EXERCISE 17 QUERY AND RETRIEVAL

Structure

17.1 INTRODUCTION

You have practised to digitise and create vector layers and to store attribute data as vector features in exercises 5 to 7 of Part I of this course. Let us now learn to carry out spatial analysis on GIS datasets. One of the first things while carrying out spatial analysis is to visualise and explore the datasets that can be done through query. Attribute and spatial queries allow you to examine general trends in the data and understand relationship between datasets.

This exercise is based on the theoretical knowledge that you have gained from Unit 11 of MGY-003. You are advised to refer to the unit in case of any doubt while performing this exercise.

Objectives

After working through this exercise, you should be able to:

- perform simple attribute query;
- carry out complex attribute query; and
- execute spatial query.

17.2 REQUIREMENTS

To carry out this exercise, you need to have the following:

- a computer with QGIS installed in it, and
- internet connection for downloading data to be used for this exercise.

17.3 IMPORTANCE OF QUERY

As you have studied in Unit 11 of MGY-003, the fundamental purpose of any GIS is to allow retrieval of desired information, which is achieved through the process of query. Queries can be categorised into spatial and non-spatial (attribute) query. Spatial query includes queries made on the spatial properties of the geographic object such as location, distance, *etc*. Non-spatial (attribute) query refers to the characteristics of any feature or phenomenon which are stored in form of a table in GIS database with a unique identifier key.

Both types of queries can be further sub-divided into a simple or a complex query depending upon the number of parameters used. If a query is made to search using just one parameter then it is called a *simple query* and if a

query is made to search using more than one parameter *i.e.* two or more criteria then it is called a *complex query*.

Query is important for visualising and exploring nature of data as it allows you to identify, select, and find features and also to examine general trends in the data and understand relationship between datasets without altering the data.

17.4 STEPS

It may be noted that when you perform a query then the particular type of data will be processed by that query. For example, an attribute query will process the non-spatial data while a spatial query will process the spatial data. In this exercise, you will familiarise with attribute and spatial queries. Let us discuss the process of each of the type of query briefly in the following section.

17.4.1 Simple Attribute Query

Query can be performed on a layer based on its attributes. In QGIS, simple query can be done with the attribute table. As you know attribute table displays features of a selected layer. Each row in the table represents one map feature with its attributes shown in several columns. Follow the steps given below to run a simple attribute query:

1. Download a sample point shape file showing places of the World from **www.naturalearthdata.com/http//www.naturalearthdata.com/download/10m/cultural/ne_10m_populated_places.zip** from the Natural Earth dataset. Then extract the shape file from the zip archive and save it on the hard disk.
2. Open QGIS. Select ***Layer → Add Vector Layer***. Add the source dataset by browsing and selecting the extracted shape file from the hard disk. Click on *Open* button to load the layer on QGIS canvas. The layer appears as in Fig. 17.1.

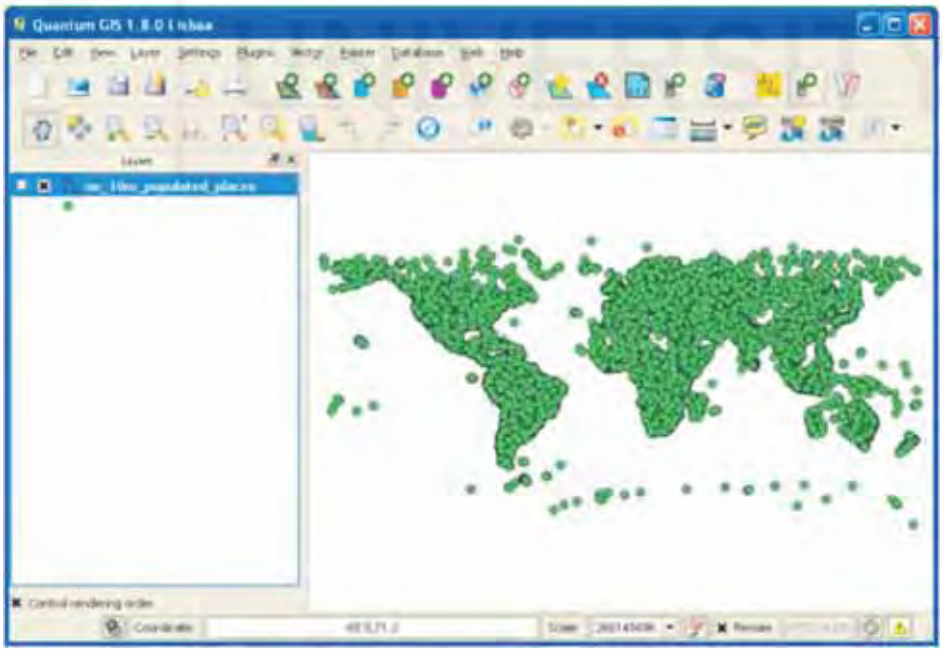

Fig. 17.1: QGIS showing point vector data

3. Right-click on the *layer name* (ne_10m_populated_places) and select *Open Attribute Table* which opens the attribute table as in Fig. 17.2.

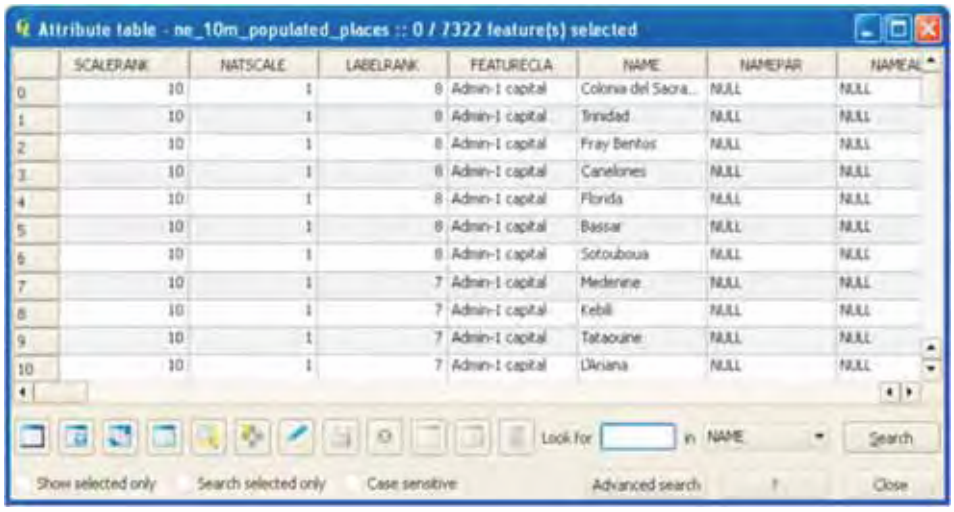

Fig. 17.2: Attribute table of the point data

4. Type *New Delhi* in the *Look for* text box. Select *Name* in the dropdown fields list. Click *Search* button as shown in Fig. 17.3. This will select *New Delhi* point feature and it will be highlighted in yellow colour on the QGIS map as shown in Fig. 17.4.

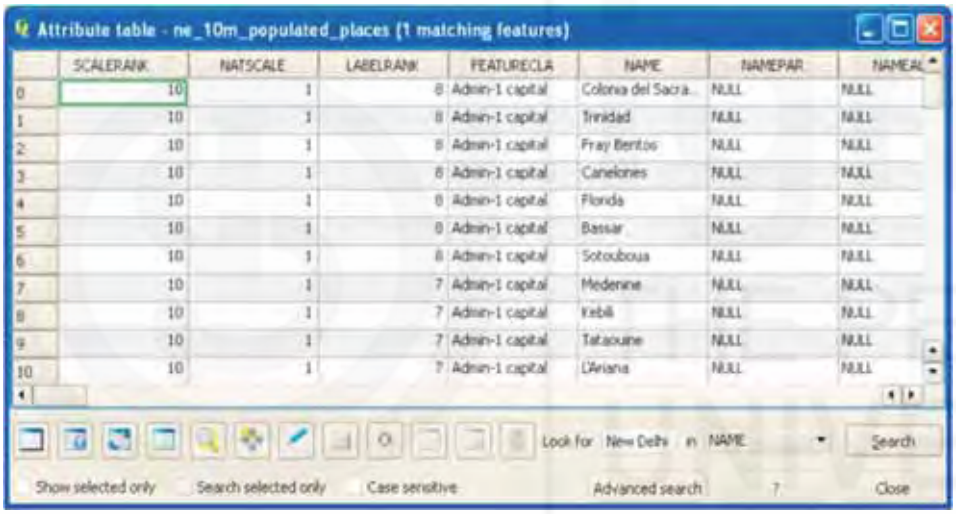

Fig. 17.3: Search for New Delhi

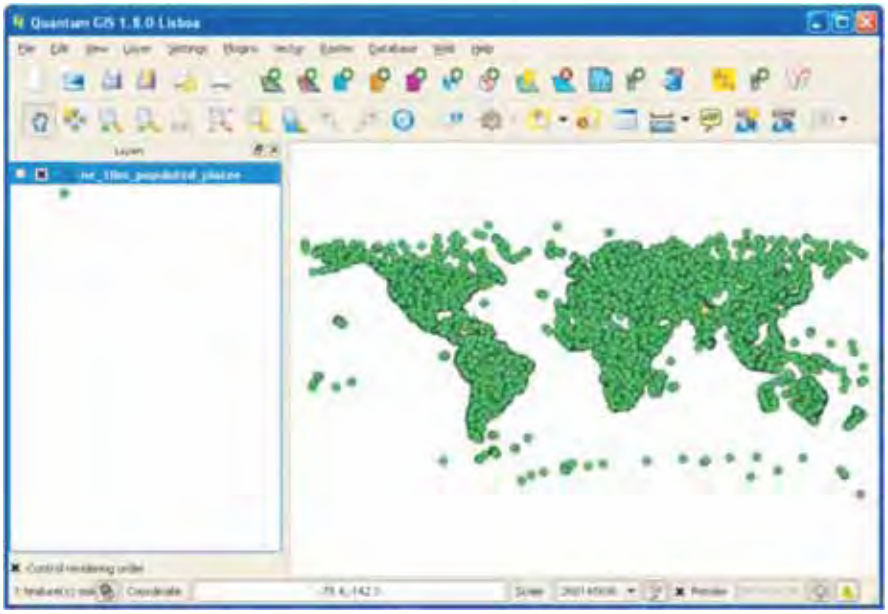

Fig. 17.4: New Delhi highlighted in yellow colour

5. See the selected record on the attribute table by checking the *Show selected only* as shown in Fig. 17.5.

Fig. 17.5: Attribute table showing the record selected

6. Click *Close* button to finish.

17.4.2 Complex Attribute Query

In QGIS, complex attribute query can be performed using query builder. The query builder defines a subset of a table using a SQL-like WHERE clause. The result will be plotted on the QGIS map and can also be saved as a separate layer. Follow the steps given below to run a complex attribute query:

1. Open the same dataset as in the previous example and open its attribute table. Click on *Advanced search*, or select ***Query*** menu item from the ***Layer*** menu. This will open the ***Query builder*** as shown in Fig. 17.6.

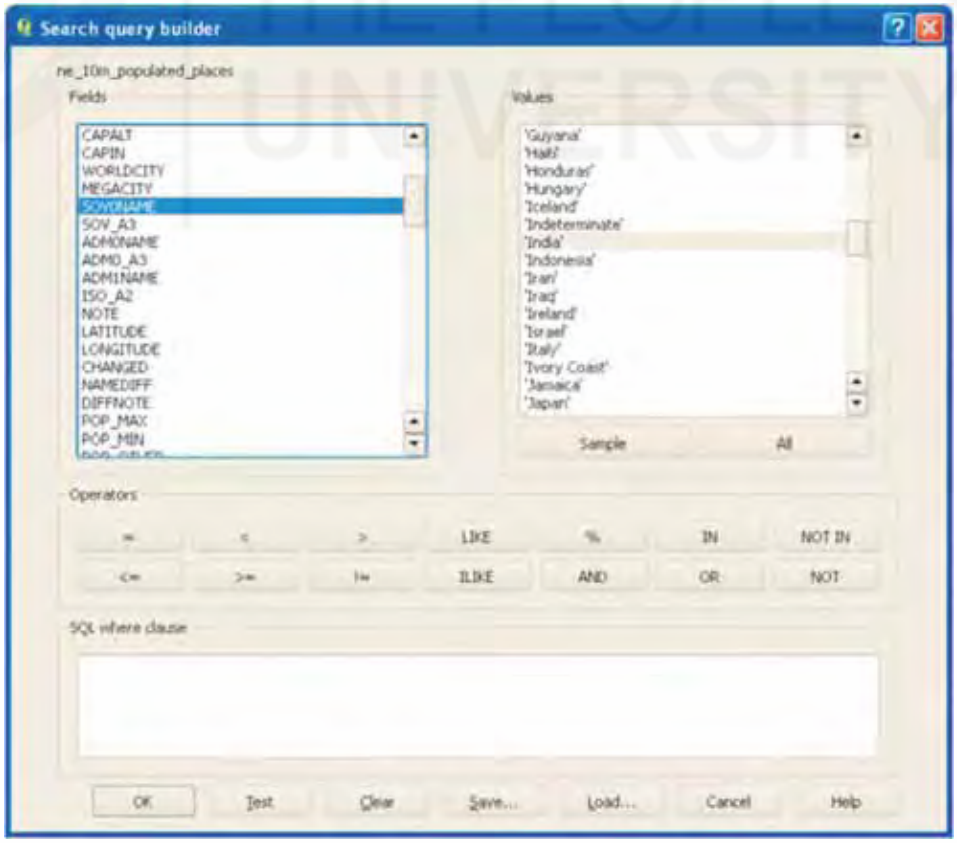

Fig. 17.6: Query builder

2. The Fields list contains all attributes of the attribute table to be searched. To add an attribute to *SQL where clause* field, double click its name in the ***Fields*** list. Use various *Fields*, *Values* and *Operators* as shown in the menu box of Fig. 17.6 to construct the query or else type the query in *SQL* box.
3. The Values list box shows the values of an attribute. To list all possible values of an attribute, select the attribute in the Fields list and click the *All* button. To add a value to the SQL where clause field, double click its name in the *Values* list.
4. The Operators section contains all usable operators. To add an operator to the SQL where clause field, click the appropriate button. Relational operators namely, =, >, <, *etc.,* string comparison operator namely, LIKE, ILIKE, *etc.,* logical operators namely, AND, OR, NOT, *etc.* are available.
5. The *Test* button shows a message box with the number of features satisfying the current query, which is usable in the process of query construction. The *Clear* button clears the text in the SQL where clause field. The *Save* and *Load* buttons allow saving and loading SQL queries, respectively. The *OK* button closes the window and selects the features satisfying the query. The *Cancel* button closes the window without changing the current selection.
6. To construct a complex query to select places in India having population more than 10 Lakhs, write a SQL query "SOV0NAME = 'India' AND POP_MAX > 1000000" in the query builder as shown in Fig. 17.7.

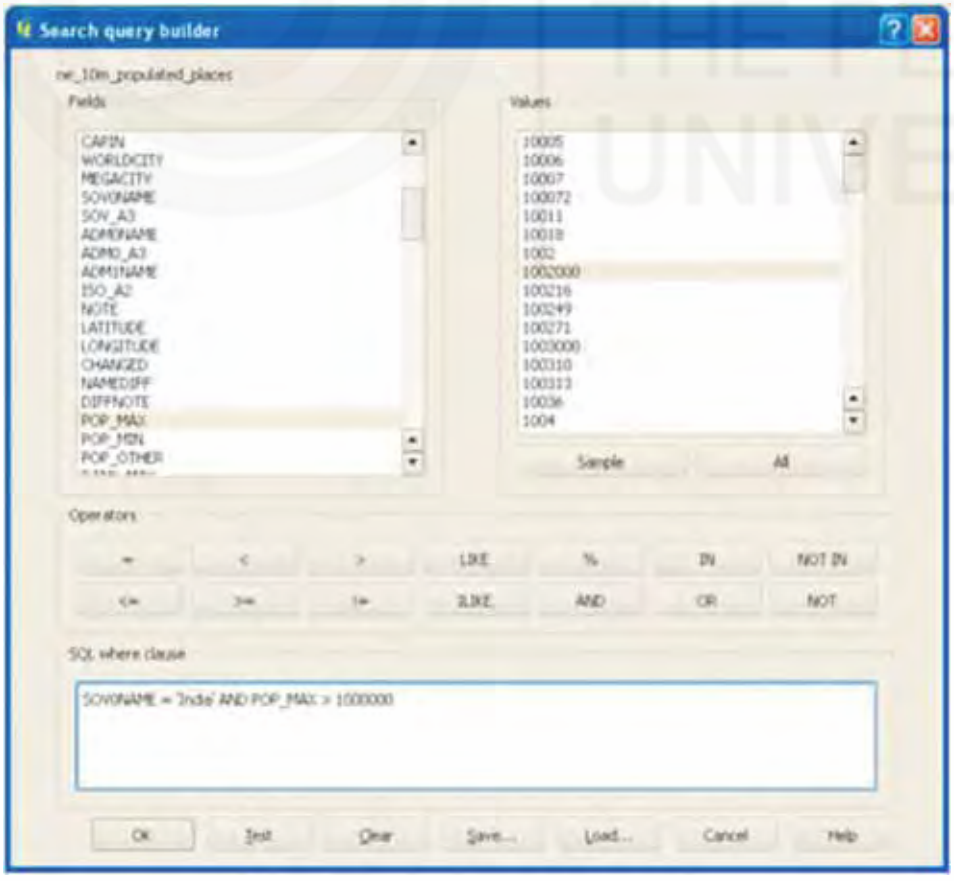

Fig. 17.7: Complex query using relational and logical operators

7. Click on *Test* button and a dialogue box showing the matching features will be displayed as in Fig. 17.8.

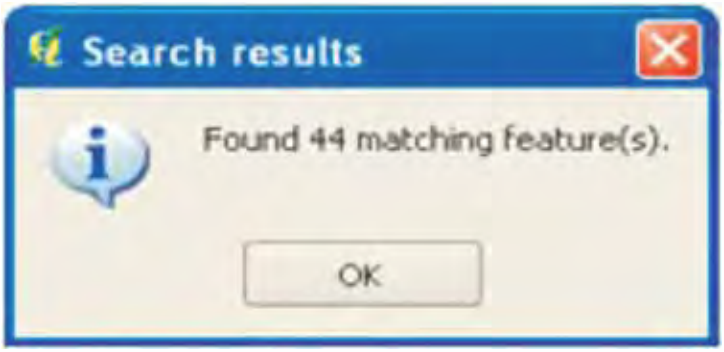

Fig. 17.8: Test result dialogue box

8. Click on *OK* button on the query builder, to see the result on QGIS map, which appears as in Fig. 17.9 and the attribute table appears as shown in Fig. 17.10 after checking *Show selected only*.

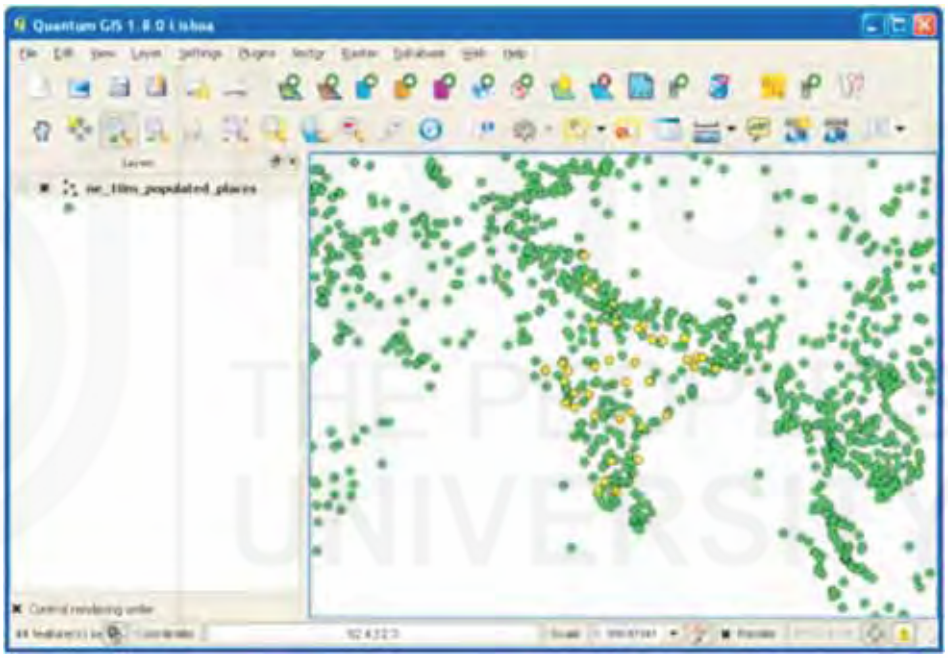

Fig. 17.9: Query builder result as displayed in QGIS map

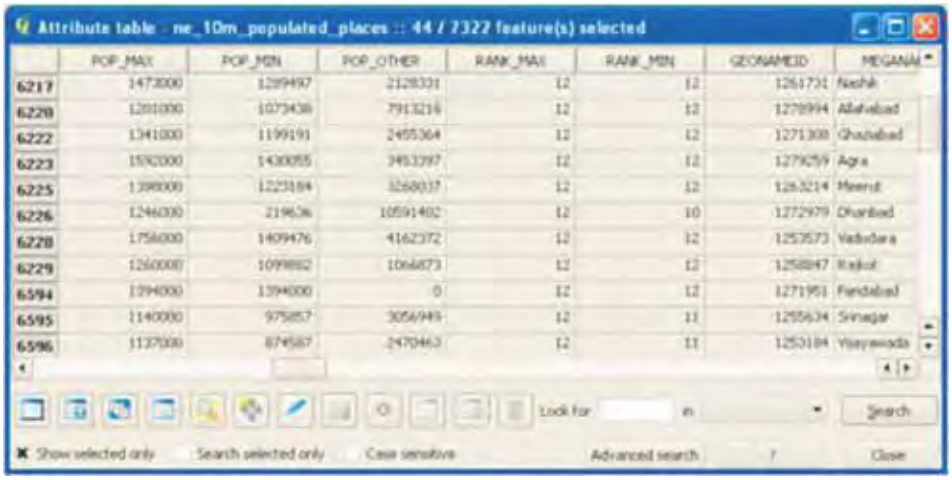

Fig. 17.10: Query builder result displayed on attribute table

9. The selected features can be saved as any OGR supported vector formats and also transformed into another Coordinate Reference System (CRS). For performing this right click on the selected layer and click on ***Save selection as*** to define the name of the output file, its format and CRS.

17.4.3 Spatial Query

Spatial query is performed to select features in a target layer with reference to another layer. In QGIS, ***Spatial Query*** is a plugin. The functionality is based on the GEOS library and depends on the selected source feature layer. Possible operators are: *Contains*, *Equals*, *Overlap*, *Crosses*, *Intersects*, *Is disjoint*, *Touches* and *Within*. Now, follow the steps given below to select all airports in India:

1. Download a sample polygon shape file showing countries of the World from **www.naturalearthdata.com/http//www.naturalearthdata.com/download/10m/cultural/ne_10m_admin_0_countries.zip** from the Natural Earth dataset. Extract the shape file from the zip archive and save it on the hard disk.
2. Download a sample point shape file showing airports of the World from **www.naturalearthdata.com/http//www.naturalearthdata.com/download/10m/cultural/ne_10m_airports.zip** from the Natural Earth dataset. Extract the shape file from the zip archive and save it on the hard disk.
3. Open both countries and airports shape files in QGIS which appear as in Fig. 17.11.

Fig. 17.11: Country boundaries and airports as displayed in QGIS

4. Select ***India*** from countries shape file, as explained in the previous example.
5. Click on ***Spatial Query*** menu item from ***Spatial Query*** submenu in ***Vector*** menu. The *Spatial Query* dialogue opens as in the Fig. 17.12.

Fig. 17.12: Spatial query dialogue box

6. Select source feature to be the *Airports* layer, where the features are *Within*, the reference features of *countries*. Check the selected geometries and create a new selection result. Click on *Apply* button which appears as shown in Fig. 17.13.

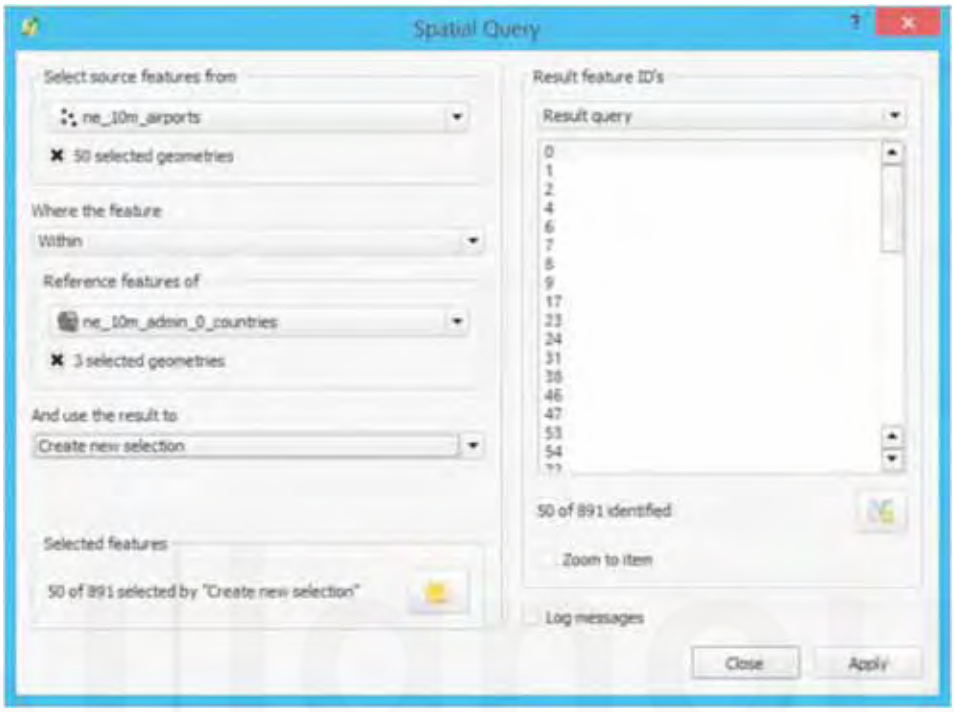

Fig. 17.13: Spatial query dialogue box showing the results

7. The results are displayed on the spatial query dialogue. Click on the *Create new selection* button. This will create new layer on the QGIS TOC and the features are displayed as shown in Fig. 17.14.

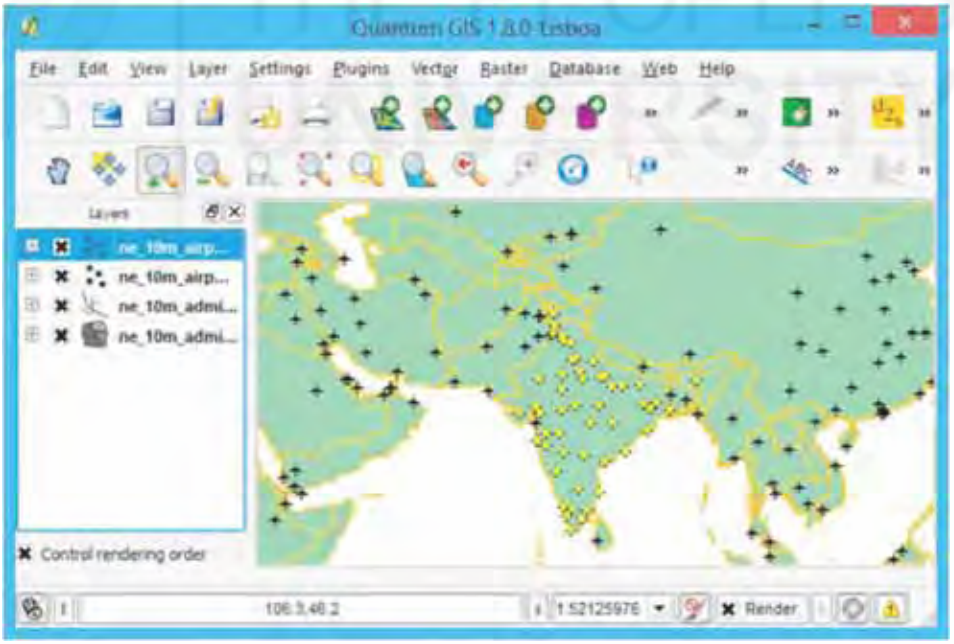

Fig. 17.14: Map showing results of spatial query

8. Close all the windows after completing this exercise.

After completing the exercise submit the following to your instructor for evaluation:

1. Snapshot of output of the simple attribute query.

2. Snapshot of output of the complex attribute query.
3. Snapshot of output of the spatial query.

17.5 HOME WORK: DO IT YOURSELF

1. The spatial query you have practised in this exercise used the *Within* operator. Use other operators like *Contains*, *Equals*, *Overlap*, *Crosses*, *Intersects*, *Is disjoint* and *Touches* for two spatial layers.
2. Compare the outputs and note the differences.
3. Explore how you can perform query in ILWIS.

17.6 FURTHER/SUGGESTED READING

- ILWIS 3.0 User's Guide, Chapter 7, Spatial data analysis: retrieval, (re) classification and measurement operations, ftp://ftp.itc.nl/pub/ilwis/ilwis30/pdf/chap\07.pdf.
- QGIS User Guide, Release 1.8.0. http://docs.qgis.org/1.8/pdf/QGIS-1.8-UserGuide-en.pdf.
- http://manual.linfiniti.com/en/vector_analysis/index.html.