Spatial Data

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Introduction:

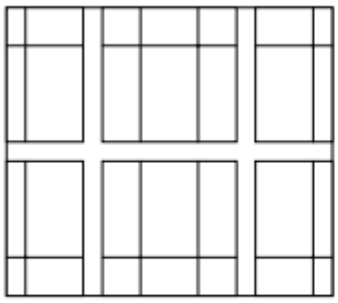
Geographic analysis allows us to study and understand the real world processes by developing and applying manipulation, analysis criteria and models and to carryout integrated modeling. These criteria illuminate underlying trends in geographic data, making new information available. A GIS enhances this process by providing tools, which can be combined in meaningful sequence to reveal new or previously unidentified relationships within or between data sets, thus increasing better understanding of real world. The results of geographic analysis can be commercial in the form of maps, reports or both. Integration involves bringing together diverse information from a variety of sources and analysis of multi-parameter data to provide answers and solutions to defined problems. Spatial analysis is the vital part of GIS. It can be done in two ways. One is the vector-based and the other is raster-based analysis. Since the advent of GIS in the 1980s, many government agencies have invested heavily in GIS installations, including the purchase of hardware and software and the construction of mammoth databases. Two fundamental functions of GIS have been widely realized: generation of maps and generation of tabular reports. Indeed, GIS provides a very effective tool for generating maps and statistical reports from a database. However, GIS functionality far exceeds the purposes of mapping and report compilation. In addition to the basic functions related to automated cartography and data base management systems, the most important uses of GIS are spatial analysis capabilities. As spatial information is organized in a GIS, it should be able to answer complex questions regarding space. Making maps alone does not justify the high cost of building a GIS. The same maps may be produced using a simpler cartographic package. Likewise, if the purpose is to generate tabular output, then a simpler database management system or a statistical package may be a more efficient solution. It is spatial analysis that requires the logical connections between attribute data and map features, and the operational procedures built on the spatial relationships among map features. These capabilities make GIS a much more powerful and cost-effective tool than automated cartographic packages, statistical packages, or data base management systems. Indeed, functions required for performing spatial analyses that are not available in either

cartographic packages or data base management systems are commonly implemented in GIS.

USING GIS FOR SPATIAL ANALYSIS

Spatial analysis in GIS involves three types of operations: Attribute Queryalso known as non-spatial (or spatial) query, Spatial Query and Generation of new data sets from the original database (Bwozough, 1987). The scope of spatial analysis ranges from a simple query about the spatial phenomenon to complicated combinations of attribute queries, spatial queries, and alterations of original data. Attribute Query: Requires the processing of attribute data exclusive of spatial information. In other words, it's a process of selecting information by asking logical questions.

Example: From a database of a city parcel map where every parcel is listed with a land use code, a simple attribute query may require the identification of all parcels for a specific land use type. Such a query can be handled through the table without referencing the parcel map (Fig. 1). Because no spatial information is required to answer this question, the query is considered an attribute query. In this example, the entries in the attribute table that have land use codes identical to the specified type are identified.



Parcel No.	*Size*	*Value*	*Land Use*
102	7,500	200,000	Commercial
103	7,500	160,000	Residential
104	9,000	250,000	Commercial
105	6,600	125,000	Residential

A sample parcel map **Attribute table of the sample parcel map**

Figure: 1 Listing of Parcel No. and value with land use = 'commercial' is an attribute query. Identification of all parcels within 100-m distance is a spatial query.

Spatial Query: Involves selecting features based on location or spatial relationships, which requires processing of spatial information. For instance a question may be raised about parcels within one mile of the freeway and each parcel. In this case, the answer can be obtained either from a hardcopy map or by using a GIS with the required geographic information.

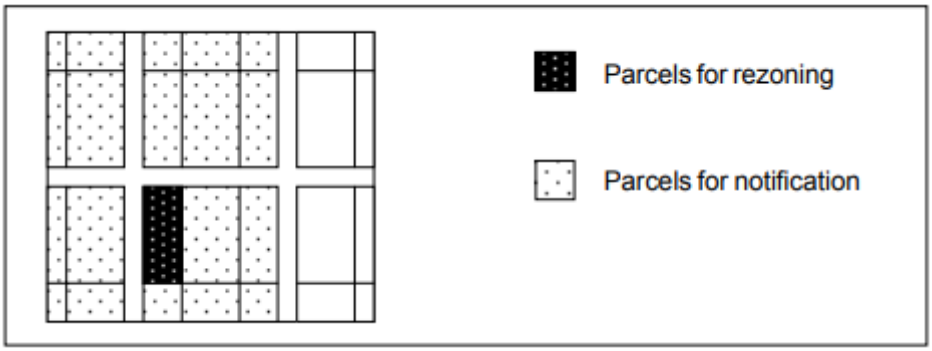


Figure: 2 Land owners within a specified distance from the parcel to be rezoned identified through spatial query

Let us take one spatial query example where a request is submitted for rezoning, all owners whose land is within a certain distance of all parcels that may be rezoned must be notified for public hearing. A spatial query is required to identify all parcels within the specified distance. This process cannot be accomplished without spatial information. In other words, the attribute table of the database alone does not provide sufficient information for solving problems that involve location.

While basic spatial analysis involves some attribute queries and spatial queries, complicated analysis typically require a series of GIS operations including multiple attribute and spatial queries, alteration of original data, and generation of new data sets. The methods for structuring and organizing such operations are a major concern in spatial analysis. An effective spatial analysis is one in which the best available methods are appropriately employed for different types of attribute queries, spatial queries, and data alteration. The design of the analysis depends on the purpose of study.

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