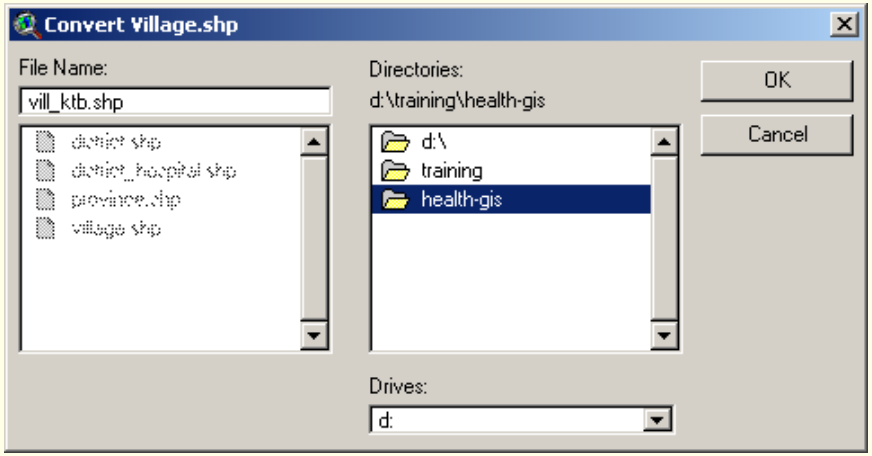
Once villages of Khanthabouri have been selected, we want the selection into separate shapefile.

- Activate theme “Village.shp” which have been selected within Khanthabouri district
- Go to Theme menu and select Convert to Shapefile

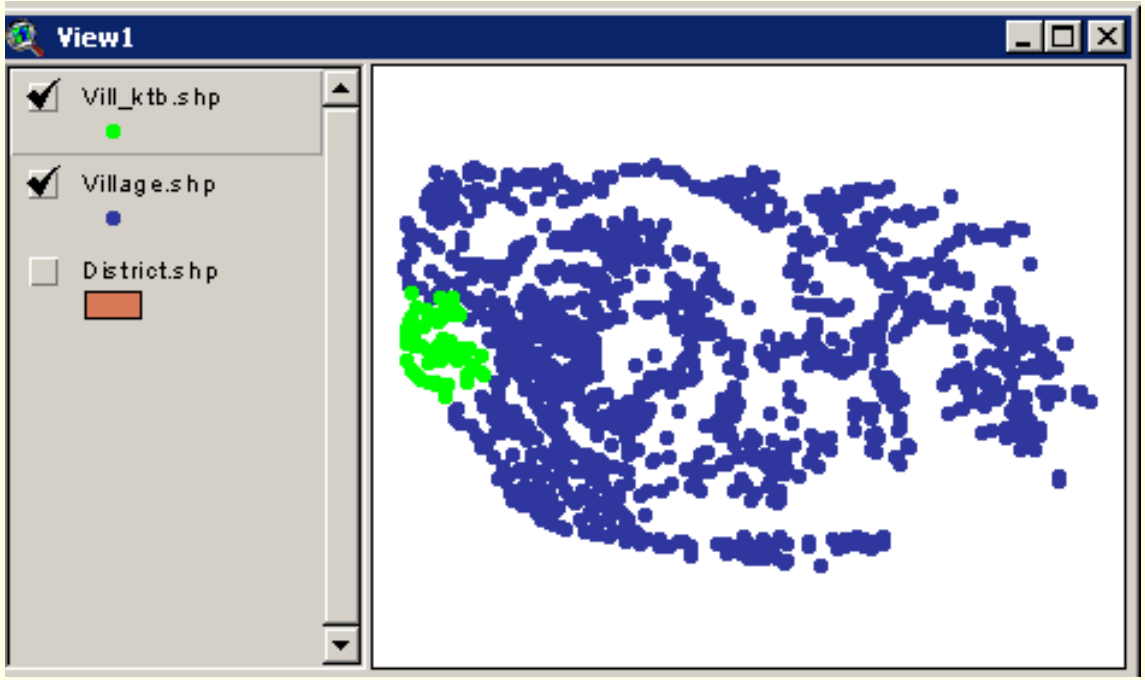




-Navigate the working directory and set a new name "vill_ktb" and click OK



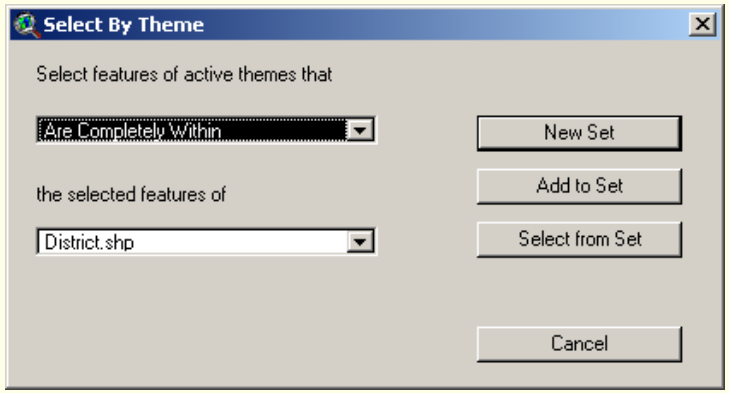
-Add new theme "vill_ktb" on View Window

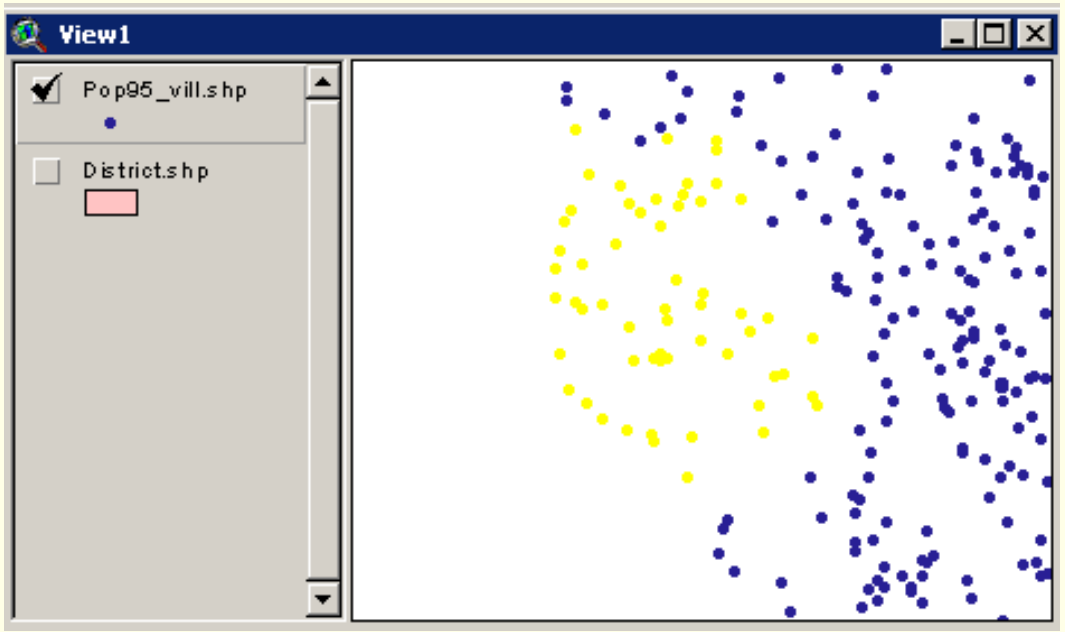


3.2 Creating subset databasefiles

This step we will create subset database file of population for Khanthabouri district.

-Add Theme name “pop95_vill.shp and “district.shp”
-Select Kanthabouri district feature
-Select “pop95_vill” feature within the distict



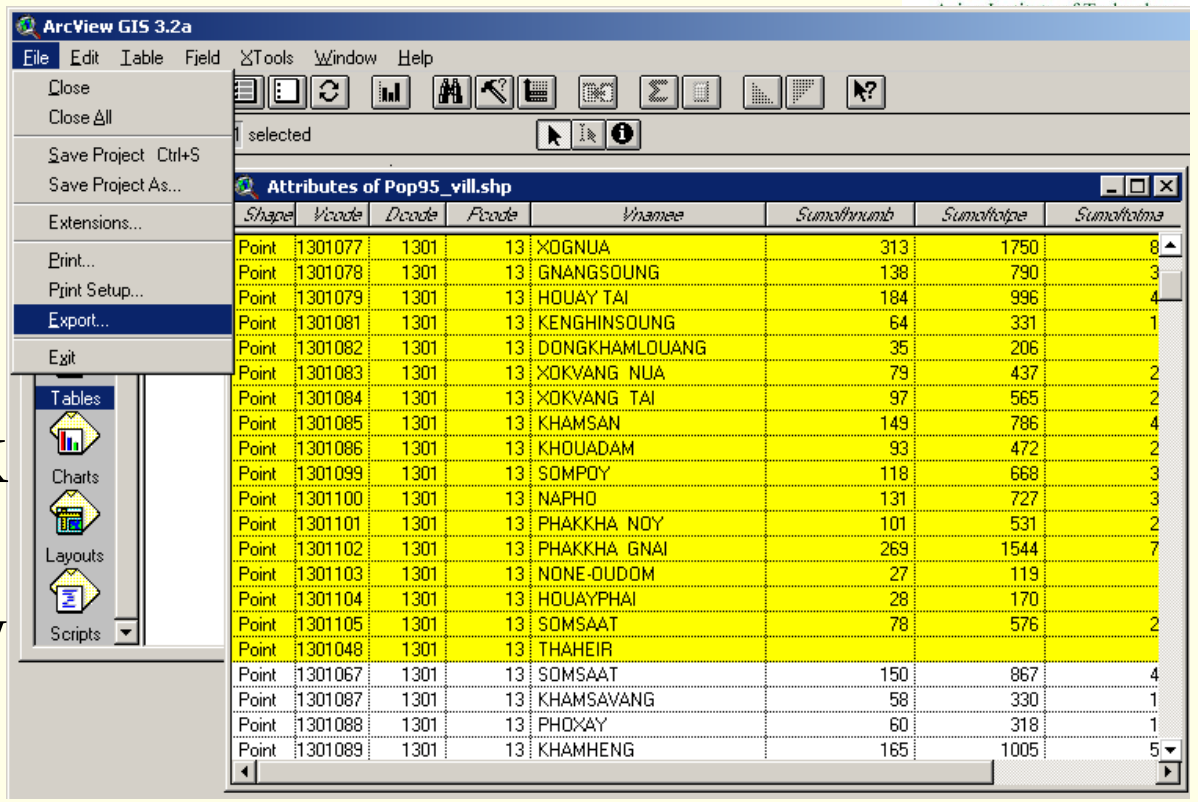


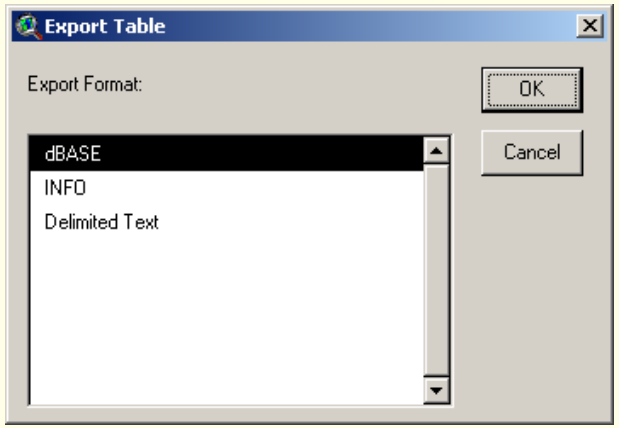
-Open the selected "Pop95_vill" table

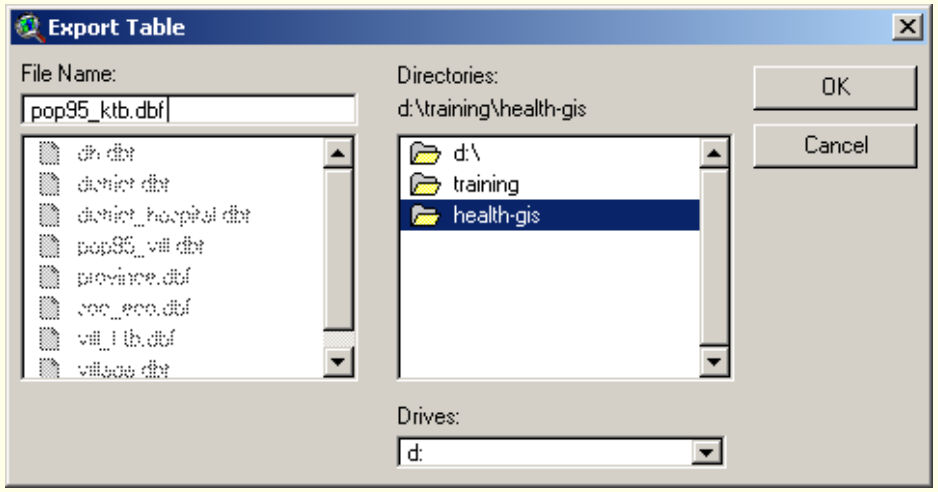
-Select Export from File menu

-Choose dBase as Export format, Click OK

-Navigate to working directory and input a new name, Click OK

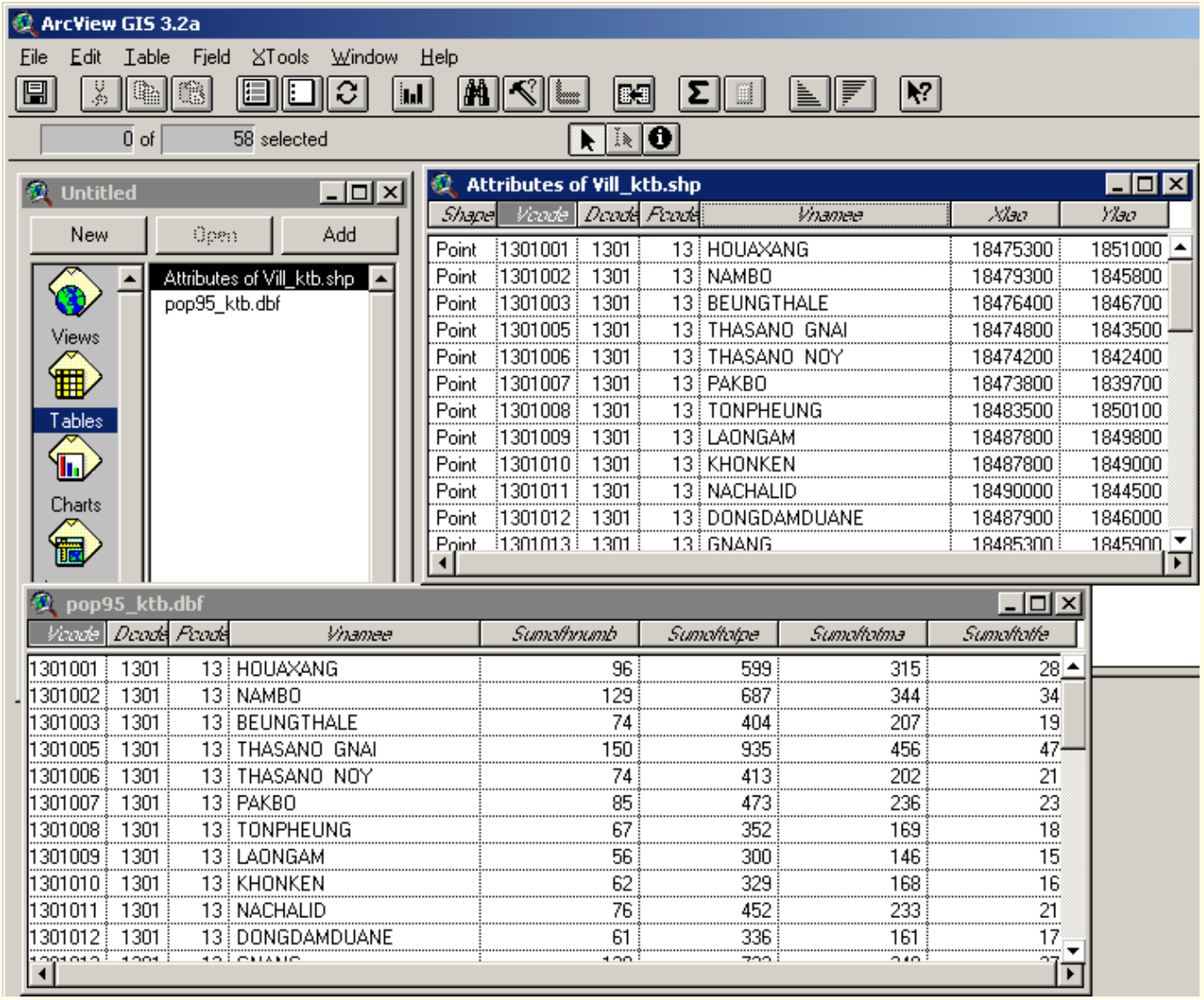






-Add table “Pop95_ktb.dbf” and open table of “Vill_ktb.shp” theme

-Join two table and save as a new shapefile (Covert to Shapefile)



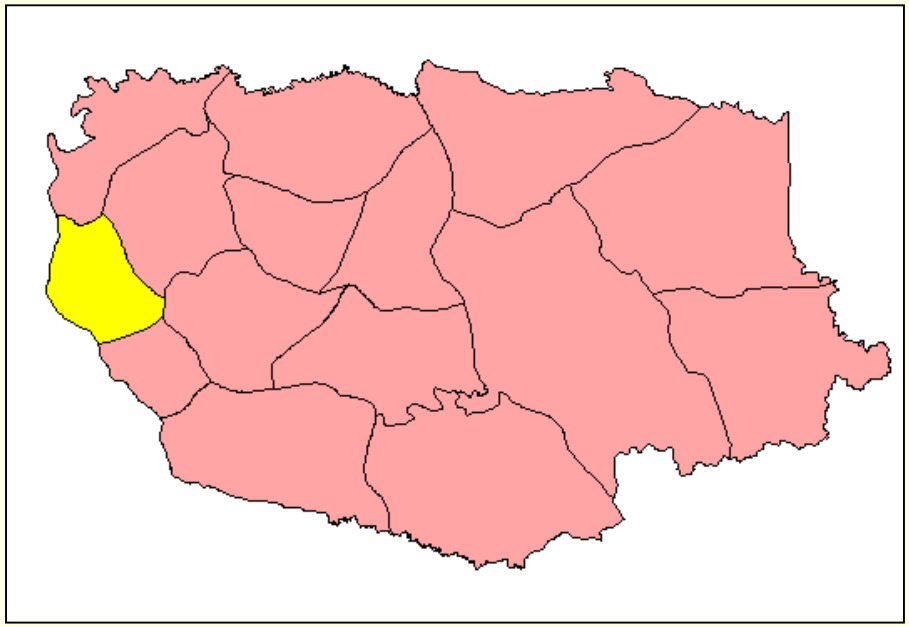
4. Database query

4.1 Build query expressions

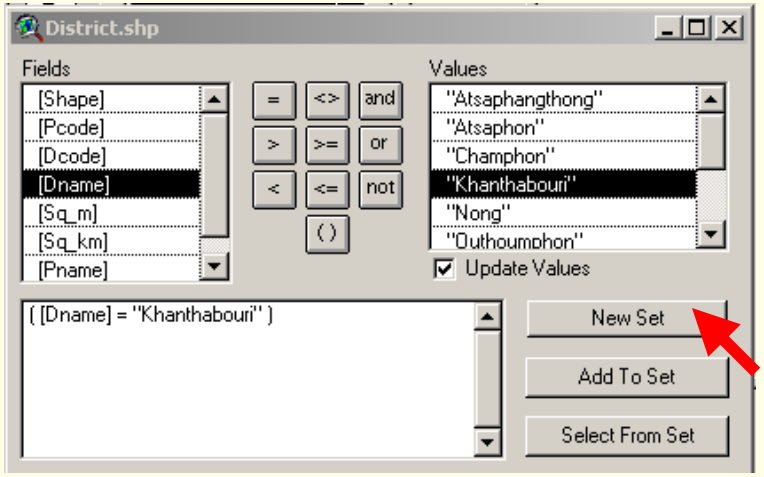
4.2 Database query (single/ multiple)

4.1 Build query expressions

Building a query expression is a powerful way to select features which fulfill certain conditions.

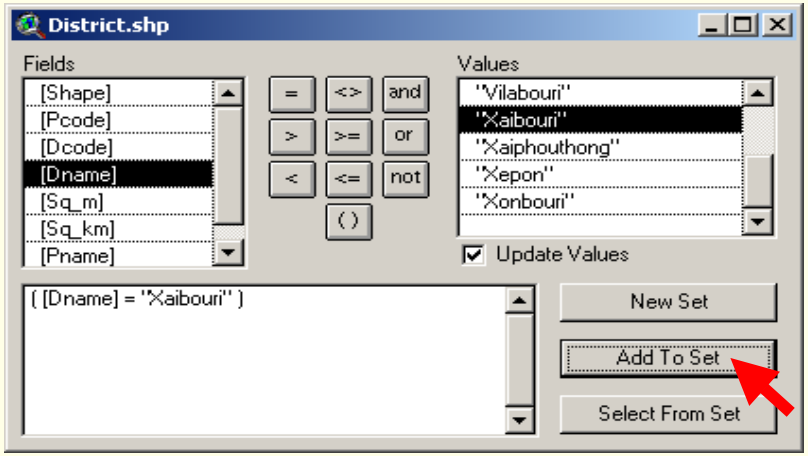


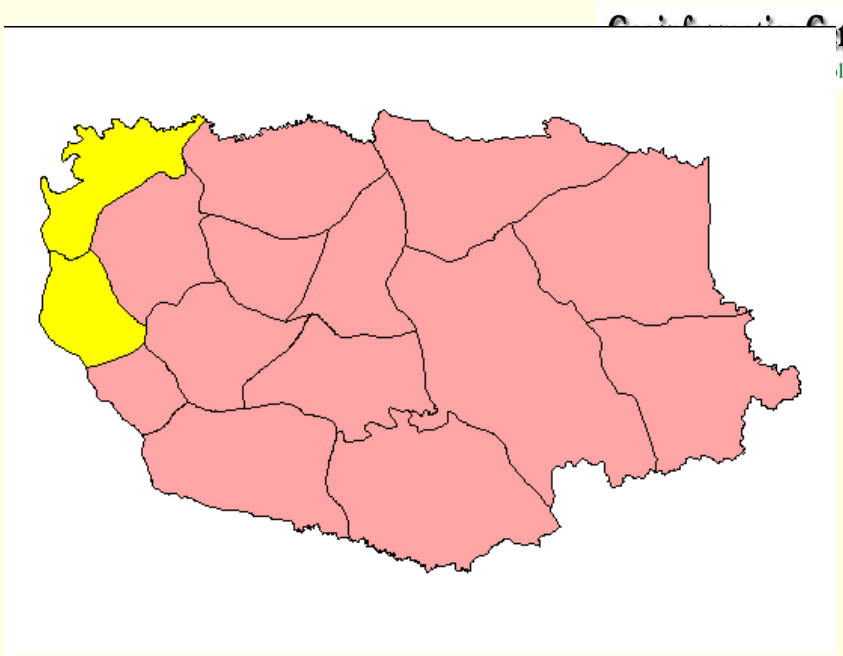
-Add theme “district.shp”
-Click Query Builder button 
-Double click field’s name and input an expression



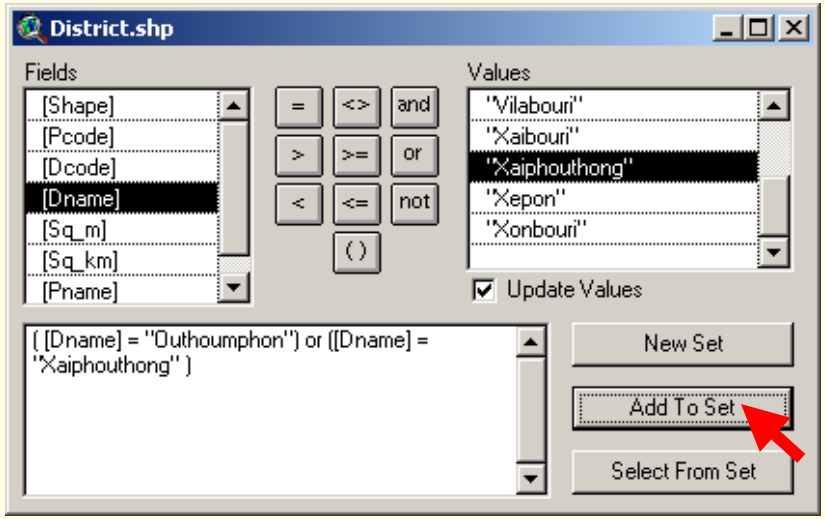
-Query district name = khanthaburi
-Click New Set button

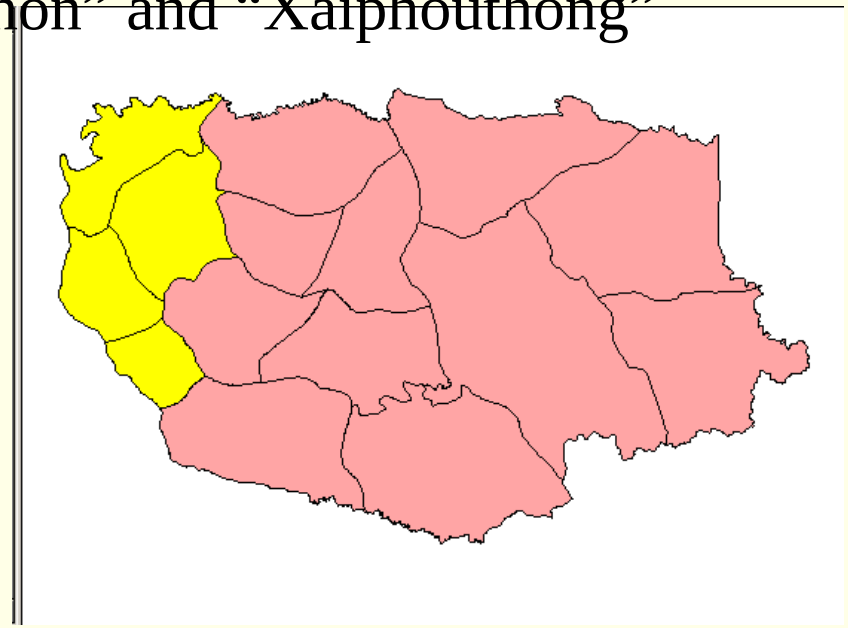
-Query district name = “Xaibouri”
-Then click Add To Set botton





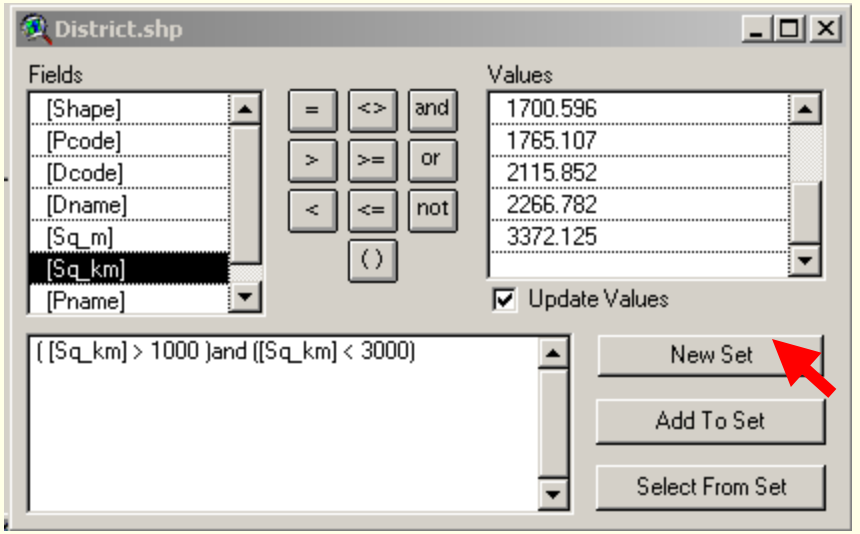
-Query more district name “Outoumphon” and “Xaiphouthong”





4.2 Database query (single)

To find districts which has an area < 3,000 Sq.Km.but > 1,000 Sq.Km.



-Activate “district.shp”

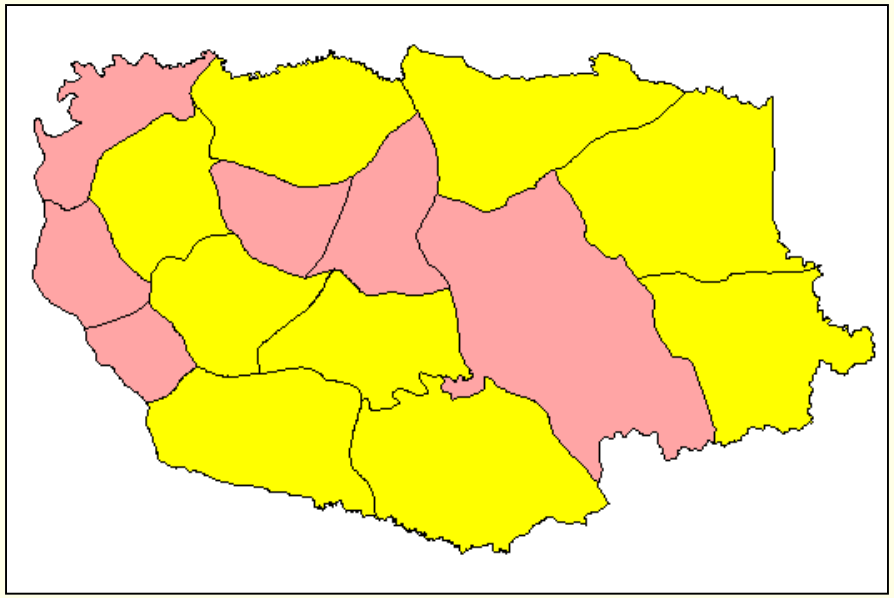
-Click Query Builder button.

-Input an expression

([Sq_km] > 1000) and ([Sq_km] < 3000)

Double click in the list of fields, Operator and Values

-Click New Set



4.2 Database query (multiple)

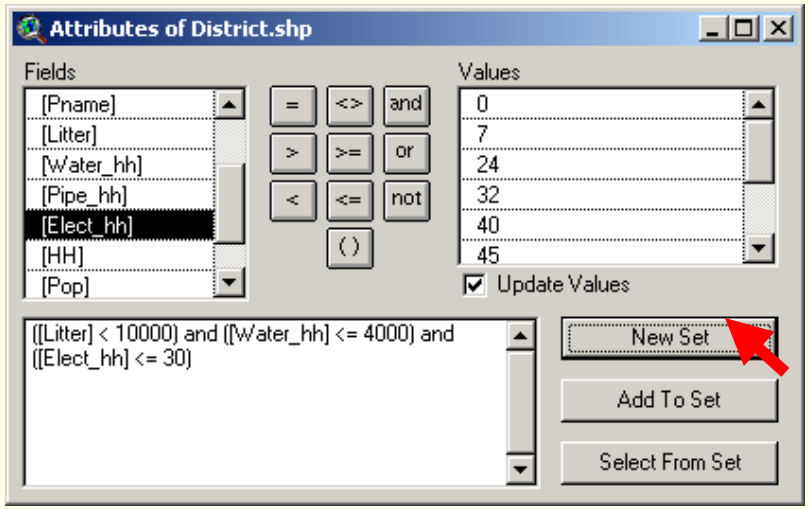
How to query multiple database tables in the same time?

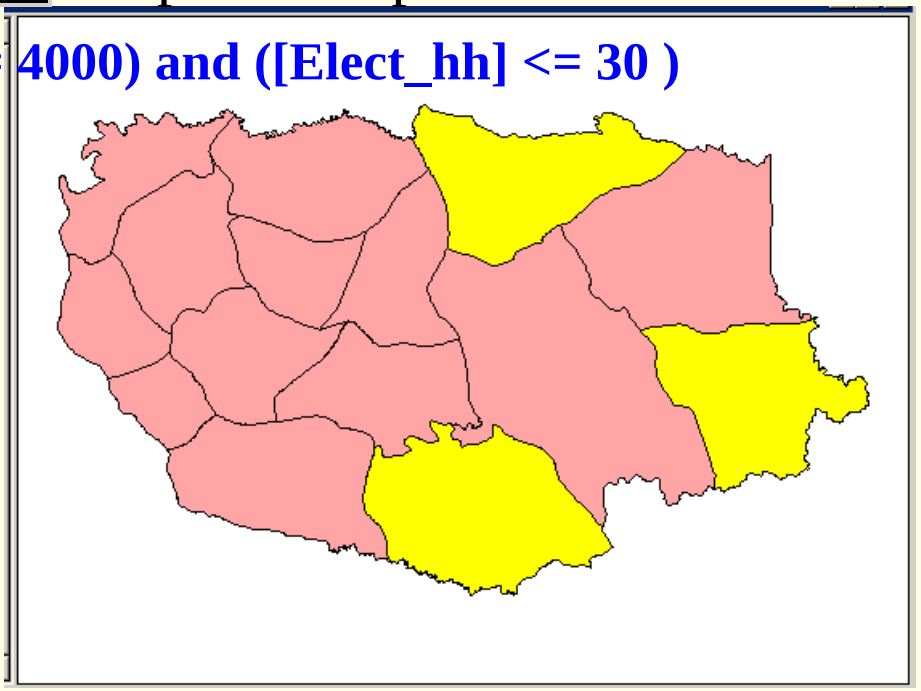
-Create a new “district” theme which already joined with table “Soc-eco.dbf” (step 1.4). Save new theme as “Social_dist”

-Add theme “Social_dist” to a View window

-Click Query Builder button.  Input an expression

([Liter] < 10000) and ([Water_hh] <= 4000) and ([Elect_hh] <= 30)





5.Calculation

5.1 Statistic

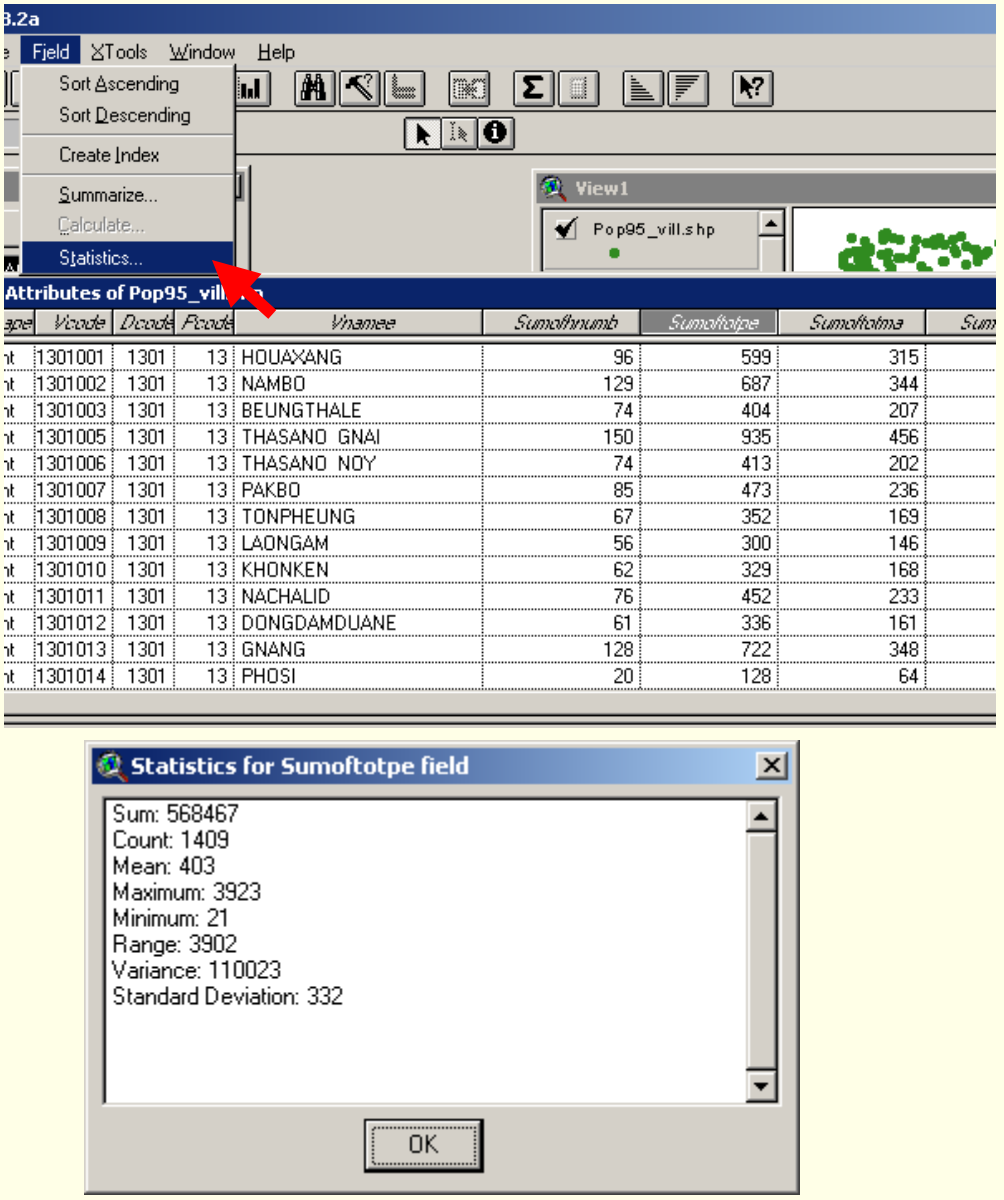
5.2 Aggregation data

5.3 Statistic

5.1 Statistic

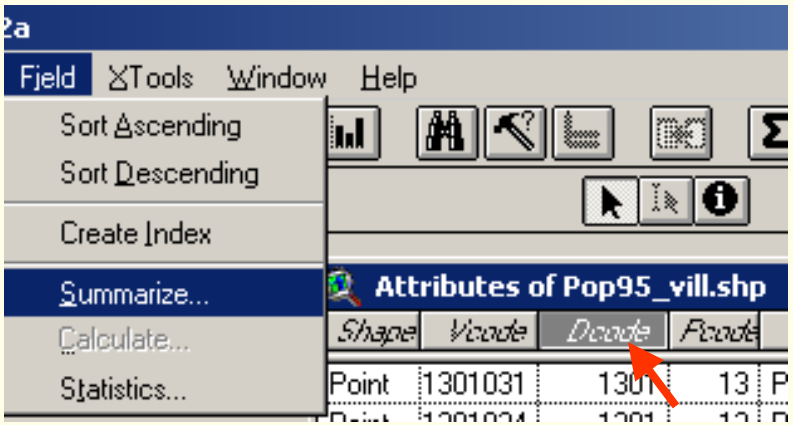
This step we would like to see statistic information of total population of attribute table “Pop95_vill.shp”

-Add table of “Pop95_vill.shp”
-Activate field name “Sumtotpe”
-Click Field and Statistic
-The statistic information of the field will be displayed
-Click OK to close the window



5.2 Aggregation data

In the population database we have information for each village on population, number of population by district



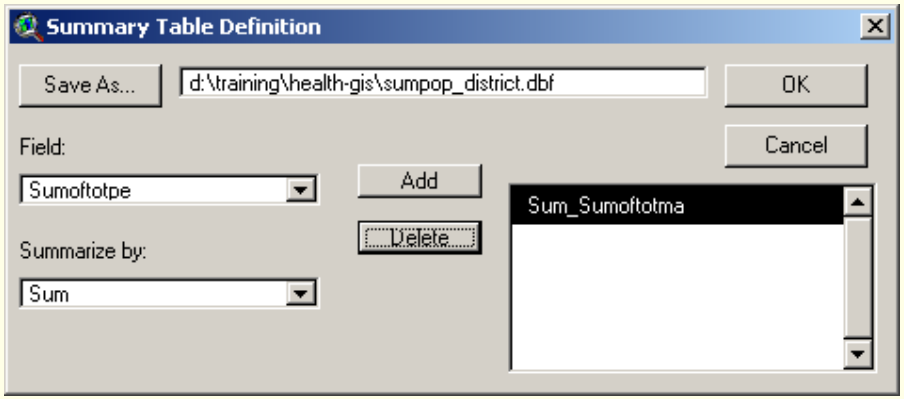
-Open attribute table of Pop95_vill.shp

-Activate the table and click on field's name "Dcode"

-Select Summarize in Field menu

-Once Summary Table Definition loaded

Click Save As to navigate output file's directory



-Select Field name "Sum_Sumoftotma"

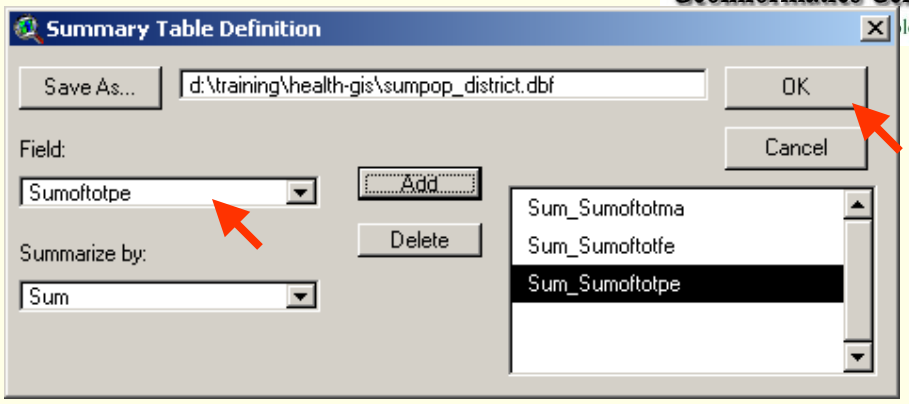
-Select a method to summarize

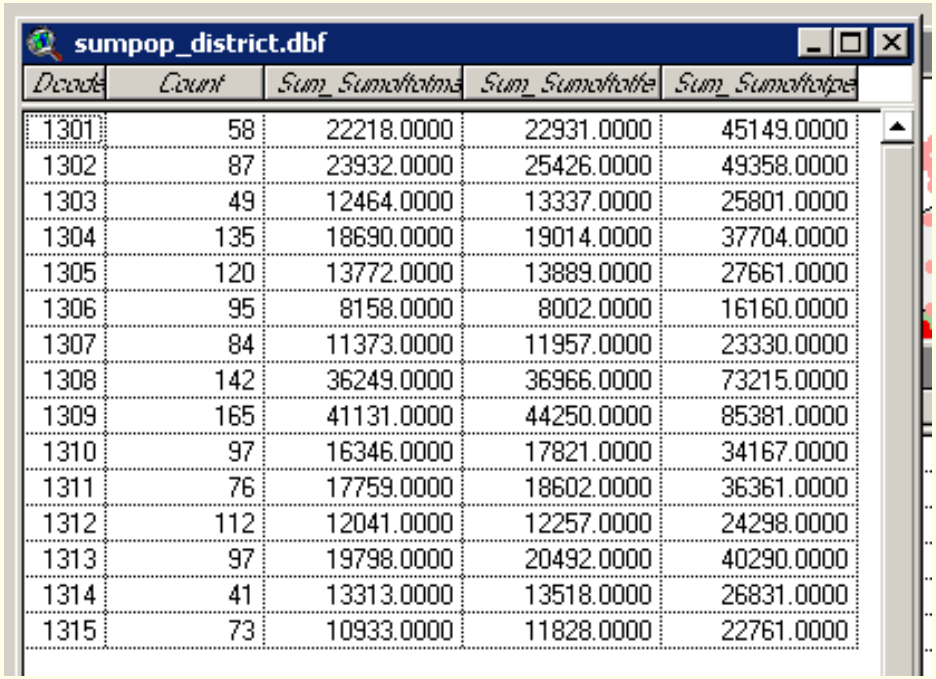
-Click add

-Select others field ; “Sum_Sumoftotfe” and “Sum_Sumoftotpe”. Click Add

-Click OK to finish aggregations

-If there are some unnecessary fields have been added. The fields can be deleted by clicking on those fields and click Delete button.





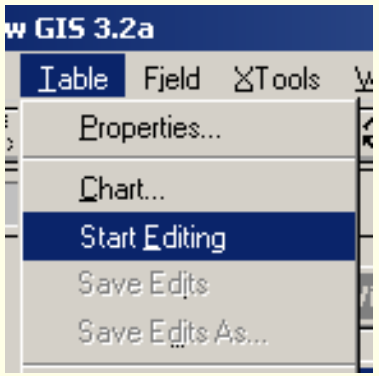
Decode	Count	Sum_Sumoftotma	Sum_Sumoftotfe	Sum_Sumoftotpe
1301	58	22218.0000	22931.0000	45149.0000
1302	87	23932.0000	25426.0000	49358.0000
1303	49	12464.0000	13337.0000	25801.0000
1304	135	18690.0000	19014.0000	37704.0000
1305	120	13772.0000	13889.0000	27661.0000
1306	95	8158.0000	8002.0000	16160.0000
1307	84	11373.0000	11957.0000	23330.0000
1308	142	36249.0000	36966.0000	73215.0000
1309	165	41131.0000	44250.0000	85381.0000
1310	97	16346.0000	17821.0000	34167.0000
1311	76	17759.0000	18602.0000	36361.0000
1312	112	12041.0000	12257.0000	24298.0000
1313	97	19798.0000	20492.0000	40290.0000
1314	41	13313.0000	13518.0000	26831.0000
1315	73	10933.0000	11828.0000	22761.0000

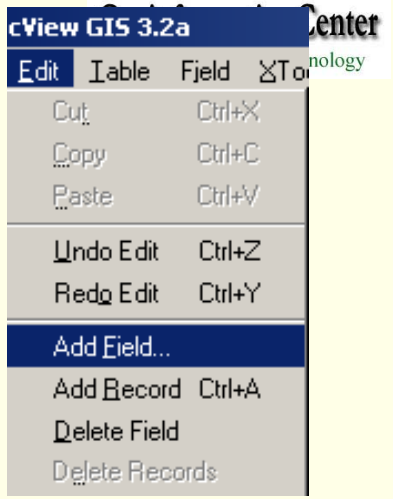
-Add “sumpop_district.dbf”

-Try more aggregations fields using others method such as Average,Minimum, Maximum.etc.

5.3 Calculator

In order to calculate percentage of number of male and female by district which we have created from the previous steps.

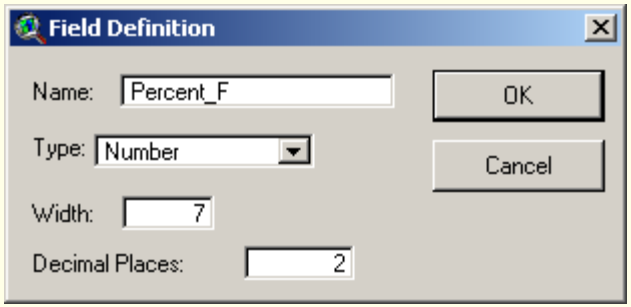




-Activate table name “sumpop_district.dbf” which we have created from the previous steps.

-Click Start Editing in Table menu

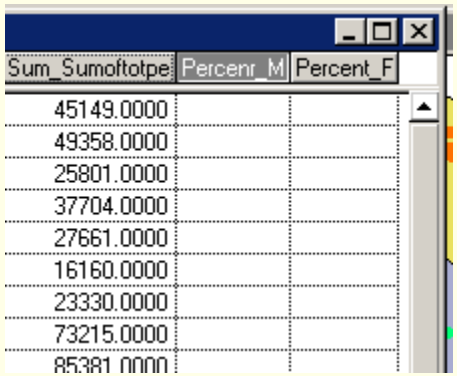
-Add two fields name “Percent_M” and “Pecent_F” with be in “Number” type, “7” width and “2” decimal places

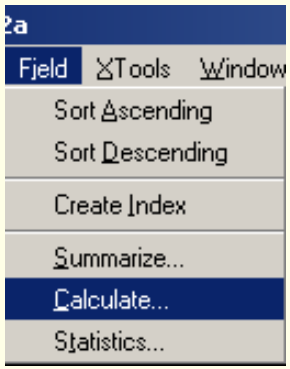


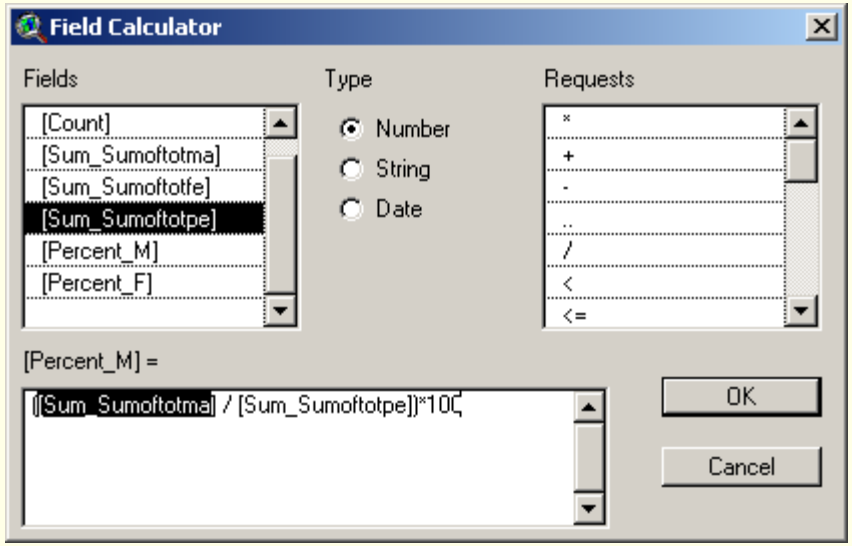
-Activate on “Percent_M” field name

-Select Calculate in Field menu

-Input an expression







Do the same expression to calculate percentage

Of number of female population by district

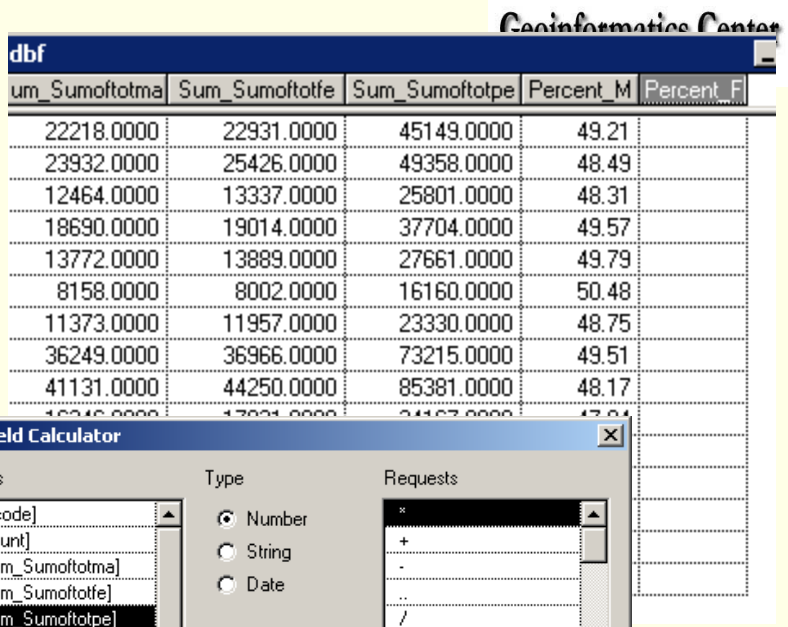
-Activate “Percent_F” field name

-Click Calculator button

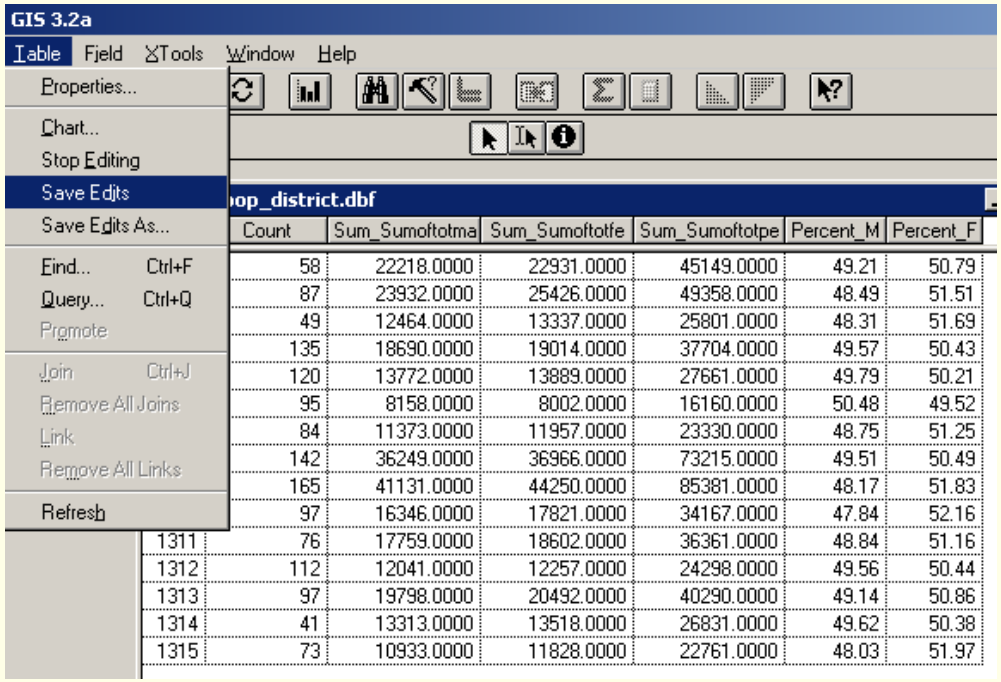
-Input an expression as follow

([Sum_Sumoftotfe] / [Sum_Sumoftotpe]) * 100

-Click OK



um_Sumoftotma	Sum_Sumoftotfe	Sum_Sumoftotpe	Percent_M	Percent_F
22218.0000	22931.0000	45149.0000	49.21	
23932.0000	25426.0000	49358.0000	48.49	
12464.0000	13337.0000	25801.0000	48.31	
18690.0000	19014.0000	37704.0000	49.57	
13772.0000	13889.0000	27661.0000	49.79	
8158.0000	8002.0000	16160.0000	50.48	
11373.0000	11957.0000	23330.0000	48.75	
36249.0000	36966.0000	73215.0000	49.51	
41131.0000	44250.0000	85381.0000	48.17	



	Count	Sum_Sumoftotma	Sum_Sumoftotfe	Sum_Sumoftotpe	Percent_M	Percent_F
	58	22218.0000	22931.0000	45149.0000	49.21	50.79
	87	23932.0000	25426.0000	49358.0000	48.49	51.51
	49	12464.0000	13337.0000	25801.0000	48.31	51.69
	135	18690.0000	19014.0000	37704.0000	49.57	50.43
	120	13772.0000	13889.0000	27661.0000	49.79	50.21
	95	8158.0000	8002.0000	16160.0000	50.48	49.52
	84	11373.0000	11957.0000	23330.0000	48.75	51.25
	142	36249.0000	36966.0000	73215.0000	49.51	50.49
	165	41131.0000	44250.0000	85381.0000	48.17	51.83
	97	16346.0000	17821.0000	34167.0000	47.84	52.16
1311	76	17759.0000	18602.0000	36361.0000	48.84	51.16
1312	112	12041.0000	12257.0000	24298.0000	49.56	50.44
1313	97	19798.0000	20492.0000	40290.0000	49.14	50.86
1314	41	13313.0000	13518.0000	26831.0000	49.62	50.38
1315	73	10933.0000	11828.0000	22761.0000	48.03	51.97

-Select Save Edits in Table menu

-Click Stop Editing