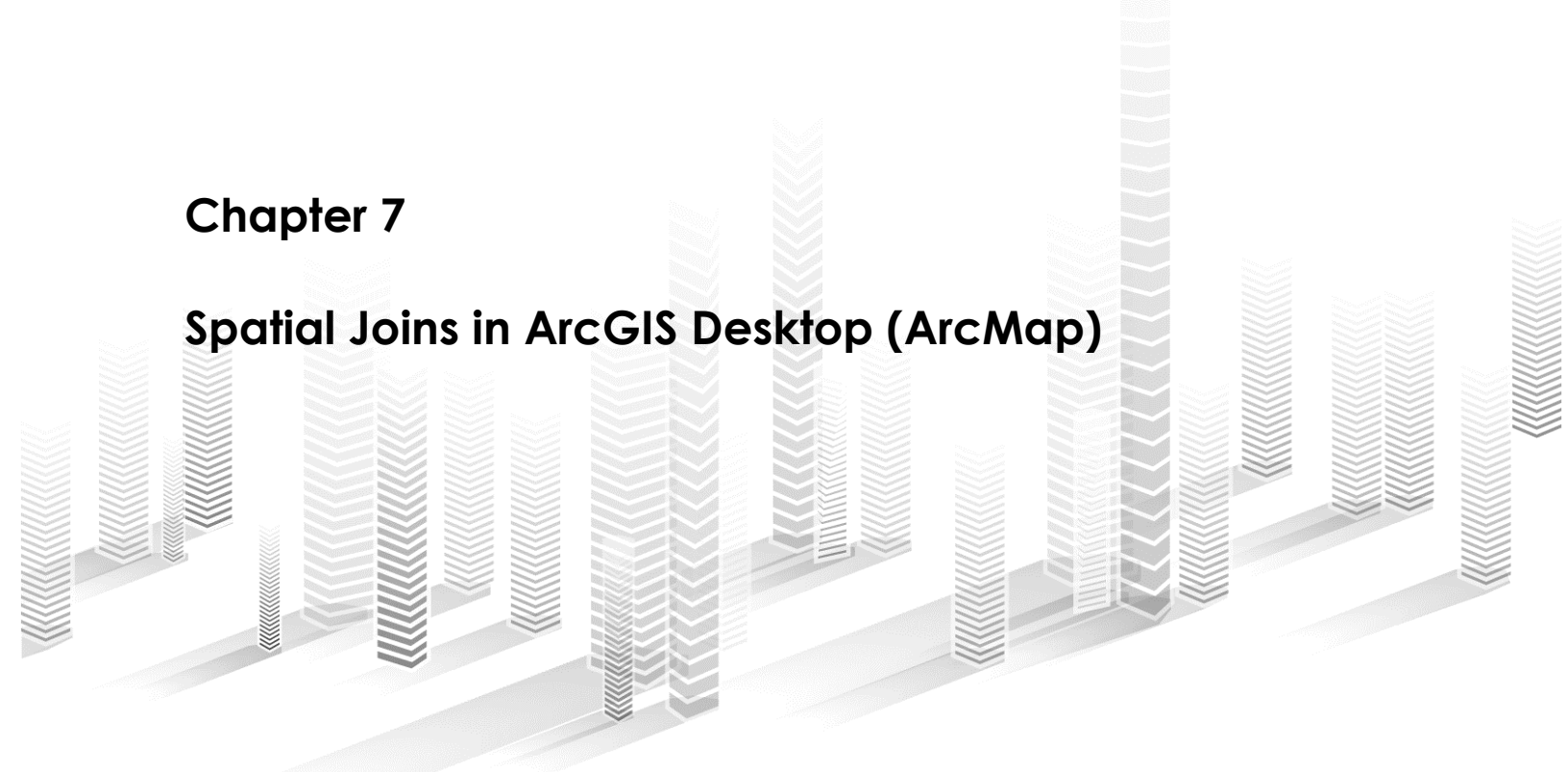# Chapter 7

Spatial Joins in ArcGIS Desktop (ArcMap)

Summary: One of the most useful kinds of analysis journalists can do with ArcMap is what Arc calls a spatial join. A spatial join is similar to a join in a database program, except that instead of joining two tables based on a common field you join them based on geographic location. It is possible to join all three types of feature classes (point, line, polygon) to one another this way. In this scenario, ArcGIS will create a new output shapefile or feature class in a file geodatabase that contains both the polygons and a count of the number of points that lie within each polygon. You can also choose to do other math, such as summing and averaging, on numeric attributes associated with the points.

Skills you will learn: How to prepare for and complete a spatial join in ArcMap.

Getting Started

To begin, add the two tables you wish to join to your map document. If you are unsure how to do this, please review the tutorial **A Quick Tour of ArcGIS Desktop**.

We will use a point layer of parking tickets in Toronto, Ontario, Canada and a polygon layer representing buffers 500 metres in diameter, drawn around hospitals. The goal is to determine how many tickets are issued within a radius of 750 metres of each hospital.

To begin making a spatial join between a polygon layer and a point layer, right click on the polygon layer in the table of contents, and choose Joins and Relates>Join.
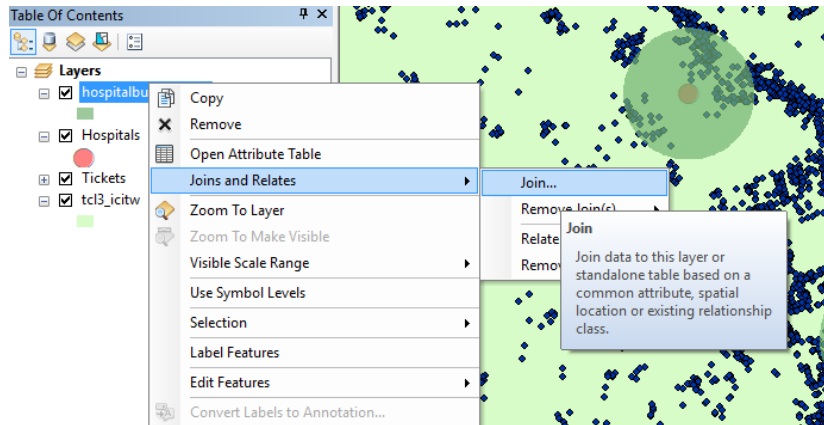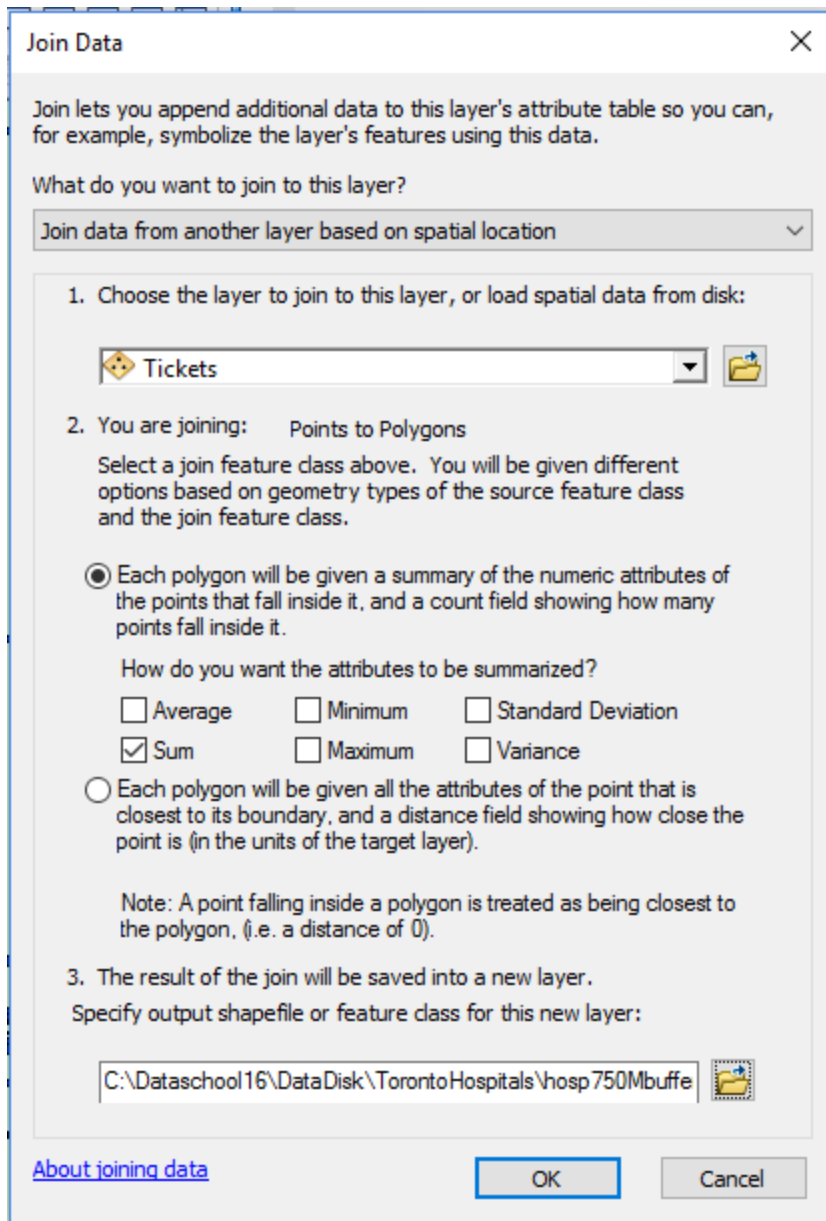
The join dialogue opens. Make sure that in the dropdown at the top you have chosen "Join data from another layer based on spatial location."

In the second dropdown, choose the point feature class (map table) that you will join to.

In area 2 of the dialogue, ArcMap tells you that the join you are making is points to polygons. You are then given options as to how the join should be carried out.

Normally in this kind of join you will want to pick the first option as this will add a summary of the points to the polygon. The join will automatically count up the number of points and add that number to the attribute table for each polygon in the resulting shapefile or feature class. You can also choose to do math on any numeric attributes associated with the points, adding or averaging them, finding the largest or smallest values, or calculating the variance or standard deviation for all of the point values within each polygon. When you tick any of these checkboxes, all numeric values will be summed, averaged, etc, no matter what they represent. In the image below, we have checked off Sum so we can see the total value of tickets issued within each buffer zone.

The final option in the dialogue is to choose the name and file location of the output shapefile or feture class. Here is the dialogue completely filled out:

Join Data ✕

Join lets you append additional data to this layer's attribute table so you can, for example, symbolize the layer's features using this data.

What do you want to join to this layer?

| Join data from another layer based on spatial location | ⌄ |

1. Choose the layer to join to this layer, or load spatial data from disk:

    ◈ Tickets ▾ 📂

2. You are joining: Points to Polygons

    Select a join feature class above. You will be given different options based on geometry types of the source feature class and the join feature class.

    ◉ Each polygon will be given a summary of the numeric attributes of the points that fall inside it, and a count field showing how many points fall inside it.

    How do you want the attributes to be summarized?

    ☐ Average   ☐ Minimum   ☐ Standard Deviation
    ☑ Sum   ☐ Maximum   ☐ Variance

    ◯ Each polygon will be given all the attributes of the point that is closest to its boundary, and a distance field showing how close the point is (in the units of the target layer).

    Note: A point falling inside a polygon is treated as being closest to the polygon, (i.e. a distance of 0).

3. The result of the join will be saved into a new layer.

    Specify output shapefile or feature class for this new layer:

    | C:\Dataschool16\DataDisk\TorontoHospitals\hosp750Mbuffe | 📂 |

About joining data   [OK]   [Cancel]

If you click OK, ArcMap will begin the spatial join. You will see this progress box:
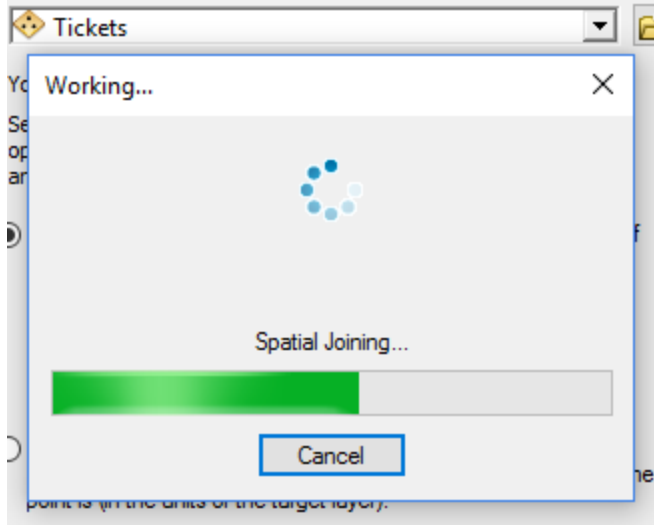
It may take a while to complete, depending on how many points need to be processed. Now may be time for a walk, coffee, or Tweet break.

When the join is completed, the output shapefile or feature class will be added to your map document. It will usually be drawn as the top layer, so you may wish to change its transparency or move it down the hierarchy, if you wish to see the points on top of it.
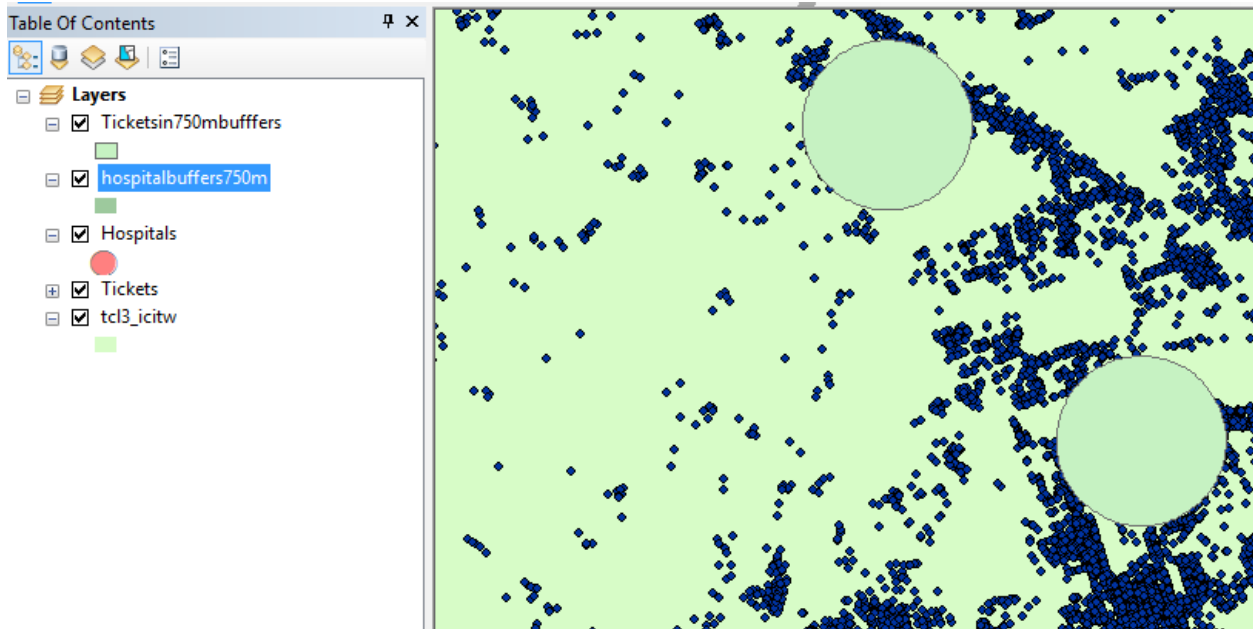
If you right click on the name of the new shapefile in the table of contents, and choose "Open Attribute Table," you will see that it has all of the information for the polygons, and then for each polygon, additional fields with the count of points that fell inside, and any mathematical calculations you choose to make. In this example,

you can see the count of the number of tickets in each buffer, as well as the sum of the set fine amount and the (nonsensical) sum of the time of day. Some fields have been hidden here for clarity.

Hospital	Street	City	Province	Code	BUFF_DIST	Count_	Sum_set_fi	Sum_time_o
Toronto General Hospital Site, University Health Network	200 Elizabeth Street,	Toronto	Ontario	M5G 2C4	750	38692	1547680	55764026
West Park Healthcare Centre	82 Buttonwood Avenue	Toronto	Ontario	M6M 2J5	750	1546	61760	2164585
Women's College Hospital	76 Grenville Street	Toronto	Ontario	M5S 1B2	750	41167	1646600	59770363
Toronto East Health Network - Michael Garron Hospital	825 Coxwell Avenue	Toronto	Ontario	M4C 3E7	750	8507	340040	10898113
Toronto Western Hospital Site	399 Bathurst Street	Toronto	Ontario	M5T 2S8	750	31447	1257840	42616633
St. Joseph's Health Centre	30 The Queensway	Toronto	Ontario	M6R 1B5	750	3079	123160	4125751
Sunnybrook Health Sciences Centre	2075 Bayview Avenue	Toronto	Ontario	M4N 3M5	750	5736	229440	6118211
Salvation Army Toronto Grace Hospital (The)	650 Church Street	Toronto	Ontario	M4Y 2G5	750	27449	1097760	36912140
St Michael's Hospital	30 Bond Street	Toronto	Ontario	M5B 1W8	750	69726	2788640	95053171
St. John's Rehabilitation Hospital Site, Sunnybrook Health Sciences Site	285 Cummer Avenue	Toronto	Ontario	M2M 2G1	750	151	6040	188296
Runnymede Healthcare Centre	625 Runnymede Road	Toronto	Ontario	M6S 3A3	750	1696	67760	2197134
Providence Healthcare	3276 St. Clair Avenue East	Toronto	Ontario	M1L 1W1	750	459	18360	616047
Mount Sinai Hospital Site, Sinai Health System	600 University Avenue	Toronto	Ontario	M5G 1X5	750	40070	1602760	58135594
Princess Margaret Hospital /The Ont.Cancer Institute Site, University Health Network	610 University Ave	Toronto	Ontario	M5G 2M9	750	38158	1526280	55158958
Queen Street Site, Centre for Addiction and Mental Health	1001 Queen Street	Toronto	Ontario	M6J 1H4	750	19170	766800	26459477
Hospital For Sick Children (The)	555 University Avenue	Toronto	Ontario	M5G 1X8	750	40103	1604120	57965270
Lyndhurst Hospital Site, University Health Network	520 Sutherland Drive	Toronto	Ontario	M4G 3V9	750	1137	45480	1075175
College Street Site, Centre for Addiction and Mental Health	250 College Street	Toronto	Ontario	M5T 1R8	750	21609	864320	29596230
Casey House Hospice	9 Huntley Street	Toronto	Ontario	M4Y 2K8	750	20403	816000	28207432
Bridgepoint Hospital Site, Sinai Health System	14 St. Matthews Road	Toronto	Ontario	M4M 2B5	750	3746	149840	4907527
Bickle Centre Site (Dunn St), University Health Network	190 Elizabeth Street	Toronto	Ontario	M5G 2C4	750	39132	1565280	56376340
Baycrest Hospital	3560 Bathurst Street	Toronto	Ontario	M6A 2E1	750	1565	62600	1986677

(0 out of 22 Selected)

hosp750Mbufferswithtickets

You can now choose to do a variety of things with your new map layer and its attribute table.

Like any polygon file, you can use it to create a thematic map. For example, you could colour the map based on the number of tickets in the buffer circle. Or you could do the same, using the total value of tickets. Keep in mind that some wards are bigger than others or may have more cars parking than others, but such a map could show general patterns, especially in heavily ticketed areas.

You can also export the data to use outside of ArcGIS, such as in Google Fusion Tables.

You could also export the raw data from the new attribute table for analysis in Excel or a database program. Choose Table Options>Export from the table options menu as shown in the tutorial **A Quick Tour of ArcGIS Desktop**.

Other types of spatial joins

As we noted earlier, you can do a spatial join between any two geographic layers. For example, you can do a spatial join between two point layers to show the points in one layer and the distance to the closest point in the other layer. This could be used to show the closest fire station from each home in a municipality.

The variations are extensive, but the process is always the same basic one we have shown here. What changes is the possible outputs, which depend on the two types of layers being joined.