Analyzing Spatial Relationships

ArcView has two tools that provide several methods to perform spatial analysis with spatial datasets.

1. Theme on theme selection methods
2. Geoprocessing methods (see Geoprocessing.pdf document)

Theme on theme selection (Select By Theme)

Selecting the features of one theme with the features of another contributes to solutions to many spatial analysis problems. You can help answer questions of whether one feature lies within another, whether it completely contains another, whether it is within a specified distance of another, and so on.

While working with a View, select one or more target themes and then use Select By Theme under the Theme menu to access these spatial analysis tools.

The **Select By Theme** operation *temporarily* selects the features of the active themes that are completely within, completely contained by, have their center in, contain the center of, intersect, or are within a specified distance of the features of the theme you specify. Selecting the features of one theme with the features of another helps solve many problems.

Types of spatial relationships between geographic features

1. Proximity – the distance between features
   a. Finding points near lines
   b. Finding points near other points
2. Adjacency or contiguity – features that share the same boundary
3. Containment – the features within, inside, or outside other features
   a. Finding polygons within other polygons
   b. Finding points within polygons
   c. Finding lines within polygons
4. Intersect – features that share the same geographic space or overlap.
   a. Finding lines that intersect other lines.
   b. Finding polygons that intersect lines.
   c. Finding polygons that intersect other polygons.
   d. Finding features that don't intersect other features
5. Spatial Join – appends the fields of one theme table to those of another theme table, based on the locations of features in the two themes with respect to each other.

Spatial joins are based on two kinds of spatial relationships to analyze the locations of features in two separate themes, proximity (nearest) and containment (inside):

a. nearest – If you compare two point themes, ArcView finds the *nearest* point feature in the second theme to each point feature in first theme. It then appends the attributes of the features in the second theme to the corresponding features in the first theme. Note: Whenever ArcView uses the nearest relationship in a spatial join, a distance field is added to the joined table.

b. inside – for example, if you compare a polygon theme with a point theme, ArcView finds points *inside* polygons and appends the attributes of the polygons to the points they contain.

Understanding spatial join. In a spatial join, you join two theme tables by using the Shape field as the common field. In an ordinary join, ArcView compares attribute values in the common field to match records. In a spatial join, it compares the locations of the features in each theme. If the destination table belongs to a point theme and the source table to a polygon theme, ArcView appends the attributes of each polygon to any and all points contained by that polygon. This is called an *inside* spatial join. If both the destination and source tables belong to point themes, ArcView appends the attributes of each point in the source table to the point nearest it in the destination table. This is called a *nearest* spatial join. Every spatial join is either inside or nearest, depending on the theme types represented by the source and destination tables.

Spatial Join

If you join two theme attribute tables together using their Shape field as the common field, ArcView automatically bases the join on the spatial relationship between the features in the two themes. This is called a spatial join.

To perform a spatial join

1 From the view, open the attribute tables of the themes you wish to join.
2 Make the source table active. This is the table you wish to join to the other table.
3 Click the Shape field's name.
4 Make the destination table active. This is the table you wish to receive the values of the source table.
5 Click the Shape field's name.
6 From the Table menu choose Join, or click the Join button . The source table is joined to the destination table. The source table is closed automatically.

A spatial join is similar to an attribute join; however it is based on the spatial relationship between the features in the two themes. For each feature represented in the destination table, ArcView looks to see if it has one of the following spatial relationships with any

feature represented in the source table, and if it does, that feature's record from the source table is joined into the destination table:

	point	line	polygon
point	nearest	nearest	inside
line	nearest	part of	inside
polygon	n/a	n/a	inside

When the spatial join is based on the 'nearest' relationship (i.e., neither of the two themes involved contains polygons and one of them contains points), ArcView adds a Distance field to the destination table. This field is automatically calculated by ArcView and contains the distance to the nearest feature represented in the source table for each feature represented in the destination table. The distance is calculated in the view's map units. When the spatial join is based on the 'part of' relationship (i.e., both themes involved contain line features), the line features represented in the destination table have to be substrings of the line features represented in the source table to satisfy the spatial join. In other words, the lines in one theme are part of the lines in the other theme. For example, if you had the Rio Branco in one theme, and all the rivers in the Amazon basin in another theme, all the features in the first theme are considered to be 'part of' the features in the second theme, because the Rio Branco is a tributary of the Amazon, and features representing the Rio Branco are present in the second theme.

Spatial relation types

ArcView provides the ability to select the features of one or more themes using the features of another theme. Selecting features in this way is one of the spatial analysis methods you can use to resolve problems that involve issues of proximity, adjacency, overlap, and containment.

ArcView provides several spatial relation types or predicates to qualify the selection that you make in the Select By Theme dialog box. These relations or predicates are associated with the feature type of the selector theme. The available spatial relation types appear in the Select By Theme dialog box, and are expressed by the following phrases:

Are Completely Within - selects features in the target themes if they fall completely within one or more of the selector theme's features.
Completely Contain - selects features in the target themes that completely contain one or more of the selector theme's features
Have their Center In - selects features in the target themes if their center falls inside the selector theme's features.
Contain the Center Of - selects features in the target themes that contain the center of one or more of the selector theme's features
Intersect - selects features in the target themes that intersect the features in the target. Intersection implies that at least one point is common to both the selector and the target or one of them is completely within the other. If the selector and target are the same, Intersect will select adjacent features.

Are Within Distance Of - selects features in the target themes that are within a specified distance of the selector theme's features. You can specify the type of distance units in the View Properties dialog box.