Urban Computing Skills Lab
Module 3: Introduction to Python
Assignment #5

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The objective of this assignment is to add a visualization capability to the script that we made in Assignment #4 to show current bus locations on a street map. Specifically, below are the contents of an output file that we would like to see when running our new script:

```
python bus_vis.py xxx-xxx-xxx-xxx-xxx M7 nyc/SimplifiedStreetSegmentAnn.shp vis.pdf
```
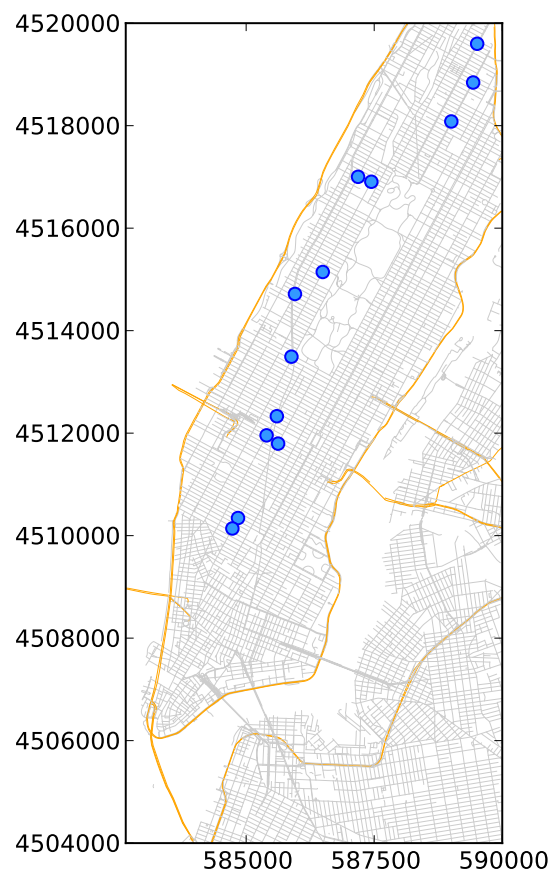
Current M7 Bus Locations

Figure 1. The contents of *vis.pdf*

In Figure 1, there are two distinct visualizations:
1. The underlying road network that were rendered using lines and paths
2. The bus locations that were rendered using an overlay scatter plot

This assignment will contain two parts; each targets one of the visualization tasks above, respectively. For the first part, you will need access to the New York City Street Segments shapefile, which is available on the NYU Classes website (as an attachment of this assignment, named **nyc.zip**).

PROBLEM 1

As mentioned above, our first task is to write a Python script that takes the NYC Street Segment shapefile (i.e. the contents of nyc.zip) and producing a PDF file with a render of the street network. The main purpose of this problem is for you to get familiar with shapefiles and how to render its contents with matplotlib. To facilitate this process, we're providing an initial Python's script for you to start with. This file is attached with this assignment on NYU Classes as *map_streets.py*. Here is how to run the script:

```
python map_streets.py <SHAPEFILE> <OUTPUT_PDF>
```
where SHAPEFILE should be pointing to the *.shp* file under the nyc folder that you should already have unzipped from nyc.zip. For example:

```
python map_streets.py nyc/SimplifiedStreetSegmentAnn.shp vis.pdf
```
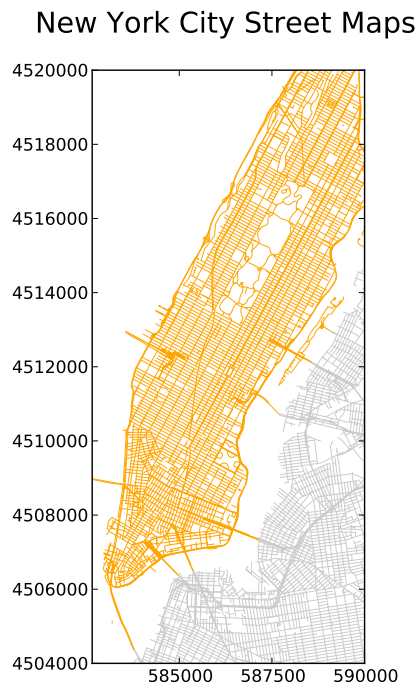would produce a *vis.pdf* with the following contents:

Figure 2. New York City Street Map with Manhattan streets being highlighted.

Important note: in *map_streets.py*, there are only about 30 lines of real code. The rest are detailed comments that we put in place to help you understand the logics and how matplotlib and shapefile operate. Please take the time to go through the file and making sure that everything is clear for you.

Please also make sure that you can run map_streets.py on your machine. This will require you to install the following packages:
- matplotlib (http://matplotlib.org/downloads.html)
- pyshp (https://code.google.com/p/pyshp/) checkout the "*Get Start Instantly*" bullet

TASK: the supplied Python script always generates a map with all streets in Manhattan colored as orange (Figure 2). Your task is to modify the code to show all highways as orange in place of Manhattan streets. Here is the expected output when running the same command as above:

```
python map_streets.py nyc/SimplifiedStreetSegmentAnn.shp vis.pdf
```
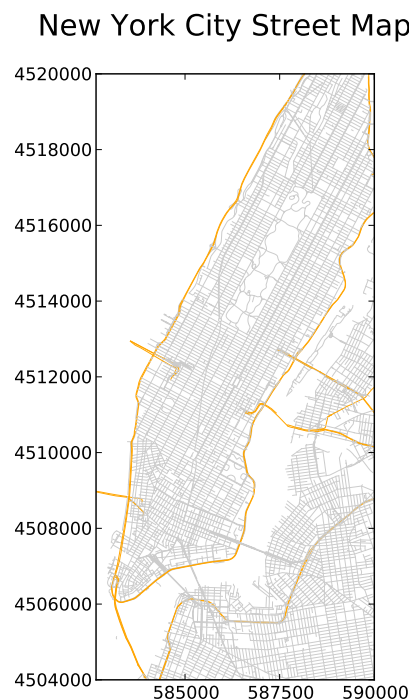
New York City Street Maps

Figure 3. New York City Street Map with US/NY highways being highlighted.

For this problem, you are required to turn-in your source code, naming *map_streets_hwy.py*, as well as a PDF highlighting only the highways like in Figure 3.

HINT: the 2nd field of the shape information indicates that whether a street is marked as US/NY highways. You could use this field to appropriately color your streets.

PROBLEM 2

This is where we put it all together. You need to combine your *map_streets_hwy.py* (from Problem 1) and *get_data_proj.py* (from Assignment #4 Problem 2) to create *bus_vis.py* where the syntax and expected results are described in Figure 1 on page 1. Your Python script would be ran in our tests as:

```
python bus_vis.py xxx-xxx-xxx-xxx-xxx M20 nyc/SimplifiedStreetSegmentAnn.shp vis.pdf
```

Please note that the bus line, aka M20 in this case, must be placed on the plot title. Here is an expected content of vis.pdf:

Current M20 Bus Locations