PUBPOL 2130/ INFO 3130

Lab 1

Logistics!

- Main GitHub Repository here
- We suggest going through the gentle intro notebook if you do not have experience with programming concepts
- You can reach out to us at
  - jrg377@cornell.edu
  - tp399@cornell.edu
- You can use Colab, Jupyter, VS code, etc.
- We're not going to do installations today, let's work on Colab if you don't have Jupyter, VS Code, etc. installed

Jan 24: Pandas

Python library used for data manipulation, analysis, and cleaning.

```python
instructors = pd.Series(["Laura Tach", "Moon Duchin", "Rachel Riedl", "Benjamin Soltoff"], index=["PUBPOL 2301","PUBPOL 2130","PUBPOL 2320","INFO 2951"])

print("\nPandas Series Example")
print(instructors)
```

```
Pandas Series Example
PUBPOL 2301          Laura Tach
PUBPOL 2130         Moon Duchin
PUBPOL 2320        Rachel Riedl
INFO 2951      Benjamin Soltoff
dtype: object
```

Series

```python
df = pd.DataFrame({
    "id": [
        "PUBPOL 2301",
        "PUBPOL 2130",
        "PUBPOL 2320",
        "INFO 2951",
    ],
    "name": [
        "Introduction to Public Policy",
        "Data and the State: How Governments See People and Places",
        "Global Democracy and Public Policy",
        "Introduction to Data Science with R",
    ],
    "instructor": ["Laura Tach", "Moon Duchin", "Rachel Riedl", "Benjamin Soltoff"],
    "credits": [4., 4., 3., 4.],
})
df
```

	id	name	instructor	credits
0	PUBPOL 2301	Introduction to Public Policy	Laura Tach	4.0
1	PUBPOL 2130	Data and the State: How Governments See People...	Moon Duchin	4.0
2	PUBPOL 2320	Global Democracy and Public Policy	Rachel Riedl	3.0
3	INFO 2951	Introduction to Data Science with R	Benjamin Soltoff	4.0

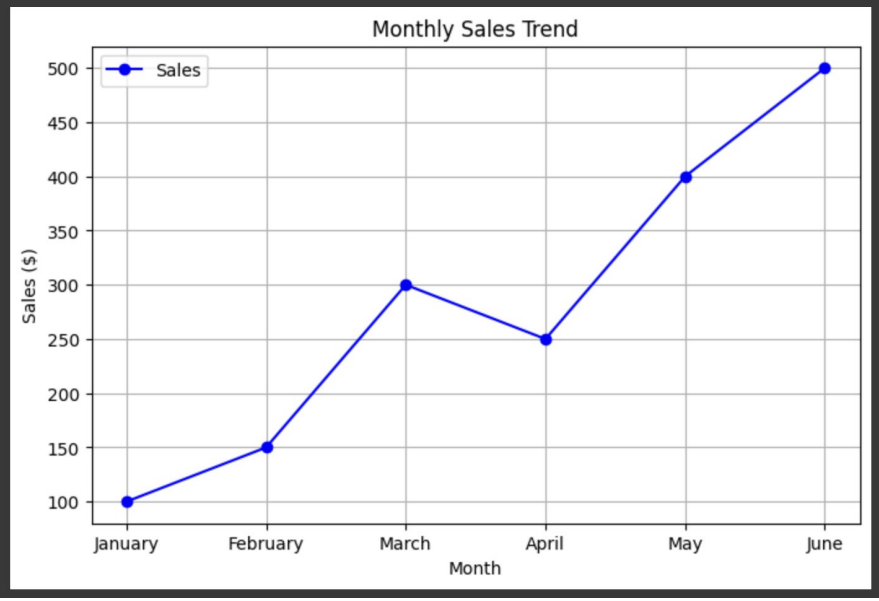
Dataframe

Jan 24: Matplotlib Theory

Python library used for creating static, interactive, and animated visualizations.

- Versatility
- Customization
- Integration
- Interactive Capabilities
- Export Options

```python
# Plot Sales over Months
plt.figure(figsize=(8, 5))
plt.plot(df['Month'], df['Sales'], marker='o', linestyle='-', color='b', label='Sales')
plt.title('Monthly Sales Trend')
plt.xlabel('Month')
plt.ylabel('Sales ($)')
plt.grid(True)
plt.legend()
plt.show()
```



Jan 24: Matplotlib Disadvantages

- Complexity
- Verbose Syntax
- Limited Interactivity
- Performance Issues
- Default Aesthetics are Outdated

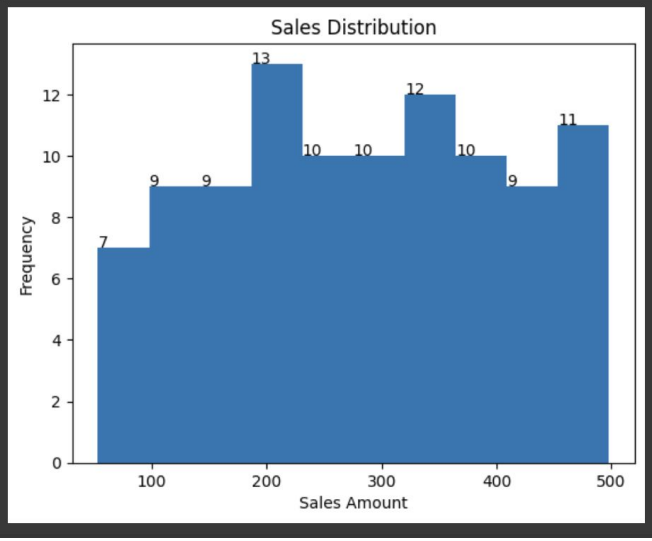
```
[8] print(df.head())

   Sales
0     99
1    406
2    319
3    206
4    187
```

```
counts, bins, _ = plt.hist(df['Sales'], bins=10)  # 10 bins by default
plt.title('Sales Distribution')
plt.xlabel('Sales Amount')
plt.ylabel('Frequency')

# Add default placement of data labels
for i in range(len(counts)):
    plt.text(bins[i], counts[i], str(int(counts[i])))

# Show the plot
plt.show()
```



Let’s start executing week1.ipynb together!

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Lab 2

Announcements!

Weekly homework assignments:

- Will be due in 11 days
- New homework assigned on Fridays during lab
- Turn in on Gradescope

Upcoming exam on Feb. 13th:

- Will be 40 minutes, in class
- Lecture on Feb. 11th – likely exam review or makeup

Announcements!

Homework Reminders:

- Don't give us code unless we ask for it!
  - *Don't turn in an .ipynb file*
  - *Turn in <u>exports</u>, not screenshots*

- Make sure axis labels are clear
- Include information on parameters that don't change

- Default parameters in matplotlib may not be optimal – experiment with different ones
  - *E.g., binning with histograms*

Jan 31: Census Data

United States Census Bureau

Search | Advanced Search

All | Tables | Maps | Charts | Profiles | Pages | Apps | Help | FAQ | Feedback

1 Filter

New York ×

Clear all filters

Search for a filter or table

Geographies
- Nation
- State
- County
- County Subdivision
- Place
- ZIP Code Tabulation Area
- Metropolitan/Micropolitan Statistical Area
- Census Tract
- Block
- Block Group
- All Geographies

Topics
- Business and Economy
- Education
- Employment
- Families and Living Arrangements

4109 Results

View: 10 | 25 | 50 — Download Table Data

Decennial Census
P1 | TOTAL POPULATION
View All 10 Products

Population Estimates
PEPANNRES | Annual Estimates of the Resident Population: Apr
2019: PEP Population Estimates

American Community Survey
DP05 | ACS Demographic and Housing Estimates
View All 30 Products

Household Pulse Survey
HPS01 | All HPS Indicators for Phase 4.0 and Later
HPS High Frequency Social and Economic Data

American Community Survey
S0101 | Age and Sex
View All 27 Products

American Community Survey
S0102 | Population 60 Years and Over in the United States
View All 27 Products

American Community Survey
S0103 | Population 65 Years and Over in the United States
View All 27 Products

P1 | RACE
Decennial Census | Universe: Total population | 2020: DEC Redistricting Data (PL 94-171)

Notes | Geos | Topics | More Tools

Label	New York
Total:	20,201,249
Population of one race:	18,433,786
White alone	11,143,349
Black or African American alone	2,986,172
American Indian and Alaska Native alone	149,690
Asian alone	1,933,127
Native Hawaiian and Other Pacific Islander alone	10,815
Some Other Race alone	2,210,633
Population of two or more races:	1,767,463
Population of two races:	1,649,229
White; Black or African American	175,686
White; American Indian and Alaska Native	113,950
White; Asian	148,927
White; Native Hawaiian and Other Pacific Islander	3,890
White; Some Other Race	840,481
Black or African American; American Indian and Alaska Native	31,562
Black or African American; Asian	21,450
Black or African American; Native Hawaiian and Other Pacific Islander	3,274
Black or African American; Some Other Race	226,733
American Indian and Alaska Native; Asian	5,958
American Indian and Alaska Native; Native Hawaiian and Other Pacific Islander	564

Jan 31: `census` Python Package

- Wrapper for the United States Census Bureau's API
  - More information here
- Information on the Census Bureau API is here and here
  - You can request an API key here

```
from census import Census
from us import states

c = Census("MY_API_KEY")
c.acs5.get(('NAME', 'B25034_010E'),
           {'for': 'state:{}'.format(states.MD.fips)})
```

Note: you do not need an API key for querying small quantities of data, with minimal restrictions (e.g. <500 queries/day per IP)

Jan 31: Exporting plots

- Tricky in Colab vs. VSCode/Jupyter
- In **matplotlib**: `plt.savefig("file_name.jpg")`
- In **Colab**:

```
from google.colab import files
plt.savefig("file_name.jpg")
files.download("file_name.jpg")
```

  - Alternatively, you can use simple scripts in Colab to save exports to your **temporary** Colab environment

```
plt.savefig("file_name.jpg", format="jpeg", dpi=95)
```

Let's start executing Week2.ipynb together!

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Lab 3

Feb 07: What Are Shapefiles?

A shapefile is a widely used **geospatial data format** for mapping locations, boundaries, and spatial relationships.

- It represents **geographic features** as points, lines, or polygons.
- **Common Uses:** Political boundaries, census tracts, roads, environmental features.
- Shapefile **Components**:
  - .shp – Stores geometry (the actual shapes).
  - .shx – Index for quick lookup.
  - .dbf – Attribute data (tabular information).

Feb 07: Census Shapefiles

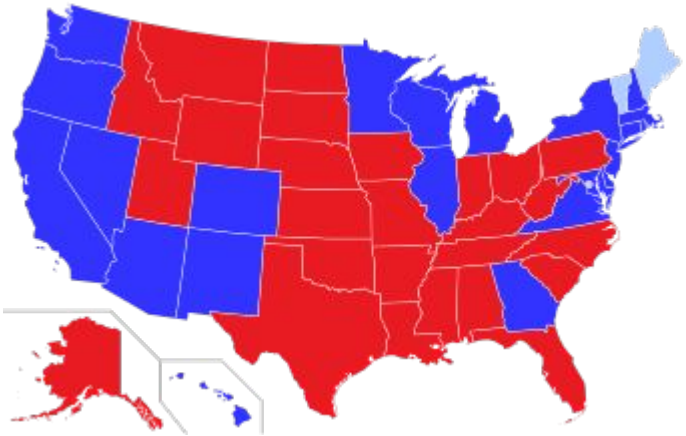
Some examples of Census shapefiles

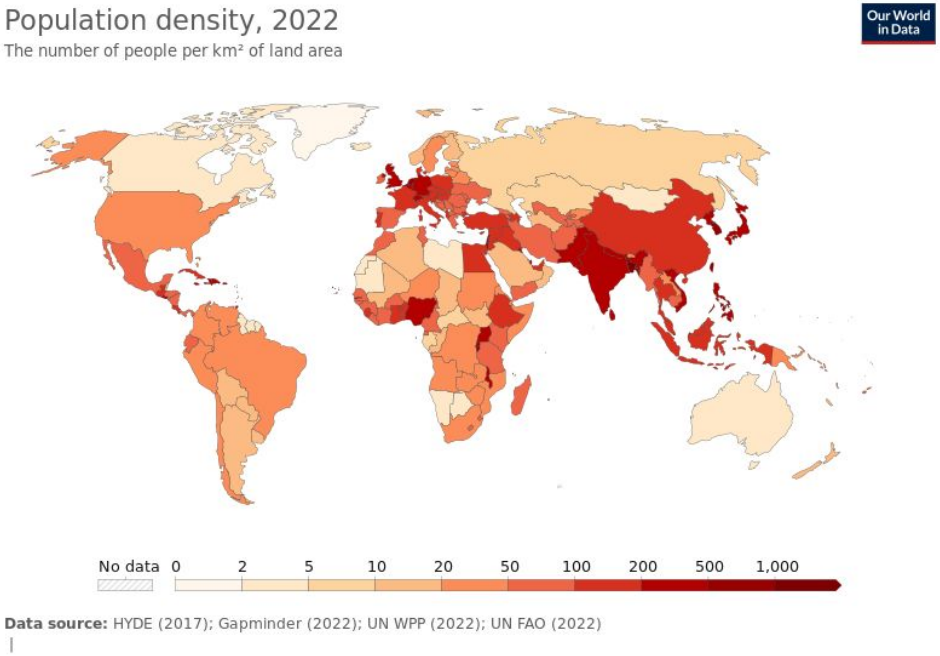
- States
- Counties and county equivalents
- County subdivisions
- Census tracts
- American Indian, Alaska Native, Native Hawaiian areas
- Tribal subdivisions
- Roads, rails, rivers
- School districts, etc.

Feb 07: What Is a Choropleth Map?

A choropleth map is a thematic map where areas are shaded or colored based on data values.

- Each region (e.g., state, county) is filled with a color corresponding to a data variable (e.g., population, unemployment rate).





Let's start executing Week3.ipynb together!

PUBPOL 2130/ INFO 3130

Lab 4

Feb 13: Census Blocks

Blocks:

- Statistical areas with natural boundaries (e.g., roads)
- Cover the entire U.S.
- Smallest geographic unit for demographic data

Feb 13: Census Tracts

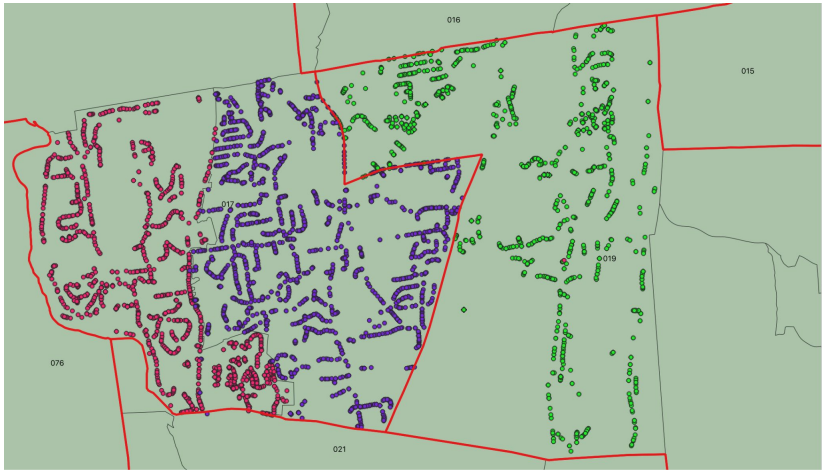
Tracts:

- Small, statistical subdivisions of counties
- Population between 1,200 and 8,000
- Spatial size varies widely

Feb 13: Precincts

Tracts:

- Finest resolution of election data
- Not consistently maintained by states!
- mggg contains an open repository of precincts data



Feb 13: maup

- A geospatial toolkit for redistricting data
- Helpful for:
  - Aggregating from blocks to precincts
  - Disaggregating from precincts to blocks
  - “Prorating” data when there is no clean overlap

Feb 13: Assigning precincts to districts

Assigning precincts to districts

The `assign` function in `maup` takes two sets of geometries called `sources` and `targets` and returns a pandas `Series`. The Series maps each geometry in `sources` to the geometry in `targets` that covers it. (Here, geometry *A covers* geometry *B* if every point of *A* and its boundary lies in *B* or its boundary.) If a source geometry is not covered by one single target geometry, it is assigned to the target geometry that covers the largest portion of its area.

```
>>> import maup
>>>
>>> precinct_to_district_assignment = maup.assign(precincts, districts)
>>> # Add the assigned districts as a column of the `precincts` GeoDataFrame:
>>> precincts["DISTRICT"] = precinct_to_district_assignment
>>> precinct_to_district_assignment.head()
0     7
1     5
2    13
3     6
4     1
dtype: int64
```

Let's start executing Week4.ipynb together!