GIS III: GIS Analysis
Module 2: Spatial Analyst Tools

*** Files needed for exercise: LA_liquor_stores.dbf, 2009_census_cty_LA.shp

**Goals:** To learn how to use the Spatial Analyst toolset, specifically density and zonal tools, to perform GIS analyses.

**Skills:** After completing this exercise, you should be familiar with raster-based analyses and the Spatial Analyst toolset.

**Mapping point level data:**
1. Open ArcMap.
2. Add the table LA_liquor_stores.dbf.
3. Open the table. We can see that these are liquor stores. They have latitude and longitude, as well as a sales volume.
4. Map the liquor stores by right clicking on the table and choosing **Display XY Data**. The Latitude and Longitude fields should be filled in for you. For the coordinate system choose **Geographic Coordinate Systems > North America > NAD 1983**. Click OK to get a restricted functionality error, and click OK to map the data.
5. Now add 2009_census_cty_LA.shp. Change the coordinate system of the data frame to match that of the shapefile.

6. Export the LA_liquor_stores Events layer to a permanent shapefile by right clicking and choosing Data > Export Data and saving it to your folder. Make sure to use the same coordinate system as the data frame. Name the permanent shapefile something logical like LA_liquor_stores.shp.

7. Point data can be hard to visualize. Let’s create a density surface to help with this.
Density Analysis:

1. First, make sure the Spatial Analyst Extension is turned on by going to Customize > Extensions and checking Spatial Analyst.

2. In ArcToolbox, find the Spatial Analyst Tools and click Density. We are going to use the Point Density tool, which measures the number of points in a given area.
3. In the Point Density dialog box, the Input point features should be our LA_liquor_stores. For now, we are going to keep the population field at None. In the Output raster box, choose a location and name for your raster. Keep in mind that raster names can only be 13 characters long. We are also going to keep the defaults for cell size and search radius. These are automatically calculated by ArcMap to give us a reasonable density surface. You may change them if you like to see the effect.

4. Change the area units to SQUARE_MILES.
5. Leave the other fields alone for now and click the **Environments** button on the bottom of the dialog box. Click on **Processing Extent** and change the Extent to be the same as the `2009_census_cty_LA.shp`. This ensures that the whole state will be covered.
6. Click **OK** twice to run the tool. A surface is produced. You can change the look and color of this surface in the Symbology tab of the raster. You can find the value at any point by using the Query tool and clicking to find the pixel value.

**Using Kernel Density:**

1. Now let’s run a similar analysis using kernel density. Find the Kernel Density tool.
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2. In the Kernel Density dialog box, the Input point features should be our LA_liquor_stores. Change the Population Field to SALES_VOL. In the Output raster box, choose a location and name for your raster. Keep in mind that raster names can only be 13 characters long. We are also going to keep the defaults for cell size and search radius. Change the area units to SQUARE_MILES.

3. Set your processing extent the same way we did for the point density analysis.
4. Click Ok to run the analysis. You now have a density surface showing the density of liquor sales volume across the state. Compare this to your previous point density layer.

Using Zonal Statistics:
1. Now let’s find the mean liquor store volume density for each parish in Louisiana. In the Zonal tab of the Spatial Analyst tools, find the Zonal Statistics tool.
2. The Input raster or feature zone data is the layer that contains the zones we want to use. In this case, it is our counties.
3. The Zone field needs to be a unique ID for each zone we want to use. Since we want each tract to be its own zone, use the FID, which is unique for every tract.
4. The Input value raster is our kernel density surface. Choose an output path and name.
5. Make sure the Extent is set to the same as your Louisiana counties in the Environments window.
6. Finally, choose **MEAN** for the statistics type (or another type if you prefer).