

## OS Python week 2: Creating geometries and handling projections

### Assignment 2a

Create polygons from vertices in a text file and write the resulting geometries to a shapefile. The text file `ut_counties.shp` has one line for each county in Utah. You need to read each line in, create a polygon from the vertices contained in that line, and write the resulting polygon out to a shapefile. Each line looks like this:

`county_name: x1 y1, x2 y2, ..., xn yn`

where  $x_n = x_1$  and  $y_n = y_1$

1. Import needed modules and set the working directory
2. Get the shapefile driver
3. Create an output shapefile of type polygon and get its layer
4. Add a field to the output shapefile for county name
  - a. Create a FieldDefn for a string field
  - b. Add a new field to your output shapefile using your FieldDefn from step 4a
5. Now that you have added the field, get the FeatureDefn for your layer
6. Open `ut_counties.txt` for reading
7. For each line in `ut_counties.txt`
  - a. Create an empty ring geometry
  - b. Split the line on colons to get the county name and a string containing the coordinates
  - c. Split the coordinate string from step 7b on commas to get a list of coordinates
  - d. For each x,y pair in the list you got in step 7c
    - i. Split the pair on spaces to get individual x and y values
    - ii. Convert the x and y values to floating point values instead of strings
    - iii. Use x and y to add a vertex to the ring created in step 7a
  - e. Create a polygon geometry and add your ring to it
  - f. Create a new feature using the FeatureDefn you got in step 5
  - g. Set the geometry and county name for the feature
  - h. Add the feature to your layer
  - i. Destroy the two geometries that you created and the feature
8. Close the text file and shapefile

Turn in your code and a screenshot of the new shapefile being displayed.

## Assignment 2b

Reproject a shapefile. You can use either the output shapefile from Assignment 2a or the `ut_counties.shp` provided with this week's data. They are both unprojected (geographic coordinates, which is the same as latitude/longitude) and in the NAD83 datum. You will reproject the shapefile so the output is in the UTM projection, Zone 12N, but still in NAD83.

1. Import needed modules and set the working directory
2. Get the shapefile driver
3. Create the `CoordinateTransformation` that you'll use to reproject each geometry
  - a. Create the input `SpatialReference` by importing information with EPSG 4269
  - b. Create the output `SpatialReference` by importing information with EPSG 26912
  - c. Use these two `SpatialReferences` to create a `CoordinateTransformation`
4. Open your output shapefile from Assignment 2a or `ut_counties.shp` and get the input layer
5. Create an output shapefile of type polygon and get its layer
6. Copy the county name field from the input layer to the output layer
  - a. Get a feature from the input layer
  - b. Get the `FieldDefn` for the county name field (it's called 'name' in `ut_counties.shp`, but I don't know what you called it if you're using your output from Assignment 2a)
  - c. Use that `FieldDefn` to create a new field in the output layer
7. Now that you have added the field, get the `FeatureDefn` for your output layer
8. For each feature in the input layer
  - a. Get the feature's geometry
  - b. Use the `CoordinateTransformation` created in step 3 to reproject the geometry
  - c. Create a new feature using the `FeatureDefn` from step 7
  - d. Set the geometry for the new feature to the reprojected geometry
  - e. Copy the county name from the input feature to the new feature
  - f. Add the feature to the output layer
  - g. Destroy both features (not the geometry because it came from an existing feature)
  - h. Get the next input feature
9. Close both shapefiles
10. Create a `.prj` file for your output shapefile
  - a. Convert your `SpatialReference` from step 3b to ESRI format
  - b. Open a text file for writing, making sure you give it the correct name
  - c. Write out the WKT for the `SpatialReference` to the text file
  - d. Close the text file

Turn in your code and a screenshot of the new shapefile being displayed. Make sure that ArcGIS doesn't reproject it on-the-fly so that I can see what projection it is in. An easy way to do this is just to create a new ArcGIS project and add your new shapefile to it before adding anything else so it will use the projection of that shapefile. If you're using QGIS, turn off on-the-fly projection in your project properties before loading the shapefile.