Problem Set 3: Merging and Regular Expressions, Part 1

Background on the policy context: here, we"re going to use two datasets to practice reshaping, merging, and regular expression patterns. Both datasets relate to the broader issue of which employers might be violating the rights of temporary guestworkers granted visas under the H-2A program. Here are some articles about potential exploitation of guestworkers by firms and inequality caused by minimal oversight:

- News media coverage of labor abuses of temporary guestworkers: https://www.buzzfeednews.com/article/kenbensinger/the-pushovers
- GAO report on labor abuses of temporary guestworkers: https://www.gao.gov/products/gao-15-154

The following datasets are located in `pset3_inputdata` (need to unzip):

- `jobs` : a dataset of guestworker jobs posted by many employers, some of whom have been debarred (banned) from the program for labor abuses; others not debarred
- `debar` : a dataset of employers who committed violations of labor regulations meant to protect temporary guestworkers

Here"s a codebook explaining the variables in `jobs.csv` : https://web.archive.org/web/20231129014506/https://www.dol.gov/sites/dolgov/files/ETA/oflc/pdfs/H-2A_Record_Layout_FY2023_Q4.pdf

In [49]:

```python
## helpful packages
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import random
import re
import os

## repeated printouts
from IPython.core.interactiveshell import InteractiveShell
InteractiveShell.ast_node_interactivity = "all"
```

Reshaping data (13 points total)

Load the following dataset stored in `pset3_inputdata` : `debar.csv`

This represents employers temporarily banned from hiring workers (debar.csv); call this `debar`

View the head()

In [50]:

```python
## your code here
debar = pd.read_csv("pset3_inputdata/debar.csv")

debar.head()
```

Out[50]:

	Name	City, State	Violation	Duration	Start date	End date
0	J&J Harvesting	Leads, ND	Failure to respond to audit (partial response)	2 years	1/19/2014	1/18/2016
1	Stahlman Apiaries, Inc	Selby, SD	Failure to respond to audit (partial response)	1 year	2/19/2015	2/14/2016
2	Trust Nursery	Pulaski, NY	Failure to respond to audit (partial response)	1 year	3/21/2014	3/20/2015
3	Anton Fertilizer Inc.	Dighton, KS	Failure to respond to audit (no response)	2 years	3/30/2014	3/29/2016
4	Great Plains Fluid Service, Inc.	Greensburg, KS	Failure to respond to audit (no response)	2 years	3/30/2014	3/29/2016

1.1 (1 point)

Print the number of rows in `debar` versus the number of unique employer names (`Name`). Is there one row per employer or multiple rows for some employers?

In [51]:

```
## your code here
num_rows = len(debar)
num_employers = debar["Name"].nunique()


print(f"The debar dataset has {num_rows} rows.")
print(f"There are {num_employers} unique employers in the dataset.")
print(f"Considering there is {num_rows - num_employers} more rows than unique employers, some employers must appear multiple times in the dataset.")
```

```
The debar dataset has 114 rows.
There are 98 unique employers in the dataset.
Considering there is 16 more rows than unique employers, some employers must appear multiple times in the dataset.
```

1.2 Investigating duplicated rows (2 points)

A. Create a new column in `debar` -- `is_repeated` -- that tells us whether an employer (`Name`) is repeated > 1 times

Hint: there are multiple ways to solve this but some possibilities to get the list of names that are repeated are:

- Using value_counts() on the `Name` variable and extracting the index from that value counts
- Using groupby to count the rows attached to one name

B. Print the rows where `is_repeated == True` and interpret

C. Subset to the rows where `is_repeated == True` and save that data as `mult_debar` . Print the head() and shape

In [52]:

```
## your code here
debar["is_repeated"] = debar["Name"].duplicated(keep=False)

mult_debar = debar[debar["is_repeated"] == True].copy()

mult_debar.head()
```

```
print(mult_debar.value_counts())
print(f"Shape: {mult_debar.shape}")
print(f"There are {mult_debar["Name"].nunique()} employers that appear multiple times in the dataset with a total of {len(mult_debar)} violations.")
```

Out[52]:

	Name	City, State	Violation	Duration	Start date	End date	is_repeated
6	Annabella Land & Cattle	Annabella, UT	Non Payment	1 year	5/9/2014	5/9/2015	True
7	Autumn Hill Orchard	Groton, MA	Failure to respond to audit (no response)	2 years	7/6/2014	7/5/2016	True
8	Caddo Creek Ranch, dba Paradise Ranch	Caddo, TX	Failure to respond to audit (partial response)	2 years	7/20/2014	7/19/2016	True
11	Loewen Harvesting LLC	Brownsville, TX	Failure to respond to audit (partial response)	1 year	8/20/2014	8/19/2015	True
12	Rollo Farm Labor Contractor	Miami, FL	Failure to respond to audit (no response)	2 years	8/23/2014	8/22/2016	True

```
Name                                     City, State       Violation                                                                  Duration  Start d
ate  End date    is_repeated
Annabella Land & Cattle                  Annabella, UT     Non Payment                                                                1 year    5/9/201
4    5/9/2015    True           1
                                         Annabella, Utah   Non-payment                                                                1 year    5/9/201
4    5/8/2015    True           1
Autumn Hill Orchard                      Groton, MA        Failure to respond to audit (no response)                                  2 years   7/6/201
4    7/5/2016    True           1
                                                           Impeding the Audit Process – Non- Response                                 2 years   7/6/201
4    7/5/2016    True           1
Caddo Creek Ranch, dba Paradise Ranch    Caddo, TX         Failure to respond to audit (partial response)                             2 years   7/20/20
14   7/19/2016   True           1
                                         Caddo, Texas      Impeding the Audit Process – Partial- Response                             2 years   7/20/20
14   7/19/2016   True           1
Cisco Produce Inc.                       Cairo, GA         Failure to respond to audit (no response)                                  2 years   12/10/2
014  12/9/2016   True           1
                                                           Impeding the Audit Process – Non- Response                                 2 years   12/10/2
015  12/9/2017   True           1
Dove Creek Farms                         Mount Vernon, TX  Failure to Respond to Audit Request                                        2 years   2/9/201
8    2/8/2020    True           1
                                                           Failure to respond to audit request                                        2 years   2/9/201
8    2/8/2018    True           1
F&W Farms                                Ingalls, KS       Failure to respond to audit (partial response)                             2 years   12/10/2
014  12/9/2016   True           1
                                                           Impeding the Audit Process – Partial- Response                             1 year    12/10/2
014  12/9/2015   True           1
Loewen Harvesting LLC                    Brownfield, TX    Impeding the Audit Process – Partial- Response                             1 year    8/20/20
14   8/19/2015   True           1
                                         Brownsville, TX   Failure to respond to audit (partial response)                             1 year    8/20/20
14   8/19/2015   True           1
Macky and Brad Farms                     Plains, TX        Failure to respond to audit (no response)                                  1 year    2/13/20
15   2/12/2016   True           1
                                                           Impeding the Audit Process – Partial- Response                             1 year    2/13/20
15   2/12/2016   True           1
Maple Ridge Custom Services, LLC         Altheimer, AK     Failure to respond to audit (partial response)                             2 years   11/16/2
014  11/15/2016  True           1
                                         Altheimer, AR     Impeding the Audit Process – Partial- Response                             1 year    11/16/2
014  11/15/2015  True           1
Mark Duncan                              Roosevelt, UT     Failure to respond to audit (no response)                                  2 years   11/16/2
014  11/15/2016  True           1
                                                           Impeding the Audit Process – Non- Response                                 2 years   11/16/2
014  11/15/2016  True           1
Old Tree Farms/Verpaalen Custom Service  Volga, SD         WHD Debarment                                                              3 years   12/11/2
014  12/10/2017  True           1
                                                           Wage Hour Debarment                                                        3 years   12/1/20
14   12/1/2017   True           1
Rollo Farm Labor Contractor              Miami, FL         Failure to respond to audit (no response)                                  2 years   8/23/20
14   8/22/2016   True           1
                                                           Impeding the Audit Process – Non- Response                                 2 years   8/23/20
14   8/22/2016   True           1
SRT Farms                                Morton, TX        Failure to respond to audit (no response)                                  2 years   11/16/2
014  11/15/2016  True           1
```

```
                                                           Impeding the Audit Process – Non- Response                                 2 years   11/16/2
014  11/15/2016  True           1
Sharon Mathis                            Tifton, GA        Failure to respond to audit (no response)                                  2 years   11/16/2
014  11/15/2016  True           1
                                                           Impeding the Audit Process – Non- Response                                 2 years   11/16/2
014  11/15/2016  True           1
Turner Farms                             Healy, KS         Failure to comply with the employer's obligations to recruit U.S. workers  6 months  7/17/19
2/10/2020   True          1
                                                                                                                                      7 months  7/17/19
2/10/20     True          1
Xavier Horne                             Lyons, Georgia    Failure to respond to audit request                                        2 years   9/27/20
17   9/26/2019   True           1
                                                           Non-payment of certification fee                                           1 year    6/16/20
16   6/15/2017   True           1
Name: count, dtype: int64
Shape: (32, 7)
There are 16 employers that appear multiple times in the dataset with a total of 32 violations.
```

1.3 Reshape mult_debar to wide to begin filtering out duplicates (4 points)

You want to separate out two cases:

- Cases where the repeat rows for one employer are due to duplicated data
- Cases where the repeat rows for one employer represent repeated violations for different issues

There are various ways to check duplicates in this data (eg converting `Violation` to lowercase; replacing spelled-out states with two-dig state codes)

We"re going to use the simple rule of:

- A row is a duplicate if, within an employer (defined by Name + City, State), the Start date for each row"s violation is the same

To begin to check this, reshape `mult_debar` to a wide dataframe (`mult_debar_wide`) with the following columns, treating the `Name` and `City, State` as the index for the pivot:

- Name
- City, State
- start_date_viol1
- start_date_viol2

Print the head and shape

In [53]:

```python
## your code here

# Create a violation number within each employer group
mult_debar["viol_num"] = mult_debar.groupby(["Name", "City, State"]).cumcount() + 1

# Pivot to wide format with Start date as the values
mult_debar_wide = mult_debar.pivot(
    index=["Name", "City, State"],
    columns="viol_num",
    values="Start date"
).reset_index()

# Rename the columns to match required format
mult_debar_wide.columns = ["Name", "City, State", "start_date_viol1", "start_date_viol2"]

mult_debar_wide.head()
print(f"Shape: {mult_debar_wide.shape}")
```

Out[53]:

	Name	City, State	start_date_viol1	start_date_viol2
0	Annabella Land & Cattle	Annabella, UT	5/9/2014	NaN
1	Annabella Land & Cattle	Annabella, Utah	5/9/2014	NaN
2	Autumn Hill Orchard	Groton, MA	7/6/2014	7/6/2014
3	Caddo Creek Ranch, dba Paradise Ranch	Caddo, TX	7/20/2014	NaN
4	Caddo Creek Ranch, dba Paradise Ranch	Caddo, Texas	7/20/2014	NaN

```
Shape: (20, 4)
```

1.4 Filter out duplicates from original debar data (6 points)

A. Using `mult_debar_wide`, add a column `is_dup` that takes value of True for cases where start_date_viol1 == start_date_viol2 marking the row as a duplicate

B. Going back to the original long-format data you loaded at the beginning -- `debar`

```
    - Create a column in `debar` called `violnum` that numbers the violations for each employer (so the first violation for an
    employer is 1, the second is 2, etc)
    - For employers where `is_dup == True` as indicated by your wide-format dataframe, only keep `violnum == 1`
    - For all other employers (so is_dup == False and ones we didnt need to check duplicates for), keep all violnum
    - Remove the `is_repeated` column from the `debar` data
```

Hint: you can complete part B without a for loop; `pd.concat` with axis = 0 (row binding) is one way

Call the resulting dataframe `debar_clean` and print the shape and # of unique employer names

Save the `debar_clean` as a csv file using `df.to_csv([filename], index=False)`. You will be using it in Problem Set 4.

In [ ]:

```
# Part A: Add is_dup column to mult_debar_wide
mult_debar_wide["is_dup"] = (mult_debar_wide["start_date_viol1"] == mult_debar_wide["start_date_viol2"])
print(mult_debar_wide["is_dup"].value_counts())

# Part B: Filter duplicates from original debar data

# Create violnum column
```

```
print(f"original debar shape: {debar.shape}")

debar = debar.sort_values(["Name", "City, State"]).copy()
debar["violnum"] = debar.groupby(["Name", "City, State"]).cumcount() + 1

# Get list of duplicate employers (Name + City, State) from the wide frame
dup_employers = mult_debar_wide.loc[mult_debar_wide["is_dup"], ["Name", "City, State"]].drop_duplicates()

# Mark rows in debar that belong to duplicate employers
debar_flagged = debar.merge(dup_employers, on=["Name", "City, State"], how="left", indicator=True)

# Keep only violnum==1 for duplicate employers; keep all rows for others
debar_dup = debar_flagged.loc[(debar_flagged["_merge"] == "both") & (debar_flagged["violnum"] == 1)]
debar_not_dup = debar_flagged.loc[debar_flagged["_merge"] == "left_only"]

# Combine and drop helper columns (is_repeated, violnum, _merge)
debar_clean = pd.concat([debar_dup, debar_not_dup], axis=0).drop(columns=["is_repeated", "violnum", "_merge"])

# Print shape and # of unique employer names
print(f"debar_clean shape: {debar_clean.shape}")
print(f"# unique employer names: {debar_clean['Name'].nunique()}")

# Save to csv
debar_clean.to_csv("debar_clean.csv", index=False)
```

```
is_dup
False    11
True      9
Name: count, dtype: int64
original debar shape: (114, 10)
debar_clean shape: (105, 8)
# unique employer names: 98
```

In [58]:

```
# Inspect which employers are being deduplicated
print(f"Employers with duplicate violations (removed to keep only one): {len(dup_employers)}")
print(dup_employers)

# Show all rows for these employers in the original debar
dup_names = dup_employers[["Name", "City, State"]].values.tolist()
print("Rows in debar for deduplicated employers:")
for name, city_state in dup_names:
    display(debar[(debar["Name"] == name) & (debar["City, State"] == city_state)])
```

```
Employers with duplicate violations (removed to keep only one): 9
                          Name       City, State
2          Autumn Hill Orchard        Groton, MA
6             Dove Creek Farms  Mount Vernon, TX
7                    F&W Farms       Ingalls, KS
10         Macky and Brad Farms        Plains, TX
13                 Mark Duncan     Roosevelt, UT
15  Rollo Farm Labor Contractor         Miami, FL
16                   SRT Farms        Morton, TX
17               Sharon Mathis        Tifton, GA
18                 Turner Farms         Healy, KS
Rows in debar for deduplicated employers:
```

	Name	City, State	Violation	Duration	Start date	End date	is_repeated	violnum	Year	State
7	Autumn Hill Orchard	Groton, MA	Failure to respond to audit (no response)	2 years	2014-07-06	7/5/2016	True	1.0	2014	MA
29	Autumn Hill Orchard	Groton, MA	Impeding the Audit Process – Non- Response	2 years	2014-07-06	7/5/2016	True	2.0	2014	MA

	Name	City, State	Violation	Duration	Start date	End date	is_repeated	violnum	Year	State
103	Dove Creek Farms	Mount Vernon, TX	Failure to respond to audit request	2 years	2018-02-09	2/8/2018	True	1.0	2018	TX
109	Dove Creek Farms	Mount Vernon, TX	Failure to Respond to Audit Request	2 years	2018-02-09	2/8/2020	True	2.0	2018	TX

	Name	City, State	Violation	Duration	Start date	End date	is_repeated	violnum	Year	State
18	F&W Farms	Ingalls, KS	Failure to respond to audit (partial response)	2 years	2014-12-10	12/9/2016	True	1.0	2014	KS
58	F&W Farms	Ingalls, KS	Impeding the Audit Process – Partial- Response	1 year	2014-12-10	12/9/2015	True	2.0	2014	KS

	Name	City, State	Violation	Duration	Start date	End date	is_repeated	violnum	Year	State
31	Macky and Brad Farms	Plains, TX	Failure to respond to audit (no response)	1 year	2015-02-13	2/12/2016	True	1.0	2015	TX
55	Macky and Brad Farms	Plains, TX	Impeding the Audit Process – Partial- Response	1 year	2015-02-13	2/12/2016	True	2.0	2015	TX

	Name	City, State	Violation	Duration	Start date	End date	is_repeated	violnum	Year	State
16	Mark Duncan	Roosevelt, UT	Failure to respond to audit (no response)	2 years	2014-11-16	11/15/2016	True	1.0	2014	UT
60	Mark Duncan	Roosevelt, UT	Impeding the Audit Process – Non- Response	2 years	2014-11-16	11/15/2016	True	2.0	2014	UT

	Name	City, State	Violation	Duration	Start date	End date	is_repeated	violnum	Year	State
12	Rollo Farm Labor Contractor	Miami, FL	Failure to respond to audit (no response)	2 years	2014-08-23	8/22/2016	True	1.0	2014	FL
24	Rollo Farm Labor Contractor	Miami, FL	Impeding the Audit Process – Non- Response	2 years	2014-08-23	8/22/2016	True	2.0	2014	FL

	Name	City, State	Violation	Duration	Start date	End date	is_repeated	violnum	Year	State
15	SRT Farms	Morton, TX	Failure to respond to audit (no response)	2 years	2014-11-16	11/15/2016	True	1.0	2014	TX
61	SRT Farms	Morton, TX	Impeding the Audit Process – Non- Response	2 years	2014-11-16	11/15/2016	True	2.0	2014	TX

	Name	City, State	Violation	Duration	Start date	End date	is_repeated	violnum	Year	State
14	Sharon Mathis	Tifton, GA	Failure to respond to audit (no response)	2 years	2014-11-16	11/15/2016	True	1.0	2014	GA
62	Sharon Mathis	Tifton, GA	Impeding the Audit Process – Non- Response	2 years	2014-11-16	11/15/2016	True	2.0	2014	GA

	Name	City, State	Violation	Duration	Start date	End date	is_repeated	violnum	Year	State
106	Turner Farms	Healy, KS	Failure to comply with the employer's obligati...	6 months	2019-07-17	2/10/2020	True	1.0	2019	KS
111	Turner Farms	Healy, KS	Failure to comply with the employer's obligati...	7 months	2019-07-17	2/10/20	True	2.0	2019	KS

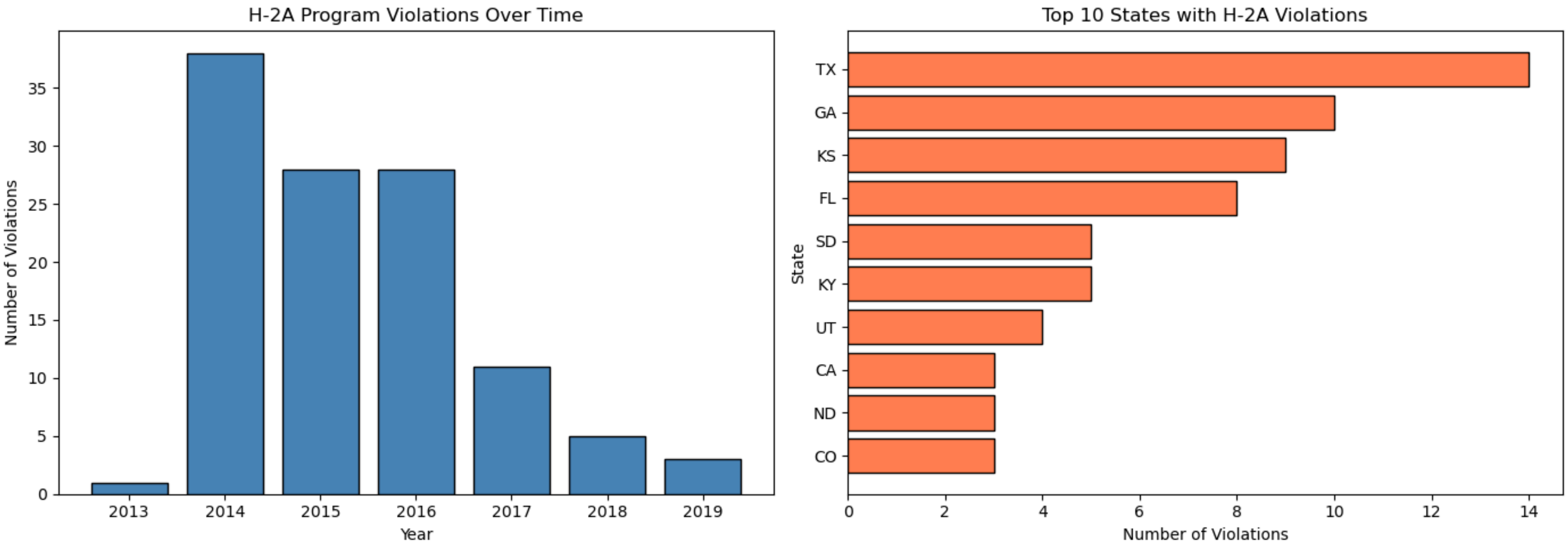
2. Optional extra credit 2 (up to 3 points)

- For 1 point extra credit, create a visualization with 1+ of the existing fields in either the raw `jobs` or `debar` data. We"ll be showing cool visualizations in class so use your imagination! Options could include visualizing between-state or over-time variation
- For 3 points extra credit instead, geocode the employer addresses in `jobs` and plot the addresses of jobs as points overlaid on top of a map of Georgia
  - **Note**: this extra credit involves Googling since we have not yet covered spatial data.
    - For discussion of how to geocode addresses -> lat/long, see: https://www.natasshaselvaraj.com/a-step-by-step-guide-on-geocoding-in-python/
    - For discussion of plotting lat/long dots against a map, see this discussion of geopandas: https://towardsdatascience.com/plotting-maps-with-geopandas-428c97295a73
  - Relevant columns include `EMPLOYER_ADDRESS_1`
  - The geocoding might have a long runtime so feel free to implement it in a separate .py script that you submit alongside your notebook and to just read in the geocoded data

In [ ]:

```python
# Convert Start date to datetime and extract year
debar["Start date"] = pd.to_datetime(debar["Start date"], format="mixed")
debar["Year"] = debar["Start date"].dt.year

# Extract state from "City, State" column
debar["State"] = debar["City, State"].str.extract(r',\s*([A-Z]{2})$')

# Create a figure with two subplots
fig, axes = plt.subplots(1, 2, figsize=(14, 5))

# Violations over time by year
violations_by_year = debar.groupby("Year").size()
_ = axes[0].bar(violations_by_year.index, violations_by_year.values, color="steelblue", edgecolor="black")
_ = axes[0].set_xlabel("Year")
```

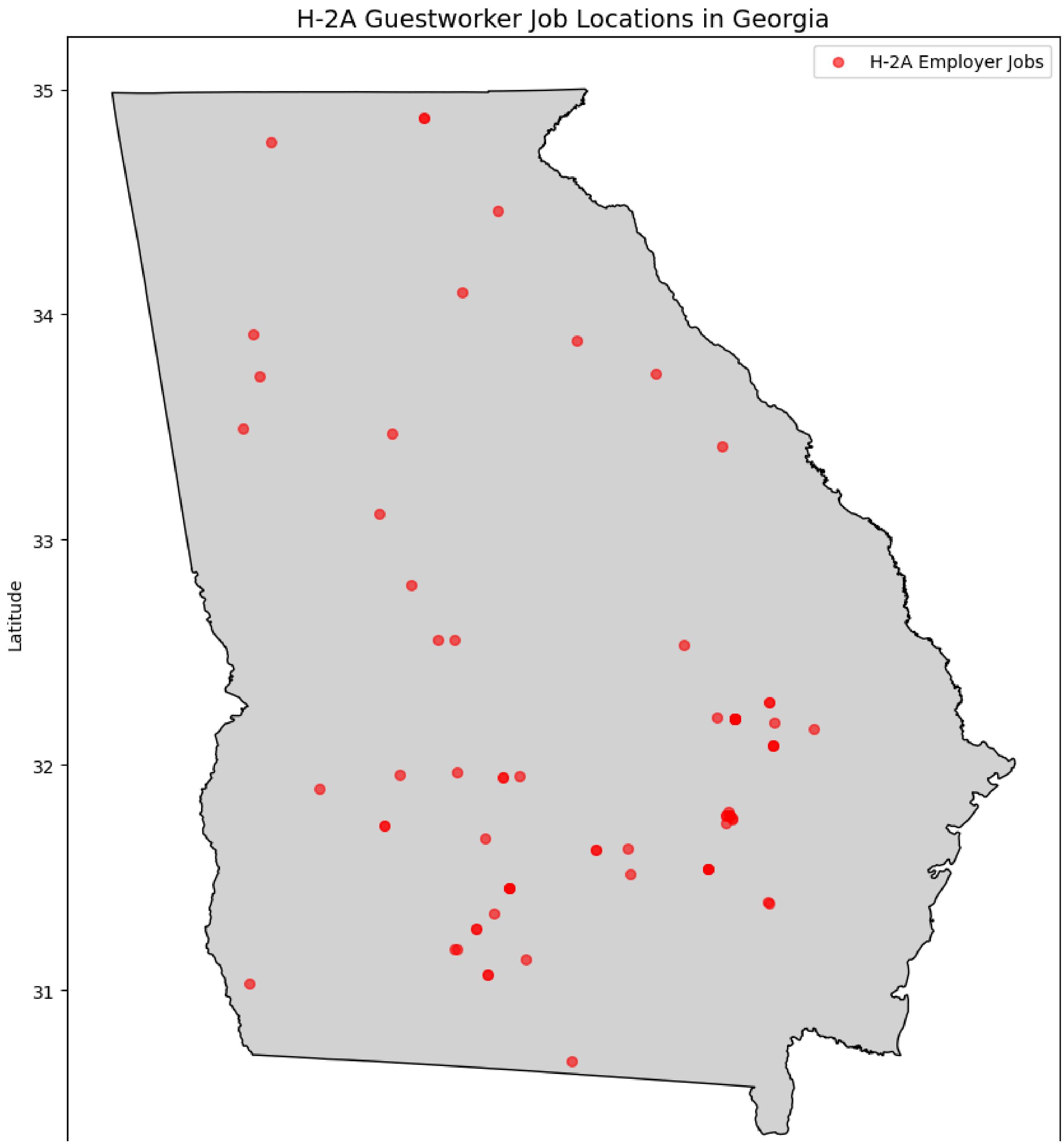
```
_ = axes[0].set_ylabel("Number of Violations")
_ = axes[0].set_title("H-2A Program Violations Over Time")
_ = axes[0].set_xticks(violations_by_year.index)

# Top 10 states by number of violations
_ = violations_by_state = debar["State"].value_counts().head(10)
_ = axes[1].barh(violations_by_state.index[::-1], violations_by_state.values[::-1], color="coral", edgecolor="black")
_ = axes[1].set_xlabel("Number of Violations")
_ = axes[1].set_ylabel("State")
_ = axes[1].set_title("Top 10 States with H-2A Violations")
plt.tight_layout()
plt.show()

print(f"\nSummary: The data shows {len(debar)} total violations across {debar['State'].nunique()} states from {debar['Year'].min()} to {debar['Year'].
```

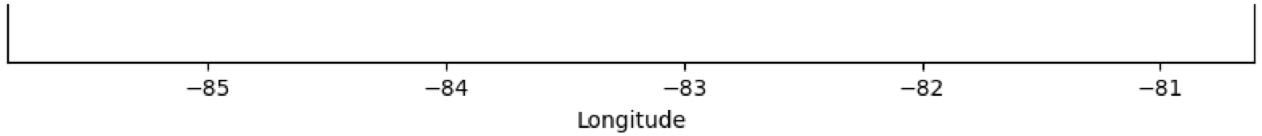


```
Summary: The data shows 114 total violations across 23 states from 2013 to 2019.
```

In [38]:
```
%run georgia_jobs_map.py
```

```
Number of Georgia employers: 74
Unique addresses to geocode: 68
No cache found, starting fresh...
  Full address failed, trying simple address: Lyons, GA 30436
  Full address failed, trying simple address: Tifton, GA 31793
  Full address failed, trying simple address: Wray, GA 31798
  Full address failed, trying simple address: Lyons, GA 30436
  Full address failed, trying simple address: Cobbtown, GA 30420
  Full address failed, trying simple address: Adel, GA 31620
  Full address failed, trying simple address: Parrott, GA 39877
Geocoded 10/68 addresses...
  Full address failed, trying simple address: Leesburg, GA 31763
  Full address failed, trying simple address: Omega, GA 31775
  Full address failed, trying simple address: Lyons, GA 30436
  Full address failed, trying simple address: Lyons, GA 30436
  Full address failed, trying simple address: Cobbtown, GA 30420
  Full address failed, trying simple address: Norman Park, GA 31771
  Full address failed, trying simple address: Pitts, GA 31072
Geocoded 20/68 addresses...
  Full address failed, trying simple address: Cordele, GA 31015
  Full address failed, trying simple address: Lake Park, GA 31636
  Full address failed, trying simple address: Alma, GA 31510
  Full address failed, trying simple address: Chatsworth, GA 30705
  Full address failed, trying simple address: Reidsville, GA 30453
  Full address failed, trying simple address: Baxley, GA 31513
  Full address failed, trying simple address: Alma, GA 31510
  Full address failed, trying simple address: Baxley, GA 31513
  Full address failed, trying simple address: Moultrie, GA 31768
Geocoded 30/68 addresses...
  Full address failed, trying simple address: Tifton, GA 31793
  Full address failed, trying simple address: Lyons, GA 30436
  Full address failed, trying simple address: Tifton, GA 31794
  Full address failed, trying simple address: Alma, GA 31510
  Full address failed, trying simple address: Hoschton, GA 30548
  Full address failed, trying simple address: Blairsville, GA 30514
  Full address failed, trying simple address: Washington, GA 30673
  Full address failed, trying simple address: Leslie, GA 31764
Geocoded 40/68 addresses...
  Full address failed, trying simple address: Baxley, GA 31513
  Full address failed, trying simple address: Norman Park, GA 31771
  Full address failed, trying simple address: Reidsville, GA 30453
  Full address failed, trying simple address: Claxton, GA 30417
  Full address failed, trying simple address: Sycamore, GA 31790
  Full address failed, trying simple address: Dearing, GA 30808
  Full address failed, trying simple address: Fort Valley, GA 31030
  Full address failed, trying simple address: Milner, GA 30257
Geocoded 50/68 addresses...
  Full address failed, trying simple address: Broxton, GA 31519
  Full address failed, trying simple address: Alto, GA 30510
  Full address failed, trying simple address: Crawford, GA 30630
  Full address failed, trying simple address: Patterson, GA 31557
  Full address failed, trying simple address: Rochelle, GA 31079
  Full address failed, trying simple address: Lyons, GA 30436
Geocoded 60/68 addresses...
  Full address failed, trying simple address: Wray, GA 31798
  Full address failed, trying simple address: Alma, GA 31510
  Full address failed, trying simple address: Leesburg, GA 31763
  Full address failed, trying simple address: Whitesburg, GA 30185
  Full address failed, trying simple address: Adrian, GA 31002

Successfully geocoded: 68 / 68 addresses
Results saved to geocoded_addresses_cache.csv
Jobs with valid coordinates: 74
```


H-2A Guestworker Job Locations in Georgia
● H-2A Employer Jobs
Latitude
35
34
33
32
31



```
Plotted 74 employer job locations on Georgia map.
```

In [ ]: