UNIT 11

ATTRIBUTE DATA AND ITS MANAGEMENT

Structure

11.1 INTRODUCTION

GIS comprises of spatial and attribute data. Spatial data describes the geometries of spatial features whereas attribute data defines the characteristics of the spatial features. The spatial data is incomplete without the non-spatial or attribute data. For any GIS application and its further analysis is generally based upon attributes information. Therefore, no GIS will work in the absence of non-spatial data. Besides, these databases are needed to be integrated together for further viewing, analysis and obtaining results in a GIS environment.

In the previous unit you have read about types of data and its conversion, creation of new data, transformation of data. In this unit, we will discuss related terminologies of attribute data management and data linkages including linking non spatial data with spatial data. In addition, we will also discuss attribute data management and data integration covering various methods of data integration.

Expected Learning Outcomes

After studying this unit, you should be able to:

- ❖ describe commonly used terminologies in attribute data management;
- ❖ discuss linking non-spatial data with spatial data;
- ❖ know attribute data management; and
- ❖ explain methods of data integration.

11.2 RELATED TERMINOLOGIES

In this section we will discuss the related terminologies that you should be aware of while studying attribute data management.

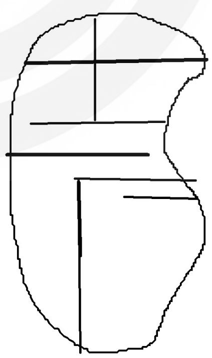
Data: are observations or measurements (unprocessed or processed) represented as text, numbers, or multimedia.

Dataset: a structured collection of data generally associated with a unique body of work.

Database: an organised collection of data files stored as multiple datasets.

Database Management System (DBMS): is a software package that allows for the creation, storage, maintenance, manipulation, and retrieval of large datasets that are distributed over one or more files.

Attribute data: are data stored in a table. And the table is in the form of rows and columns to store data (Fig. 11.1). Each row represents a spatial feature, each column describes a characteristic of the spatial feature with their geometry. In the table, at the intersection of a row and a column represent the value/significance of a particular characteristic for a particular feature shown in either string, decimal or text etc.



Street name	Address	FETYPE	FRADDL	TOADDL	FRADDR	PINR	PINL
St1	Xross Ph-I	Street	6698	5988	7099	800007	800006

Fig. 11.1: Arc with street segment in the polygon 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 PIN codes on both sides.

Feature Attribute Table: A feature attribute table has access to the spatial vector data. In the georelational data model, the feature attribute table uses the feature ID for the each feature to link to the geometry of that feature (Table 11.1). For the object-based data model, each feature attribute table has a defined field that stores the geometry of a feature (Table 11.2).

Table 11.1: An example of the georelational data model where the soils coverage uses LU/LC Class to link to the spatial and attribute data.

Record	LU/LC Class	Area	Soil Moisture Content
01	001	105.99	0.021
02	002	8299.25	0.022
03	003	496.38	0.023
04	004	532.11	0.023
05	005	669.80	0.019

Table 11.2: The object-based data model uses the shape field to store the geometry of building polygons. The table therefore contains both spatial and attribute data.

Object ID	Shape	Shape_Area	Shape_length
01	Polygon	2358.12	329.12
02	Polygon	23587.42	46807.12
03	Polygon	5872.17	12398.3
04	Polygon	1469.01	18790.2
05	Polygon	1469.01	21783.8

Types of Attribute Data: There are two methods for classifying attribute data. The first method followed for classifying attribute data is by data type. In this method common data types used are number, text (or character), date, and binary large object (BLOB). The second method used to classify attribute data is by measurement scale. The measurement scale concept groups attribute data into nominal, ordinal, interval, and ratio data, with increasing degrees of sophistication.

Value Attribute Table: It is the value of the cell that comes into numeric number and each cell number is represented with its frequency (number of count to the particular cell) (Table 11.3). For example, in raster file format data, it has a value attribute table, which lists the cell values and their frequencies/count in integer raster of land use/land cover feature. A value attribute table differs from the feature attribute. 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 (Fig. 11.1 and Table 11.4).

Table 11.3: 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.

Object ID	Value	Count
000	101, 082	189
001	101,086	1258

002	101,110	860
003	180, 082	249
004	180, 086	1987

Table 11.4: A feature attribute table represented by rows and columns.

Label_ID	Hardness	Depth	Maturity
001	122	12.1	Low
002	124	8.4	High

Data capture: There are different means to capture data for a computer. It may be captured either by collecting document to be typed in, making measurement and keying it and/or asking people to fill in questionnaires or listing information of the measurable events. Data may also be collected directly by an input device without using a key board, such as bar code reader, scanning picture, using sensors for data logging. Data as attributes can be entered by direct data loggers, manual keyboard entry, optical character recognition (OCR) or, increasingly, voice recognition, etc. (Fig. 11.2).

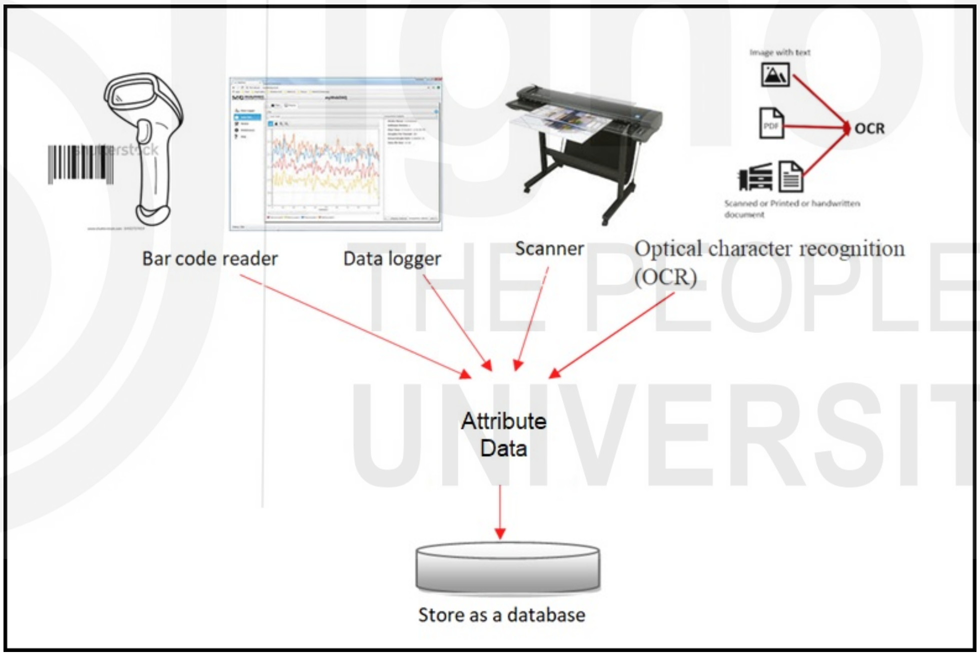


Fig. 11.2: A schematic view of data capture.

11.3 DATA LINKAGES

Linking non-spatial (attribute) data with spatial data is to utilise data for multiple purposes. Therefore, the purpose includes analysis, expedite data retrieval and obtain redundancy free database etc.

In GIS sense, a data link connects data from different sets (e.g., non-spatial data with spatial data). For example, suppose you want to know what percentage of total food grains production of each state of India is grown for export. Let us assume that you have required data stored in your computer into two separate files in which one file containing data of total food grains production for each state and another is on food grains export. You must combine these two files to solve the problem. Once the files are combined then it becomes simple for computer to process. The production and export situation may be seen spatially on map once these data are linked to the state boundary map. Hence, data linkage is very useful to determine location, conditions, trends, patterns and modelling.

11.3.1 Linking Non Spatial Data with Spatial Data

Linking non-spatial (attribute) data with spatial data serves multiple purposes. Firstly, keeping the non-spatial data separate and joining for analysis and mapping allows the spatial data to handle easily. Secondly, many tables containing non-spatial database may be joined together making the retrieval faster and maintaining the database redundancy free.

In GIS language, the logical linking of attribute or external data is called '***relate***' and appending of attribute data is termed as **'*append*** or ***join*'** **(**http://webhelp.esri.com). When the data is permanently joined, (e.g., with the change in property), the data needs to be updated in the map itself. The temporary join is saved in terms of link only in the project file with various formats or terms used by various software like .apr and .mxd in ArcView old or new version, .wor in MapInfo, etc. In this case, with the change in property, whenever the data in table is updated, the map also gets updated.

The basis of data joining between and among various tables or between spatial and non-spatial data is the common identifier known as '***primary key***' and '***foreign key***'. This identifier is unique in both the files like a unique code which is not repeatable anywhere in the file. Sometimes, with smaller database, names are taken as common identifier but in large database there may be several identical names with different identities. Thus, for each feature unique code is assigned to avoid this kind of confusion. For example, in spatial terms there may be two villages of same names in a block or *taluka*. If one wants to join the population data of those all the villages with the village map, there will be an error in joining the data to the corresponding village of same name. In larger context, the same district names exist in two states in India for example, Bilaspur exists in Himachal Pradesh and Chhattisgarh States, Hamirpur district exists in Himachal Pradesh and Uttar Pradesh states, Aurangabad district exists in Bihar and Maharashtra States, and Pratapgarh district exists in Uttar Pradesh and Rajasthan States. One example of this can be seen in Fig. 11.3. At lower level, like Block, Panchayat and Villages, there are large numbers of repetitions of names. In this case, data of one spatial unit (district, block, panchayat or village) may be linked to another one having same name. For instance, data of Aurangabad district of Bihar may go to the Aurangabad district of Maharashtra and vice-versa after joining, if there is no unique identity for each district in the spatial data (map) as well as non-spatial (attribute or table) data. And for this reason, unique identity is required for data joining. Example of different spatial units is given in Fig. 11.4.

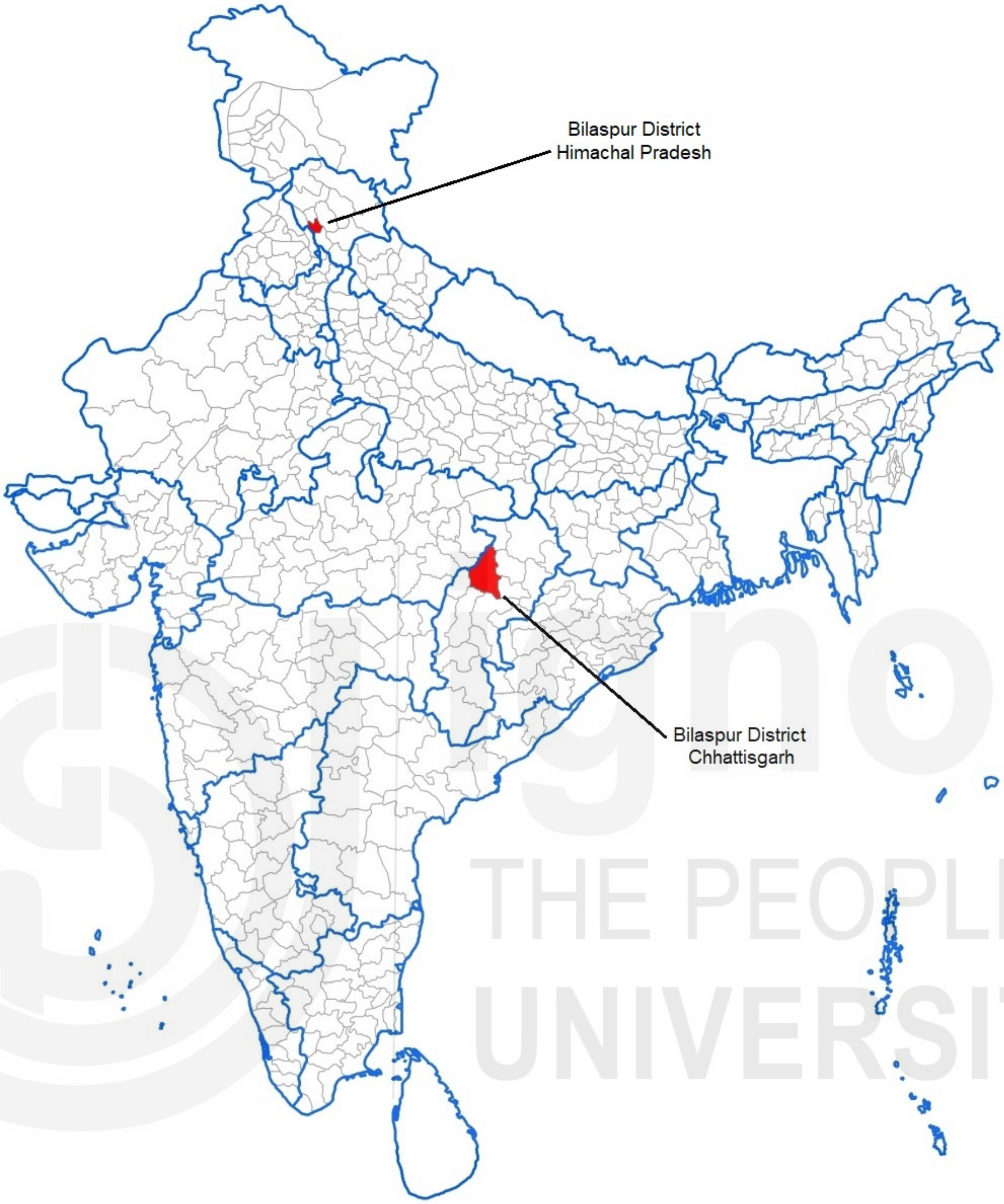
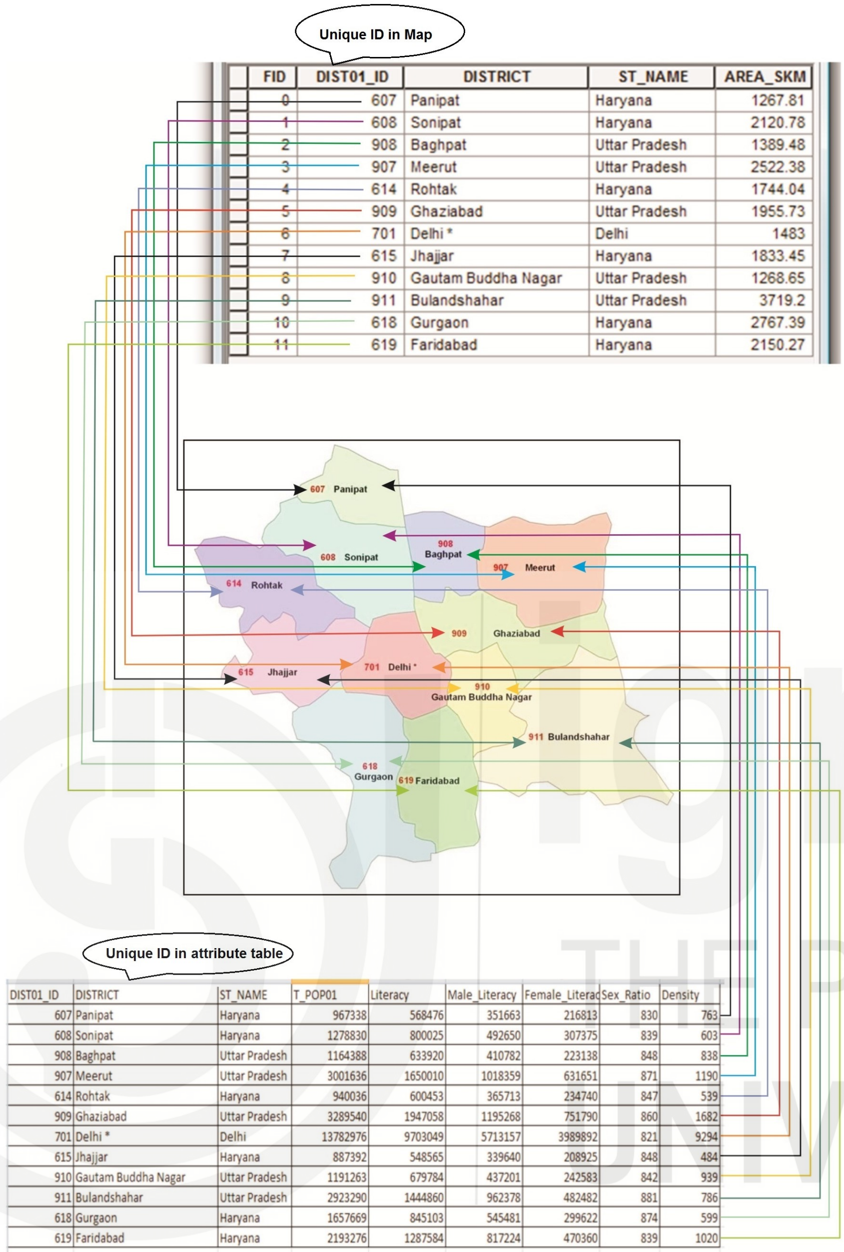


Fig. 11.3: Map of India showing districts with same name "Bilaspur" in Himachal Pradesh and Chhattisgarh with different spatial locations.



FID	DIST01_ID	DISTRICT	ST_NAME	AREA_SKM
0	607	Panipat	Haryana	1267.81
1	608	Sonipat	Haryana	2120.78
2	908	Baghpat	Uttar Pradesh	1389.48
3	907	Meerut	Uttar Pradesh	2522.38
4	614	Rohtak	Haryana	1744.04
5	909	Ghaziabad	Uttar Pradesh	1955.73
6	701	Delhi *	Delhi	1483
7	615	Jhajjar	Haryana	1833.45
8	910	Gautam Buddha Nagar	Uttar Pradesh	1268.65
9	911	Bulandshahar	Uttar Pradesh	3719.2
10	618	Gurgaon	Haryana	2767.39
11	619	Faridabad	Haryana	2150.27

DIST01_ID	DISTRICT	ST_NAME	T_POP01	Literacy	Male_Literacy	Female_Literac	Sex_Ratio	Density
607	Panipat	Haryana	967338	568476	351663	216813	830	763
608	Sonipat	Haryana	1278830	800025	492650	307375	839	603
908	Baghpat	Uttar Pradesh	1164388	633920	410782	223138	848	838
907	Meerut	Uttar Pradesh	3001636	1650010	1018359	631651	871	1190
614	Rohtak	Haryana	940036	600453	365713	234740	847	539
909	Ghaziabad	Uttar Pradesh	3289540	1947058	1195268	751790	860	1682
701	Delhi *	Delhi	13782976	9703049	5713157	3989892	821	9294
615	Jhajjar	Haryana	887392	548565	339640	208925	848	484
910	Gautam Buddha Nagar	Uttar Pradesh	1191263	679784	437201	242583	842	939
911	Bulandshahar	Uttar Pradesh	2923290	1444860	962378	482482	881	786
618	Gurgaon	Haryana	1657669	845103	545481	299622	874	599
619	Faridabad	Haryana	2193276	1287584	817224	470360	839	1020

Fig 11.4: Non-spatial and spatial data joining based on unique identities.

This way, various small attribute tables containing specific details of the spatial features are joined with spatial features using the unique but common identities, where a common field like DIST_ID in above example is essential in all attribute tables for data joining as an identifier. This relates the various tables or attribute table (non-spatial data) with spatial data to the exact feature.

SAQ 1

a) Define DBMS.

b) What is attribute data?

c) What is the difference between data relate and join?

11.4 ATTRIBUTE DATA MANAGEMENT

You have read about data linkages in the previous section. Let us now discuss the attribute data management.

Attribute data management deals with attribute data, creation of attribute data, retrieval of other attributes data into spatial data, query building for data management, over all retrieval and manipulation of data. You have already ready about that how to manage attribute data table with spatial data in the previous section.

Now let us discuss about basic concept based on database management. Based upon this concept data management is performed very effectively. Database management normally refers to the management of tabular data in row and column format. It is frequently used for personal, business, government, and scientific endeavours. To know about database management, let us discuss the non-spatial data strucuture.

11.4.1 Non-spatial Data Structure

Non-spatial data structure is a database which refers to attributes data, logs data etc. It is a data without spatial location like geographical referenced position and represented as a database model.

A database model is the theoretical foundation of a database and fundamentally determines in which manner data can be stored, organised and manipulated in a database system. It thereby defines the infrastructure offered by a particular database system.

Databases can be organised in different ways known as *database models.* These conventional database models are: *relational*, *network, hierarchical and object-oriented* (Fig 11.5).

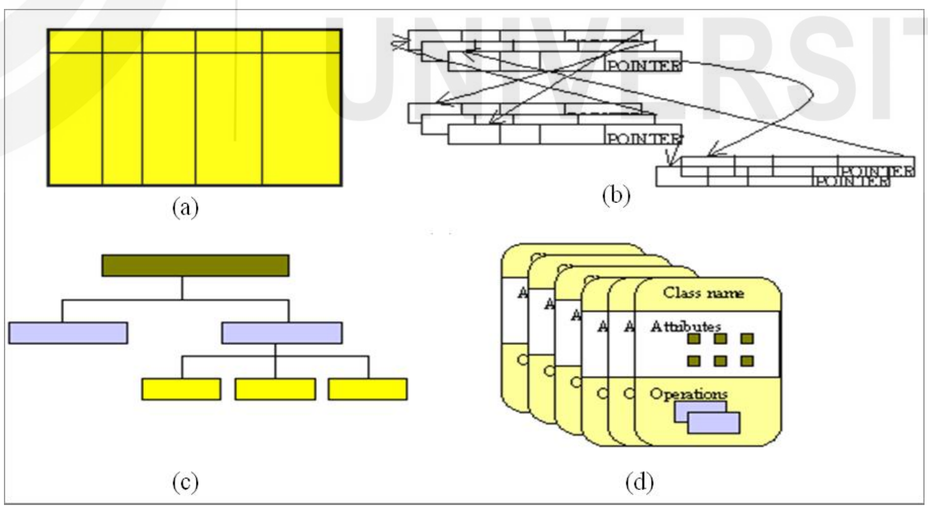


Fig. 11.5: Database models: a) Relational; b) Network; c) Hierarchical; and d) Object-oriented database models.

- ***hierarchical data*** are organised by records on a parent-child one-to-many relations
- ***network data*** are organised by records which are classified into record types within pointers linking associated records

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- ***relational data*** are organised by records in relations which resemble a table
- ***object-oriented data*** are uniquely identified as individual objects that are classified into object types or classes according to the characteristics (attributes and operations) of the object.

Now let us discuss all these database models one by one.

i) **Hierarchical Model**

It organises data in a tree structure. There is a hierarchy of parent and child data segments. This structure implies that a record can have repeating information generally in the child data segments. Data in a series of records have a set of field values attached to it. It collects all the instances of a specific record together as a record type. These record types are the equivalent of tables in the relational model and with the individual records being the equivalent of rows. To create links between these record types, the hierarchical model uses parent child relationships. These are a 1: N mapping between record types. This is done by using trees, like set theory used in the relational model, borrowed from mathematics. For example, an organisation might store information about population in a city such as ward name, locality name, street number, house number, residents name, etc. The organisation might also store information about resident's children such as name and date of birth. The resident and children data forms a hierarchy where the resident data represents parent segment and children data represents child segment. If a resident has four children then there would be four child segments associated with one resident segment. In a hierarchical database, the parent-child relationship is one-to-many. This restricts a child segment to having only one parent segment. In the hierarchical model, the links established by the pointers are permanent and cannot be modified. This makes the hierarchical model more rigid and inflexible causing difficulties in expansion or modification of databases. Hierarchical database management systems (DBMSs) were popular from the late 1960s with the introduction of IBM's Information Management System (IMS) DBMS through the 1970s.

ii) **Network Model**

The popularity of the network data model coincided with the popularity of the hierarchical data model. Some data were more naturally modelled with more than one parent per child. But the network model permitted the modelling of many-to-many relationships in data. The basic data modelling construct in the network model is the set construct. A set consists of an owner record type, a set name and a member record type. A member record type can have that role in more than one set; hence the multi-parent concept is supported. An owner record type can also be a member or owner in another set. The data model is a simple network, and link and intersection record types may exist as well as sets between them. Thus, the complete network of relationships is represented by several pair wise sets; in each set, some (one) record type is owner (at the tail of the network arrow) and one or more record types are members (at the head of the relationship arrow). Network model becomes complex with the increase in size of database. This model also suffers from inflexibility but the degree of inflexibility is lower compared to the hierarchical model because it provides multi-parent relationship.

iii) **Relational Model**

Relational model based on the concept proposed by Codd (1970) and is popular among GIS users. A relational database allows the definition of data structures, storage and retrieval operations and integrity constraints. In such a database, data and relations between them are organised in tables. A table is a collection of records and each record in a table contains the same fields. The properties of relational tables are:

- values are atomic
- each row is unique
- sequence of rows is insignificant
- each column has a unique name
- column values are of the same kind
- sequence of columns is insignificant

Certain fields may be designated as keys, which mean that searches for specific values of that field will use indexing to speed them up. Fields in two different tables take values from the same set; a join operation can be performed to select related records in the two tables by matching values in those fields. Often, but not always, the fields will have the same name in both tables. For example, an organisation table might contain (employee-ID, department-code) pairs and a department table might contain (department name-code, number of employee in the department) pairs to identify an organisation's salary expenses. We could sum the salaries of employees in the department by joining on the employee-code and department-code fields of the two tables. This can be extended to joining multiple tables on multiple fields. Because these relationships are only specified at retrieval time, the relational databases are classed as dynamic database management system. The relational database management system (RDBMS) is database based on relational model.

The main disadvantage is the terminology of relational database which can be confusing because of the use of different terminologies by different users. Although the relational model is flexible than hierarchical model and network model but still suffers from data redundancy and can be slow and difficult to implement. Its efficiency is reduced with handling of complex data formats of GIS because of limited range of data types.

iv) **Object-Oriented Model**

Object-oriented database (OODB) paradigm is the combination of object-oriented programming language (OOPL) systems and persistent systems. The power of OODB comes from the seamless treatment of both persistent data as found in databases and transient data as found in executing programmes. Object DBMSs add database functionality to object programming languages. They bring much more than persistent storage of programming language objects and provide full-featured database programming capability. A major

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benefit of this approach is the unification of the application and database development into a seamless data model and language environment. As a result, applications require less code, use more natural data modelling and code bases are easier to maintain.

In contrast to a relational DBMS, where a complex data structure must be flattened out to fit into tables or joined together from those tables to form the in-memory structure, object DBMSs have no performance overhead to store or retrieve a web or hierarchy of interrelated objects. This one-to-one mapping of object programming language objects to database objects has two benefits over other storage approaches. Firstly, it provides higher performance management of objects and secondly, it enables better management of the complex interrelationships between objects. This makes object DBMSs better suited to support applications such as risk analysis systems, telecommunications service applications, World Wide Web (WWW) document structures, design and manufacturing systems which have complex relationships between data. Main problem of object oriented model is the implicit uncertainty of geographical ideas; therefore, it is difficult to represent them in rigidly bounded datasets. There is also no theoretical base or standard query language for object oriented model.

11.5 DATA INTEGRATION

Data integration as a process of making different data sets compatible with each other, so that they can reasonably be displayed on the same map and their relationships can sensibly be analysed (Flowerdew, 1991). Data integration helps to bring all the data together at the same platform to answer variety of questions related to spatial data. In Unit 9, you have studied that GIS data standardisation is needed for the seamless integration of various information layers or themes to get the real picture of any situation or place to make better decisions based on the spatial relationships, connections and patterns, and attribute properties. This is not possible without integration of various data sets.

The data creation standards are still not uniform all across the globe. As a consequence, data is created in different standards like coverage or boundaries, time period, data structure, different formats, types, accuracy levels of various kinds, etc. as per the needs. It is created from various sources and by using various methods.

In data integration, data from different sources or of different standards are standardised to make compatible to place one over other with matching locations and boundaries for spatial analysis and mapping. The major conversion in this case is done for coordinate and projection system and scale. The other standards are conceptual or logical. For example, the other standards like the land use data of one part of the region is done for three level classification and the other part is level four. In this case, both the parts need to be brought into the same level by either expanding or reducing one class for uniformity to integrate and work.

11.5.1 Methods of Integration

The following types of integration may be done:

i) **Horizontal Integration**: It is a process to merge the data of all the adjacent areas seamlessly. This is done when the area of interest is digitised in two or several contiguous spatial sub-units. For example, toposheet-wise digitisation of resources for a district or state to need be mosaiced finally as a single unit. In this process, the adjacent sheets are brought together and matched for point to point locations doing edge matching with various techniques. For example, Fig. 11.6 shows horizontal integration in a simple way where each state digitised separately in a mosaiced form to make the map of India.

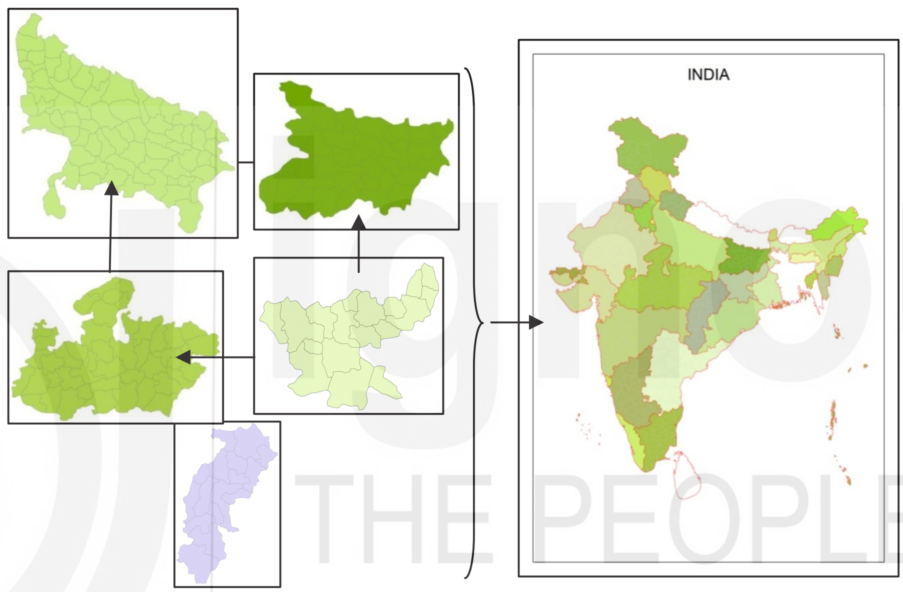

Fig. 11.6: Horizontal integration of adjacent sheets/maps to prepare one single map.

a) **Vertical Integration**: It is a process to keep all the databases of common area one over other with matching all points or locations in all the data layers (Fig. 11.7). It is superimposition on computer like keeping various maps on tracing sheets/transparencies of same area layer-by-layer.

The other vertical integration is the conceptual or thematic adjustment for identical entities in all the layers if the data is of different time period. For example, making identical land use classes or soil classes for all the years for integration and studies or keeping the same administrative boundaries of an area for temporal studies as the data sets are often created at various scales or classes for various requirements over the time.

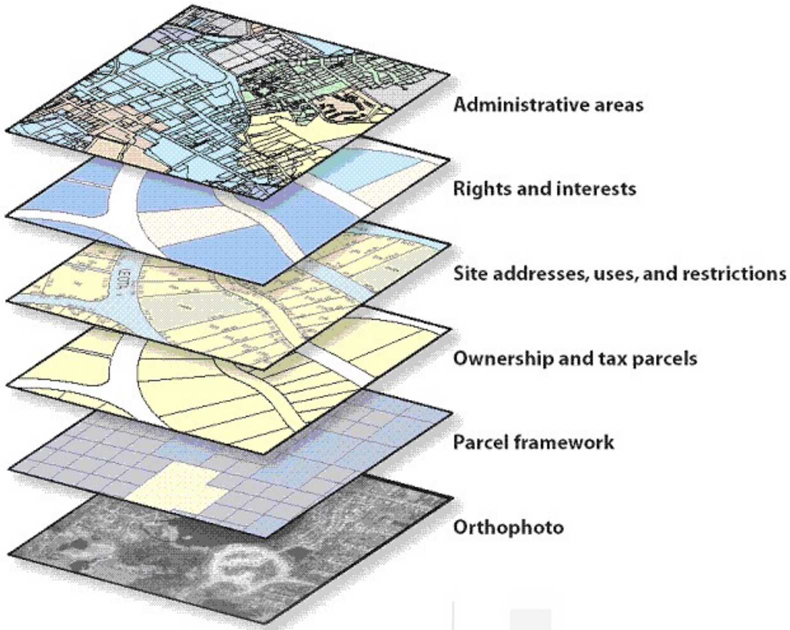

Fig. 11.7: Vertical integration of various thematic layers. (Source: http://webhelp.esri.com)

The above horizontal and vertical data integration is done for the attribute data also.

b) **Spatial and Non-Spatial Data Integration**: It is also referred to data linkages, which we have already discussed in the sub-section 11.3.1 of this Unit. Attribute data attachment with spatial data is also data integration making compatible as per the spatial units where the number of features will be equal to the number of rows in any table for complete matching all the units and rows. Mismatch of units or rows in terms of identifier will leave the incomplete integration of non-spatial data into the spatial data.

While doing integration there are some conversion principles that should be taken into account which are considered stepwise as listed below:

- the conversion of data from analogue to digital form
- all the data are converted into the same data format like .shp of arcview before integrating
- coverage or boundaries and locations are matched for the integration, if the data are of non-matching pairs
- temporal matching is also taken care of before integration. For example, a data is of 1991 and other data is of 2001, both need to be of identical time based on their nature and applications
- standardisation of projection and reference system, which is prerequisite for all data sets to be integrated together. If the various data layers of same area are prepared in different projections and reference systems, the seamless integration is not possible due to different transformation models, and
- scale and accuracy of various data layers are also required to be standardised for integration.

Similarly, the standardisation is also needed in the attribute data of any administrative or spatial unit with the change of the administrative unit or boundary of the spatial unit. For example, if a district is divided into two districts, the attribute data like population also needs to be divided accordingly before integration.

c) **Conceptual/logical Integration**: GIS database that are sourced from different places, inputs and characteristics are standardised to make compatible to place one over other with matching locations and boundaries for spatial analysis and mapping. Data conversion for the data procured from different sources is done either though coordinate, projection system and scale or through the other standards under conceptual or logical conversion. For instance, Urban Master Plan data is structured with five levels of classification while Land use-land cover data is designed with three or four levels of classification. In this case, both the sources need to be brought into the same level by either expanding or reducing one class for uniformity to integrate and work.

SAQ II

a) What do you mean by data integration?

b) Define vertical integration.

c) What are conventional data models?

d) Define relational data.

11.6 SUMMARY

Let us summarise what you have studied in this unit.

- Data are observations or measurements (unprocessed or processed) represented as text, numbers, or multimedia. Dataset is a structured collection of data generally associated with a unique body of work.
- Database management System (DBMS) is a software package that allows for the creation, storage, maintenance, manipulation, and retrieval of large datasets that are distributed over one or more files. Attribute data are data stored in a table. And the table is in the form of rows and columns to store data.
- In GIS sense, a data link connects data from different sets. Linking non-spatial (attribute) data with spatial data serves multiple purposes. In GIS language, the logical linking of attribute or external data is called 'relate' and appending of attribute data is termed as 'append or join'
- The basis of data joining between and among various tables or between spatial and non-spatial data is the common identifier known as 'primary key' and 'foreign key'. This identifier is unique in both the files like a unique code which is not repeatable anywhere in the file.

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- Attribute data management deals with attribute data, creation of attribute data, retrieval of other attributes data into spatial data, query building for data management, over all retrieval and manipulation of data.
- Non-spatial data structure is a database which refers to attributes data, logs data etc. A database model is the theoretical foundation of a database and fundamentally determines in which manner data can be stored, organised and manipulated in a database system. Databases can be organised in different ways known as database models. The database models are: relational, network, hierarchical and object-oriented.
- Data integration as a process of making different data sets compatible with each other, so that they can reasonably be displayed on the same map and their relationships can sensibly be analysed.
- Horizontal integration is a process to merge the data of all the adjacent areas seamlessly. Vertical integration is a process to keep all the databases of common area one over other with matching all points or locations in all the data layers.

11.7 ACTIVITY

1. Check the hard disk of your computer and see how files are stored in different folders and subfolders.
2. Visit any drug shop and observe how they arrange the medicines in different stacks or shelf and relate this data in a GIS.

11.8 TERMINAL QUESTIONS

1. Explain data capture with a neat diagram?
2. What are data linkages? Explain linking non spatial data with spatial data?
3. Give a brief account of non-spatial data structure.
4. What is data integration? Explain different methods of data integration.

11.9 REFERENCES

- Buckley, D. J. (1997) The GIS Primer: An Introduction to Geographic Information System. GIS Solutions Inc. (http://www.innovativegis.com/basis/primer/The_GIS_Primer_Buckley.pdf).
- Chang, K.-T. (2010) Geographic Information System, Tata McGraw-Hill, New Delhi.
- Codd, E. (1970) A relational model for large shared data banks. Communications of the Association for Computing Machinery, vol 13, no 6, pp 377-87.
- Flowerdew, R. (1991) Spatial Data Integration. In: Maguire, D. J., Goodchild, M. F. and Rhind, D. W. (Eds.). Geographical Information Systems: Principles and Applications. Vol. 1 (pp. 375-387), Longman Scientific and Technical, London.
- Montegomery, G. E. and Schuch, H. C. (1993) GIS Conversion Handbook. GIS World Inc., Fort Collings.

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- National Land Records Modernization Programme (NLRMP): Guidelines, Technical Manuals and MIS 2008-09, Department of Land Resources, Ministry of Rural Development, Government of India, p. 99.
- United Nations (2000) Handbook on Geographic Information Systems and Digital Mapping. Studies in Methods Series F No. 79, ST/ESA/STAT/ SER.F/79, Department of Economic and Social Affairs Statistics Division. New York.
- www.google.com/earth
- http:www.leica-geosystems.com/en/index.htm http://webhelp.esri.com/arcgisserver/9.3/dotnet/index.htm#geodatabases/an_over-776141322.htm
- http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=About_joining_and_relating_tables
- https://2012books.lardbucket.org/books/geographic-information-system-basics/s09-02-geospatial-database-management.html

Data from above-mentioned websites was retrieved between 29th July 2011 and 5th July 2012; 29th January 2023 and 5th February 2023.

11.10 FURTHER/SUGGESTED READINGS

- Fazal, S. (2008) GIS Basics, New Age International Publishers, New Delhi.
- Longley, P. A. Goodchild, M. F. Maguire, D. J. and Rhind, D. W. (2001) Geographical Information Systems and Science. Wiley Publication, Chichester.

11.11 ANSWERS

SAQ I

a) DBMS is defined as a software package that allows for the creation, storage, maintenance, manipulation, and retrieval of large datasets that are distributed over one or more files.

b) Attribute data are the data stored in a table. And the table is in the form of rows and columns to store data.

c) The difference between data relate and join is the temporary joining of attribute data is called relate and permanent joining of attribute data is termed as append or join.

SAQ II

a) Data integration is a process of bringing all the data sets from various sources into one platform.

b) Vertical integration is a process to keep all the databases of common area one over other with matching all points or locations in all the data layers.

c) The conventional database models are the models such as relational, network, hierarchical and object-oriented.

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d) Relational data are the data organised by records in relations that resemble a table.

Terminal Questions

1. Please refer to section 11.2.
2. Please refer to section 11.3.
3. Please refer to subsection 11.4.1.
4. Please refer to section 11.5.

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