Census Subject Tables

ANALYZING US CENSUS DATA IN PYTHON

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Census Data Products

- **Decennial Census of Population and Housing**
- **American Community Survey (annual)**
- Current Population Survey (monthly)
- Economic Survey (5 years)
- Annual Survey of State and Local Government Finances

Course Prerequisites

- Lists
- Dictionaries
- Package imports
- Control flow, looping
- List comprehensions
- `pandas` data frames

Introduction to Census Topics

Decennial Census of Population and Housing

- Demographics (age, sex, race, family structure)
- Housing Occupancy and Ownership (vacant/occupied, rent/own)
- Group Quarters Population (prisons, college dorms)

American Community Survey

- Educational Attainment
- Commuting (mode, time leaving, time travelled)
- Disability Status

Structure of a Subject Table

P5. HISPANIC OR LATINO ORIGIN BY RACE [17]

Universe: Total population

Total:	P0050001
Not Hispanic or Latino:	P0050002
White alone	P0050003
Black or African American alone	P0050004
American Indian and Alaska Native alone	P0050005
Asian alone	P0050006
Native Hawaiian and Other Pacific Islander alone	P0050007
Some Other Race alone	P0050008
Two or More Races	P0050009
Hispanic or Latino:	P0050010
White alone	P0050011
Black or African American alone	P0050012
American Indian and Alaska Native alone	P0050013

Subject Table to Data Frame

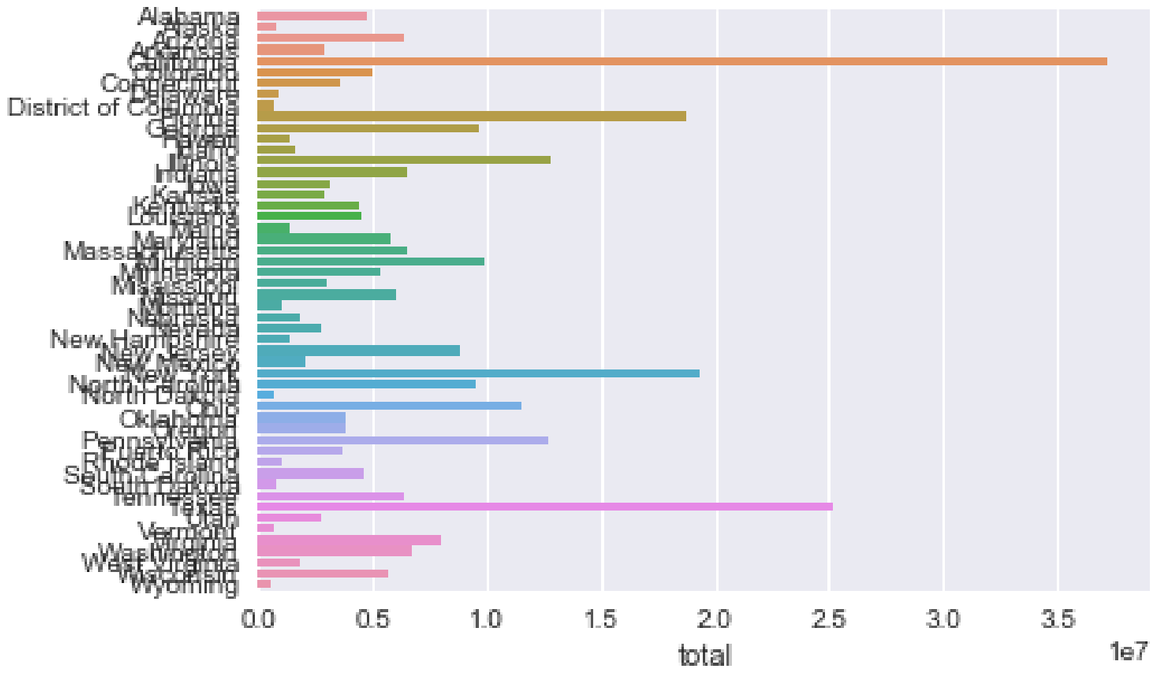
```
states.head()
```

```
              total          ...          hispanic_multiracial
Alabama     4779736          ...                         10806
Alaska       710231          ...                          6507
Arizona     6392017          ...                        103669
Arkansas    2915918          ...                         11173
California 37253956          ...                        846688

[5 rows x 17 columns]
```

Basic Data Visualization

```
import seaborn as sns
sns.set()
sns.barplot(
    x = "total",
    y = states.index,
    data = states
    )
```



Going further: **Data Visualization with Seaborn**

Let's practice!

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Using the Census API

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Structure of a Census API Request

```
https://api.census.gov/data/2010/dec/sf1?get=NAME,P001001,&for=state:*
```

Structure of a Census API Request

`https://api.census.gov/data/2010/dec/sf1?`

- Base URL
  - Host = `https://api.census.gov/data`
  - Year = `2010`
  - Dataset = `dec/sf1`

Structure of a Census API Request

`https://api.census.gov/data/2010/dec/sf1?get=NAME,P001001,&for=state:*`

- Base URL
  - Host = `https://api.census.gov/data`
  - Year = `2010`
  - Dataset = `dec/sf1`
- Parameters
  - `get` - List of variables
  - `for` - Geography of interest

The requests Library

```
import requests
HOST = "https://api.census.gov/data"
year = "2010"
dataset = "dec/sf1"
base_url = "/".join([HOST, year, dataset])
predicates = {}
get_vars = ["NAME", "AREALAND", "P001001"]
predicates["get"] = ",".join(get_vars)
predicates["for"] = "state:*"
r = requests.get(base_url, params=predicates)
```

Examine the Response

```
print(r.text)
```

```
[["NAME","AREALAND","P001001","state"],
["Alabama","131170787086","4779736","01"],
["Alaska","1477953211577","710231","02"],
["Arizona","294207314414","6392017","04"],
...
```

Response Errors

```
print(r.text)
```

```
error: unknown variable 'nonexistentvariable'
```

Create User-Friendly Column Names

```
print(r.json()[0])
```

```
['NAME', 'AREALAND', 'P001001', 'state']
```

Create easy to remember column names using snake_case:

```
col_names = ["name", "area_m2", "total_pop", "state"]
```

Load into Pandas Data Frame

```
import pandas as pd
df = pd.DataFrame(columns=col_names, data=r.json()[1:])
# Fix data types
df["area_m2"] = df["area_m2"].astype(int)
df["total_pop"] = df["total_pop"].astype(int)
print(df.head())
```

```
         name         area_m2  total_pop state
0     Alabama   1311170787086    4779736    01
1      Alaska  14779532115 77     710231    02
2     Arizona   294207314414    6392017    04
3    Arkansas   134771261408    2915918    05
4  California   403466310059   37253956    06
```

Find 3 Most Densely Settled States

```
# Create new column
df["pop_per_km2"] = 1000**2 * df["total_pop"] / df["area_m2"]
# Find top 3
df.nlargest(3, "pop_per_km2")
```

	name	area_m2	total_pop	state	pop_per_km2
8	District of Columbia	158114680	601723	11	3805.611218
30	New Jersey	19047341691	8791894	34	461.581156
51	Puerto Rico	8867536532	3725789	72	420.160547

Let's practice!

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Census Geography

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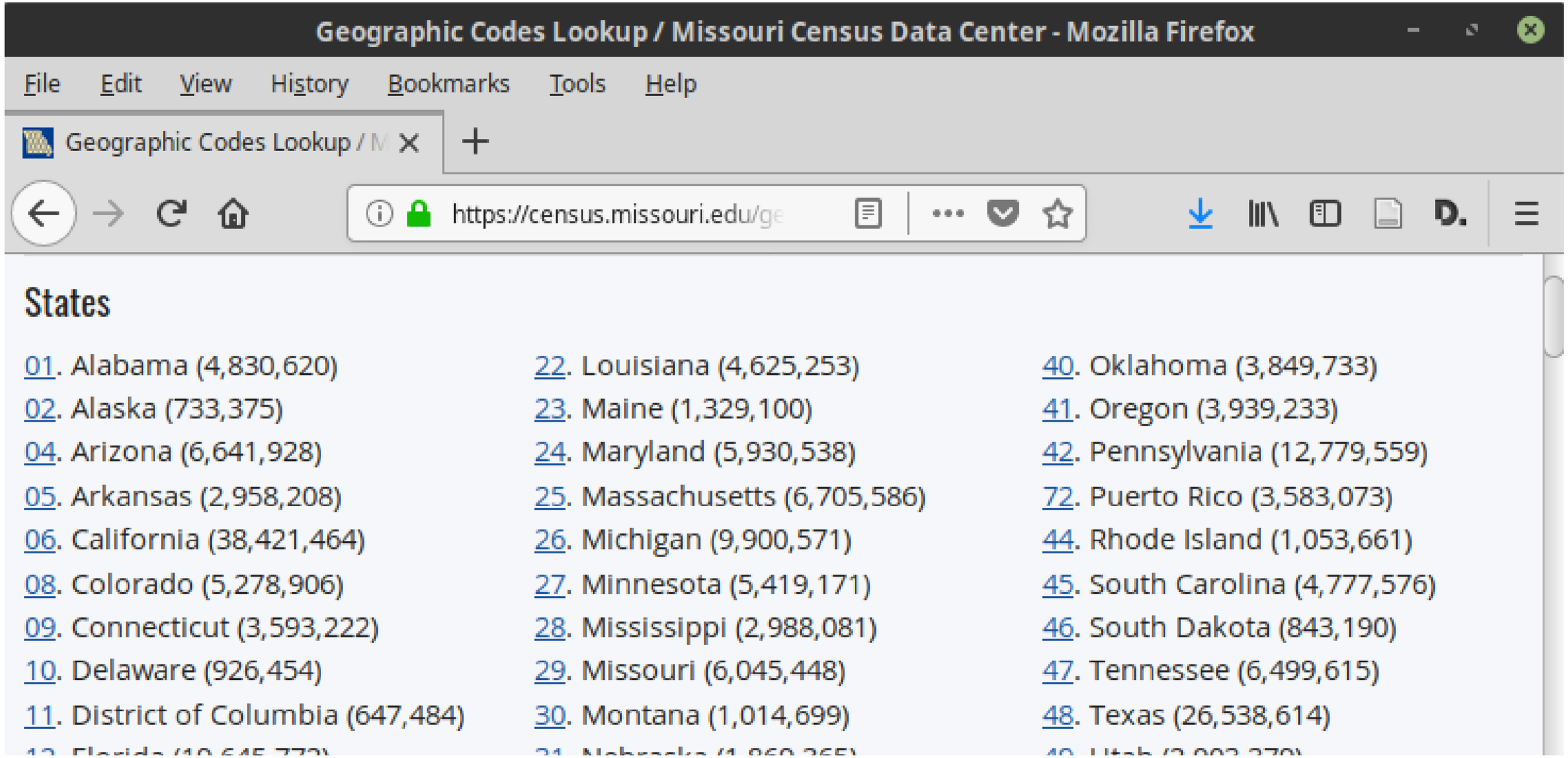
Request All Geographies

```
import requests

HOST = "https://api.census.gov/data"
year = "2010"
dataset = "dec/sf1"
base_url = "/".join([HOST, year, dataset])

predicates = {}
predicates["get"] = "NAME,P001001"
predicates["for"] = "state:*"
r = requests.get(base_url, params=predicates)
```

Request Specific Geographies

```
import requests

HOST = "https://api.census.gov/data"
year = "2010"
dataset = "dec/sf1"
base_url = "/".join([HOST, year, dataset])

predicates = {}
predicates["get"] = "NAME,P001001"
predicates["for"] = "state:42"
r = requests.get(base_url, params=predicates)
```



[1] https://census.missouri.edu/geocodes/

Geographic Entities

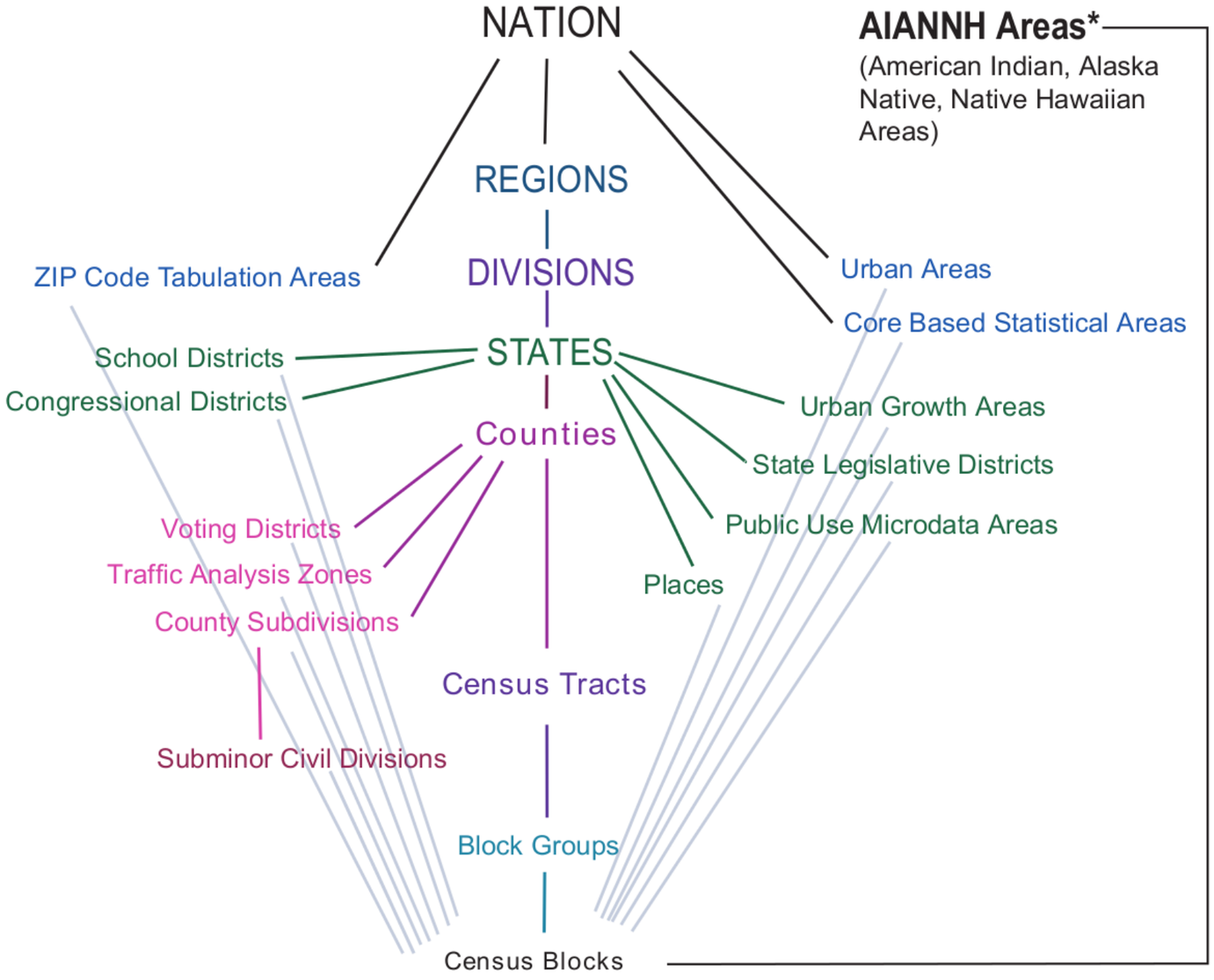
Legal/Administrative

- State
- County
- Congressional Districts
- School Districts
- etc.

Statistical

- Block
- (Census) Tract
- Metropolitan/Micropolitan Statistical Area
- ZIP Code Tabulation Area
- etc.

[1] https://www.census.gov/geo/education/legstat_geo.html


NATION
AIANNH Areas*
(American Indian, Alaska Native, Native Hawaiian Areas)
REGIONS
DIVISIONS
ZIP Code Tabulation Areas
Urban Areas
Core Based Statistical Areas
STATES
School Districts
Congressional Districts
Urban Growth Areas
Counties
State Legislative Districts
Public Use Microdata Areas
Voting Districts
Traffic Analysis Zones
County Subdivisions
Places
Census Tracts
Subminor Civil Divisions
Block Groups
Census Blocks

The "in" Predicate

Request all counties in specific states:

```
predicates["for"] = "county:*"
predicates["in"] = "state:33,50"
```

Request specific counties in **one** state:

```
predicates["for"] = "county:001,003"
predicates["in"] = "state:33"
```

```
r = requests.get(base_url, params=predicates)
```

Places

- "An **incorporated place** is established to provide governmental functions for a concentration of people.... An incorporated place usually is a city, town, village, or borough, but can have other legal descriptions."
- "**Census Designated Places (CDPs)** are the statistical counterparts of incorporated places, and are delineated to provide data for settled concentrations of population that are identifiable by name but are not legally incorporated under the laws of the state in which they are located."

Source: **https://www.census.gov/geo/reference/gtc/gtc_place.html**

Geography Level	Geography Hierarchy
40	state
50	state› county
60	state› county› county subdivision
101	state› county› tract› block
140	state› county› tract
150	state› county› tract› block group
160	state› place

https://api.census.gov/data/2010/dec/sf1/geography.html

Part Geographies

state› congressional district› county (or part)

```
predicates = {}
predicates["get"] = "NAME,P001001"
predicates["for"] = "county (or part):*"
predicates["in"] = "state:42;congressional district:02"
r = requests.get(base_url, params=predicates)
print(r.text)
```

```
[["NAME","P001001","state","congressional district","county"],
["Montgomery County (part)","36793","42","02","091"],
["Philadelphia County (part)","593484","42","02","101"]]
```

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