**Lab**

Redo the last lab (listed below again) but this time do not use arcpy at all.

Landscape metrics are statistics that can be caluclated for polygon shapes (patches) that can be utilized in a variety of applications.  
These statisitics are meant to be able to discover patterns in different types of patches for quantative comparison.  
Shape metrics represents a collection of unitless metrics that describe the geometric complexity and/or compactness of patch shapes and quantify landscape configuration in terms of geometric complexity at the patch, class, and landscape levels. Most of these shape metrics are based on perimeter-area relationships. Some of the common metrics in this group include the following:

1. Perimeter-area ratio (PARA) – simple ratio of patch perimeter to area, in which patch shape is confounded with patch size; holding shape constant, an increase in patch size will cause a decrease in the perimeter-area ratio.
2. Shape index (SHAPE) – normalized ratio of patch perimeter to area in which the complexity of patch shape is compared to a standard shape (square) of the same size, thereby alleviating the size dependency problem of PARA.
3. Related circumscribing circle (CIRCLE) – another method of assessing shape based on the ratio of patch area to the area of the smallest circumscribing circle; providing a measure of overall patch elongation. A highly convoluted but narrow patch will have a relatively low related circumscribing circle index due to the relative compactness of the patch. Conversely, a narrow and elongated patch will have a relatively high circumscribing circle index. This index may be particularly useful for distinguishing patches that are both linear (narrow) and elongated.
4. Related circle of same area (SCIRCLE) - another method of assessing shape based on the ratio of patch perimeter to the perimeter of a circle of the same area. (This is similar to Shape Index, except for using a circle instead of a square).
5. Fractal dimension index (FRAC) – another normalized shape index based on perimeter-area relationships in which the perimeter and area are log transformed (We won't calculate this one).

The metrics have many applications in both envorimental, biological and social studies. For example:

1. The shape of landscape patches (land cover) can influence habitats and the ability of certain species to colonize and grow.
2. The shape of patches can be used to determine what an object is by a computer alogrithm. Agricultral fields, and meadows look simmilar spectrally, but often have different shapes.
3. The shapes of municiple boundaries, voting districs and other arbitrary social units especially over time can be an important cultural and social indicator.

1) Your task for this lab is write a program that takes as input a shapefile, and adds a field for each of the first four metrics discussed above. Then populates the appropriate value into the field (you should have 4 added fields). 2) Also output a new shapefile that contains the difference between the smallest circumscribing circle and the area of the input polygon, and another shapefile that contains the circles that are the same area as the inputs.

The circle.py script, already contains code to calculate the smallest circumscribing circle. Go ahead and use this rather than creating your own. You will need to find the circle and square of the same area as each of the input polygons.

Use the accompanying cities of Mississippi GIS file to test your program.

From shapely.geometry import point

Point = point

Mapping(points.buffer(point))