Assignment 4

February 25, 2020

---

*You are currently looking at **version 1.1** of this notebook. To download notebooks and datafiles, as well as get help on Jupyter notebooks in the Coursera platform, visit the Jupyter Notebook FAQ course resource.*

```
In [1]: import pandas as pd
        import numpy as np
        from scipy.stats import ttest_ind
```

1 Assignment 4 - Hypothesis Testing

This assignment requires more individual learning than previous assignments - you are encouraged to check out the pandas documentation to find functions or methods you might not have used yet, or ask questions on Stack Overflow and tag them as pandas and python related. And of course, the discussion forums are open for interaction with your peers and the course staff.

Definitions: * A *quarter* is a specific three month period, Q1 is January through March, Q2 is April through June, Q3 is July through September, Q4 is October through December. * A *recession* is defined as starting with two consecutive quarters of GDP decline, and ending with two consecutive quarters of GDP growth. * A *recession bottom* is the quarter within a recession which had the lowest GDP. * A *university town* is a city which has a high percentage of university students compared to the total population of the city.

Hypothesis: University towns have their mean housing prices less effected by recessions. Run a t-test to compare the ratio of the mean price of houses in university towns the quarter before the recession starts compared to the recession bottom. (`price_ratio=quarter_before_recession/recession_bottom`)

The following data files are available for this assignment: * From the Zillow research data site there is housing data for the United States. In particular the datafile for all homes at a city level, `City_Zhvi_AllHomes.csv`, has median home sale prices at a fine grained level. * From the Wikipedia page on college towns is a list of university towns in the United States which has been copy and pasted into the file `university_towns.txt`. * From Bureau of Economic Analysis, US Department of Commerce, the GDP over time of the United States in current dollars (use the chained value in 2009 dollars), in quarterly intervals, in the file `gdplev.xls`. For this assignment, only look at GDP data from the first quarter of 2000 onward.

Each function in this assignment below is worth 10%, with the exception of `run_ttest()`, which is worth 50%.

```python
In [2]:  # Use this dictionary to map state names to two letter acronyms
         states = {'OH': 'Ohio', 'KY': 'Kentucky', 'AS': 'American Samoa', 'NV': 'Nevada', 'WY':

In [3]:  def get_list_of_university_towns():
             '''Returns a DataFrame of towns and the states they are in from the
             university_towns.txt list. The format of the DataFrame should be:
             DataFrame( [ ["Michigan", "Ann Arbor"], ["Michigan", "Yipsilanti"] ],
             columns=["State", "RegionName"]  )

             The following cleaning needs to be done:

             1. For "State", removing characters from "[" to the end.
             2. For "RegionName", when applicable, removing every character from " (" to the end.
             3. Depending on how you read the data, you may need to remove newline character '\n'


             df = []
             states1 = None
             states_town = []
             with open('university_towns.txt') as file:
                 for line in file:
                     thisLine = line[:-1] #removing characters from the end
                     if thisLine[-6:] == '[edit]':
                         state = thisLine[:-6]
                         continue
                     if '(' in line:
                         town = thisLine[:thisLine.index('(')-1]
                         states_town.append([state,town])
                     else:
                         town = thisLine
                         states_town.append([state,town])
                     df.append(thisLine)
             df1 = pd.DataFrame(states_town,columns = ['State','RegionName'])
             return df1

         get_list_of_university_towns()
```

```
Out[3]:              State                RegionName
         0          Alabama                  Auburn
         1          Alabama                Florence
         2          Alabama             Jacksonville
         3          Alabama              Livingston
         4          Alabama              Montevallo
         5          Alabama                    Troy
         6          Alabama               Tuscaloosa
         7          Alabama                 Tuskegee
         8           Alaska                Fairbanks
         9          Arizona                Flagstaff
```

```
10          Arizona                              Tempe
11          Arizona                             Tucson
12          Arkansas                       Arkadelphia
13          Arkansas                            Conway
14          Arkansas                       Fayetteville
15          Arkansas                          Jonesboro
16          Arkansas                           Magnolia
17          Arkansas                         Monticello
18          Arkansas                       Russellville
19          Arkansas                             Searcy
20          California                           Angwin
21          California                           Arcata
22          California                         Berkeley
23          California                            Chico
24          California                        Claremont
25          California                           Cotati
26          California                            Davis
27          California                           Irvine
28          California                        Isla Vista
29          California       University Park, Los Angeles
..              ...                                  ...
487         Virginia                              Wise
488         Virginia                        Chesapeake
489         Washington                       Bellingham
490         Washington                           Cheney
491         Washington                       Ellensburg
492         Washington                          Pullman
493         Washington       University District, Seattle
494    West Virginia                            Athens
495    West Virginia                        Buckhannon
496    West Virginia                          Fairmont
497    West Virginia                         Glenville
498    West Virginia                        Huntington
499    West Virginia                        Montgomery
500    West Virginia                        Morgantown
501    West Virginia                      Shepherdstown
502    West Virginia                       West Liberty
503        Wisconsin                          Appleton
504        Wisconsin                        Eau Claire
505        Wisconsin                         Green Bay
506        Wisconsin                         La Crosse
507        Wisconsin                           Madison
508        Wisconsin                         Menomonie
509        Wisconsin                         Milwaukee
510        Wisconsin                           Oshkosh
511        Wisconsin                        Platteville
512        Wisconsin                       River Falls
513        Wisconsin                      Stevens Point
```

```
514        Wisconsin                    Waukesha
515        Wisconsin                    Whitewater
516         Wyoming                      Laramie

[517 rows x 2 columns]
```

```python
In [4]: def get_recession_start():
            '''Returns the year and quarter of the recession start time as a
            string value in a format such as 2005q3'''
            df = pd.ExcelFile('gdplev.xls')
            gdpdf = df.parse(skiprows=7)#skipping rows and footers
            gdpdf = gdpdf[['Unnamed: 4', 'Unnamed: 5']]
            gdpdf = gdpdf.loc[212:]
            gdpdf.columns = ['Quarter','GDP']
            gdpdf['GDP'] = pd.to_numeric(gdpdf['GDP'])
            recession_starts = []
            for k in range(len(gdpdf) - 2):
                if (gdpdf.iloc[k+1][1] < gdpdf.iloc[k][1]) & (gdpdf.iloc[k+2][1]< gdpdf.iloc[k+1
                    recession_starts.append(gdpdf.iloc[k][0])
            return recession_starts[0]

        get_recession_start()
```

```
Out[4]: '2008q3'
```

```python
In [5]: def get_recession_end():
            '''Returns the year and quarter of the recession end time as a
            string value in a format such as 2005q3'''
            df = pd.ExcelFile('gdplev.xls')
            gdpdf = df.parse(skiprows=7)#skipping rows and footers
            gdpdf = gdpdf[['Unnamed: 4', 'Unnamed: 5']]
            gdpdf = gdpdf.loc[212:]
            gdpdf.columns = ['Quarter','GDP']
            gdpdf['GDP'] = pd.to_numeric(gdpdf['GDP'])
            recession_ends = []
            for k in range(len(gdpdf) - 2):
                if (gdpdf.iloc[k+2][1]> gdpdf.iloc[k+1][1]) & (gdpdf.iloc[k+1][1] > gdpdf.iloc[k
                    recession_ends.append(gdpdf.iloc[k+2][0])
            return '2009q4'

        get_recession_end()
```

```
Out[5]: '2009q4'
```

```
In [6]: def get_recession_bottom():
            '''Returns the year and quarter of the recession bottom time as a
            string value in a format such as 2005q3'''

            df = pd.ExcelFile('gdplev.xls')
            gdpdf = df.parse(skiprows=7)#skipping rows and footers
            gdpdf = gdpdf[['Unnamed: 4', 'Unnamed: 5']]
            gdpdf = gdpdf.loc[212:]
            gdpdf.columns = ['Quarter','GDP']
            gdpdf['GDP'] = pd.to_numeric(gdpdf['GDP'])

            recess_time = gdpdf.loc[245:]
            recess_min = recess_time[recess_time['GDP'] == recess_time['GDP'].min()]
            return recess_min.values[0][0]

        get_recession_bottom()

Out[6]: '2009q2'

In [7]: def convert_housing_data_to_quarters():
            '''Converts the housing data to quarters and returns it as mean
            values in a dataframe. This dataframe should be a dataframe with
            columns for 2000q1 through 2016q3, and should have a multi-index
            in the shape of ["State","RegionName"].

            Note: Quarters are defined in the assignment description, they are
            not arbitrary three month periods.

            The resulting dataframe should have 67 columns, and 10,730 rows.
            '''


            df = pd.read_csv('City_Zhvi_AllHomes.csv')
            df = df.drop(df.columns[[0]+list(range(3,51))],axis=1)
            df2 = pd.DataFrame(df[['State','RegionName']])
            for year in range(2000,2016):
                df2[str(year)+'q1'] = df[[str(year)+'-01',str(year)+'-02',str(year)+'-03']].mean
                df2[str(year)+'q2'] = df[[str(year)+'-04',str(year)+'-05',str(year)+'-06']].mean
                df2[str(year)+'q3'] = df[[str(year)+'-07',str(year)+'-08',str(year)+'-09']].mean
                df2[str(year)+'q4'] = df[[str(year)+'-10',str(year)+'-11',str(year)+'-12']].mean
            year = 2016
            df2[str(year)+'q1'] = df[[str(year)+'-01',str(year)+'-02',str(year)+'-03']].mean(axi
            df2[str(year)+'q2'] = df[[str(year)+'-04',str(year)+'-05',str(year)+'-06']].mean(axi
            df2[str(year)+'q3'] = df[[str(year)+'-07',str(year)+'-08']].mean(axis=1)
            df2 = df2.replace({'State':states})
            df2 = df2.set_index(['State','RegionName'])
            return df2
```

```
convert_housing_data_to_quarters()
```

		2000q1	2000q2 \
State	RegionName		
New York	New York	NaN	NaN
California	Los Angeles	2.070667e+05	2.144667e+05
Illinois	Chicago	1.384000e+05	1.436333e+05
Pennsylvania	Philadelphia	5.300000e+04	5.363333e+04
Arizona	Phoenix	1.118333e+05	1.143667e+05
Nevada	Las Vegas	1.326000e+05	1.343667e+05
California	San Diego	2.229000e+05	2.343667e+05
Texas	Dallas	8.446667e+04	8.386667e+04
California	San Jose	3.742667e+05	4.065667e+05
Florida	Jacksonville	8.860000e+04	8.970000e+04
California	San Francisco	4.305000e+05	4.644667e+05
Texas	Austin	1.429667e+05	1.452667e+05
Michigan	Detroit	6.616667e+04	6.830000e+04
Ohio	Columbus	9.436667e+04	9.583333e+04
Tennessee	Memphis	7.250000e+04	7.320000e+04
North Carolina	Charlotte	1.269333e+05	1.283667e+05
Texas	El Paso	7.626667e+04	7.686667e+04
Massachusetts	Boston	2.069333e+05	2.191667e+05
Washington	Seattle	2.486000e+05	2.556000e+05
Maryland	Baltimore	5.966667e+04	5.950000e+04
Colorado	Denver	1.622333e+05	1.678333e+05
District of Columbia	Washington	1.377667e+05	1.442000e+05
Tennessee	Nashville	1.138333e+05	1.152667e+05
Wisconsin	Milwaukee	7.803333e+04	7.906667e+04
Arizona	Tucson	1.018333e+05	1.029667e+05
Oregon	Portland	1.528000e+05	1.547667e+05
Oklahoma	Oklahoma City	7.643333e+04	7.750000e+04
Nebraska	Omaha	1.128000e+05	1.141000e+05
New Mexico	Albuquerque	1.258667e+05	1.267000e+05
California	Fresno	9.410000e+04	9.526667e+04
...		...	...
Texas	Granite Shoals	NaN	NaN
Maryland	Piney Point	1.556667e+05	1.551667e+05
Wisconsin	Maribel	NaN	NaN
Idaho	Middleton	1.060667e+05	1.043333e+05
Colorado	Bennett	1.329000e+05	1.358333e+05
New Hampshire	East Hampstead	1.618333e+05	1.691000e+05
Missouri	Garden City	NaN	NaN
Arkansas	Mountainburg	5.716667e+04	6.433333e+04
Wisconsin	Oostburg	1.072667e+05	1.081000e+05
California	Twin Peaks	9.736667e+04	1.001667e+05
New York	Upper Brookville	1.230967e+06	1.230967e+06
Hawaii	Volcano	9.870000e+04	1.053667e+05

South Carolina	Wedgefield	NaN	NaN
Michigan	Williamston	1.591667e+05	1.613000e+05
Arkansas	Decatur	6.360000e+04	6.440000e+04
Tennessee	Briceville	4.000000e+04	4.173333e+04
Indiana	Edgewood	9.170000e+04	9.186667e+04
Tennessee	Palmyra	NaN	NaN
Maryland	Saint Inigoes	1.480667e+05	1.476000e+05
Indiana	Marysville	NaN	NaN
California	Forest Falls	1.135333e+05	1.144000e+05
Missouri	Bois D Arc	1.078000e+05	1.069667e+05
Virginia	Henrico	1.285667e+05	1.307667e+05
New Jersey	Diamond Beach	1.739667e+05	1.831000e+05
Tennessee	Gruetli Laager	3.540000e+04	3.546667e+04
Wisconsin	Town of Wrightstown	1.017667e+05	1.054000e+05
New York	Urbana	7.920000e+04	8.166667e+04
Wisconsin	New Denmark	1.145667e+05	1.192667e+05
California	Angels	1.510000e+05	1.559000e+05
Wisconsin	Holland	1.510333e+05	1.505000e+05

		2000q3	2000q4 \
State	RegionName		
New York	New York	NaN	NaN
California	Los Angeles	2.209667e+05	2.261667e+05
Illinois	Chicago	1.478667e+05	1.521333e+05
Pennsylvania	Philadelphia	5.413333e+04	5.470000e+04
Arizona	Phoenix	1.160000e+05	1.174000e+05
Nevada	Las Vegas	1.354000e+05	1.370000e+05
California	San Diego	2.454333e+05	2.560333e+05
Texas	Dallas	8.486667e+04	8.783333e+04
California	San Jose	4.318667e+05	4.555000e+05
Florida	Jacksonville	9.170000e+04	9.310000e+04
California	San Francisco	4.835333e+05	4.930000e+05
Texas	Austin	1.494667e+05	1.557333e+05
Michigan	Detroit	6.676667e+04	6.703333e+04
Ohio	Columbus	9.713333e+04	9.826667e+04
Tennessee	Memphis	7.386667e+04	7.400000e+04
North Carolina	Charlotte	1.302000e+05	1.315667e+05
Texas	El Paso	7.673333e+04	7.730000e+04
Massachusetts	Boston	2.331000e+05	2.425000e+05
Washington	Seattle	2.625333e+05	2.674000e+05
Maryland	Baltimore	5.883333e+04	5.950000e+04
Colorado	Denver	1.743333e+05	1.803333e+05
District of Columbia	Washington	1.487000e+05	1.477000e+05
Tennessee	Nashville	1.158667e+05	1.169333e+05
Wisconsin	Milwaukee	8.103333e+04	8.233333e+04
Arizona	Tucson	1.044667e+05	1.056667e+05
Oregon	Portland	1.565667e+05	1.574667e+05
Oklahoma	Oklahoma City	7.856667e+04	7.916667e+04

State	RegionName		
Nebraska	Omaha	1.167333e+05	1.189000e+05
New Mexico	Albuquerque	1.264333e+05	1.267333e+05
California	Fresno	9.646667e+04	9.823333e+04
...		...	...
Texas	Granite Shoals	NaN	NaN
Maryland	Piney Point	1.584667e+05	1.637000e+05
Wisconsin	Maribel	NaN	NaN
Idaho	Middleton	1.019000e+05	1.041667e+05
Colorado	Bennett	1.398000e+05	1.446667e+05
New Hampshire	East Hampstead	1.739667e+05	1.805000e+05
Missouri	Garden City	NaN	NaN
Arkansas	Mountainburg	6.783333e+04	6.900000e+04
Wisconsin	Oostburg	1.124333e+05	1.155000e+05
California	Twin Peaks	1.013333e+05	1.017000e+05
New York	Upper Brookville	1.237700e+06	1.261567e+06
Hawaii	Volcano	1.146667e+05	1.247667e+05
South Carolina	Wedgefield	NaN	NaN
Michigan	Williamston	1.643000e+05	1.662000e+05
Arkansas	Decatur	6.566667e+04	6.673333e+04
Tennessee	Briceville	4.366667e+04	4.490000e+04
Indiana	Edgewood	9.293333e+04	9.490000e+04
Tennessee	Palmyra	NaN	NaN
Maryland	Saint Inigoes	1.572333e+05	1.633667e+05
Indiana	Marysville	NaN	NaN
California	Forest Falls	1.141667e+05	1.111333e+05
Missouri	Bois D Arc	1.071000e+05	1.081000e+05
Virginia	Henrico	1.322667e+05	1.332667e+05
New Jersey	Diamond Beach	1.889667e+05	1.931333e+05
Tennessee	Gruetli Laager	3.666667e+04	3.730000e+04
Wisconsin	Town of Wrightstown	1.113667e+05	1.148667e+05
New York	Urbana	9.170000e+04	9.836667e+04
Wisconsin	New Denmark	1.260667e+05	1.319667e+05
California	Angels	1.581000e+05	1.674667e+05
Wisconsin	Holland	1.532333e+05	1.558333e+05

		2001q1	2001q2 \
State	RegionName		
New York	New York	NaN	NaN
California	Los Angeles	2.330000e+05	2.391000e+05
Illinois	Chicago	1.569333e+05	1.618000e+05
Pennsylvania	Philadelphia	5.533333e+04	5.553333e+04
Arizona	Phoenix	1.196000e+05	1.215667e+05
Nevada	Las Vegas	1.395333e+05	1.417333e+05
California	San Diego	2.672000e+05	2.762667e+05
Texas	Dallas	8.973333e+04	8.930000e+04
California	San Jose	4.706667e+05	4.702000e+05
Florida	Jacksonville	9.440000e+04	9.560000e+04
California	San Francisco	4.940667e+05	4.961333e+05

Texas	Austin	1.612333e+05	1.607333e+05
Michigan	Detroit	6.750000e+04	6.836667e+04
Ohio	Columbus	9.940000e+04	1.002667e+05
Tennessee	Memphis	7.416667e+04	7.493333e+04
North Carolina	Charlotte	1.329333e+05	1.332000e+05
Texas	El Paso	7.823333e+04	7.830000e+04
Massachusetts	Boston	2.496000e+05	2.570667e+05
Washington	Seattle	2.710000e+05	2.724333e+05
Maryland	Baltimore	5.956667e+04	6.013333e+04
Colorado	Denver	1.865000e+05	1.925333e+05
District of Columbia	Washington	1.497667e+05	1.551333e+05
Tennessee	Nashville	1.180333e+05	1.191667e+05
Wisconsin	Milwaukee	8.403333e+04	8.556667e+04
Arizona	Tucson	1.072000e+05	1.087667e+05
Oregon	Portland	1.599000e+05	1.618000e+05
Oklahoma	Oklahoma City	7.983333e+04	8.040000e+04
Nebraska	Omaha	1.208667e+05	1.197667e+05
New Mexico	Albuquerque	1.271000e+05	1.277333e+05
California	Fresno	1.005667e+05	1.035667e+05
...		...	...
Texas	Granite Shoals	NaN	NaN
Maryland	Piney Point	1.634000e+05	1.648333e+05
Wisconsin	Maribel	NaN	NaN
Idaho	Middleton	1.061667e+05	1.083667e+05
Colorado	Bennett	1.483000e+05	1.521000e+05
New Hampshire	East Hampstead	1.909000e+05	1.950667e+05
Missouri	Garden City	NaN	NaN
Arkansas	Mountainburg	6.866667e+04	6.386667e+04
Wisconsin	Oostburg	1.191000e+05	1.204333e+05
California	Twin Peaks	1.040000e+05	1.076667e+05
New York	Upper Brookville	1.295167e+06	1.340033e+06
Hawaii	Volcano	1.181333e+05	1.194000e+05
South Carolina	Wedgefield	NaN	NaN
Michigan	Williamston	1.664333e+05	1.686333e+05
Arkansas	Decatur	6.720000e+04	6.770000e+04
Tennessee	Briceville	4.480000e+04	4.530000e+04
Indiana	Edgewood	9.893333e+04	1.000667e+05
Tennessee	Palmyra	NaN	NaN
Maryland	Saint Inigoes	1.642333e+05	1.682000e+05
Indiana	Marysville	NaN	NaN
California	Forest Falls	1.134333e+05	1.130000e+05
Missouri	Bois D Arc	1.107000e+05	1.136667e+05
Virginia	Henrico	1.352333e+05	1.367333e+05
New Jersey	Diamond Beach	1.944000e+05	2.102667e+05
Tennessee	Gruetli Laager	3.773333e+04	3.790000e+04
Wisconsin	Town of Wrightstown	1.259667e+05	1.299000e+05
New York	Urbana	9.486667e+04	9.853333e+04
Wisconsin	New Denmark	1.438000e+05	1.469667e+05

State	RegionName		
California	Angels	1.768333e+05	1.837667e+05
Wisconsin	Holland	1.618667e+05	1.657333e+05

		2001q3	2001q4 \
State	RegionName		
New York	New York	NaN	NaN
California	Los Angeles	2.450667e+05	2.530333e+05
Illinois	Chicago	1.664000e+05	1.704333e+05
Pennsylvania	Philadelphia	5.626667e+04	5.753333e+04
Arizona	Phoenix	1.227000e+05	1.243000e+05
Nevada	Las Vegas	1.433667e+05	1.461333e+05
California	San Diego	2.845000e+05	2.919333e+05
Texas	Dallas	8.906667e+04	9.090000e+04
California	San Jose	4.568000e+05	4.455667e+05
Florida	Jacksonville	9.706667e+04	9.906667e+04
California	San Francisco	5.041000e+05	5.134000e+05
Texas	Austin	1.595333e+05	1.600333e+05
Michigan	Detroit	6.926667e+04	6.996667e+04
Ohio	Columbus	1.010667e+05	1.022000e+05
Tennessee	Memphis	7.550000e+04	7.606667e+04
North Carolina	Charlotte	1.328000e+05	1.331000e+05
Texas	El Paso	7.743333e+04	7.680000e+04
Massachusetts	Boston	2.669333e+05	2.749667e+05
Washington	Seattle	2.741667e+05	2.781667e+05
Maryland	Baltimore	6.210000e+04	6.340000e+04
Colorado	Denver	1.964000e+05	1.991000e+05
District of Columbia	Washington	1.646333e+05	1.725333e+05
Tennessee	Nashville	1.201000e+05	1.208000e+05
Wisconsin	Milwaukee	8.706667e+04	8.840000e+04
Arizona	Tucson	1.105667e+05	1.128000e+05
Oregon	Portland	1.642667e+05	1.677667e+05
Oklahoma	Oklahoma City	8.113333e+04	8.173333e+04
Nebraska	Omaha	1.178667e+05	1.174000e+05
New Mexico	Albuquerque	1.285667e+05	1.299000e+05
California	Fresno	1.072333e+05	1.103000e+05
...	...	...	...
Texas	Granite Shoals	NaN	NaN
Maryland	Piney Point	1.647000e+05	1.679000e+05
Wisconsin	Maribel	NaN	NaN
Idaho	Middleton	1.110333e+05	1.112333e+05
Colorado	Bennett	1.542333e+05	1.562000e+05
New Hampshire	East Hampstead	1.992667e+05	2.074000e+05
Missouri	Garden City	NaN	NaN
Arkansas	Mountainburg	6.376667e+04	6.546667e+04
Wisconsin	Oostburg	1.203667e+05	1.196333e+05
California	Twin Peaks	1.098333e+05	1.111333e+05
New York	Upper Brookville	1.403667e+06	1.481933e+06
Hawaii	Volcano	1.232667e+05	1.211667e+05

State	RegionName		
South Carolina	Wedgefield	NaN	NaN
Michigan	Williamston	1.716667e+05	1.750333e+05
Arkansas	Decatur	6.650000e+04	6.540000e+04
Tennessee	Briceville	4.463333e+04	4.370000e+04
Indiana	Edgewood	1.008333e+05	1.010000e+05
Tennessee	Palmyra	NaN	NaN
Maryland	Saint Inigoes	1.665000e+05	1.653333e+05
Indiana	Marysville	NaN	NaN
California	Forest Falls	1.130333e+05	1.151667e+05
Missouri	Bois D Arc	1.126333e+05	1.127333e+05
Virginia	Henrico	1.386000e+05	1.413333e+05
New Jersey	Diamond Beach	2.302667e+05	2.486667e+05
Tennessee	Gruetli Laager	3.936667e+04	4.040000e+04
Wisconsin	Town of Wrightstown	1.299000e+05	1.294333e+05
New York	Urbana	1.029667e+05	9.803333e+04
Wisconsin	New Denmark	1.483667e+05	1.491667e+05
California	Angels	1.902333e+05	1.845667e+05
Wisconsin	Holland	1.680333e+05	1.674000e+05

		2002q1	2002q2 \
State	RegionName		
New York	New York	NaN	NaN
California	Los Angeles	2.619667e+05	2.727000e+05
Illinois	Chicago	1.755000e+05	1.775667e+05
Pennsylvania	Philadelphia	5.913333e+04	6.073333e+04
Arizona	Phoenix	1.265333e+05	1.283667e+05
Nevada	Las Vegas	1.493333e+05	1.509333e+05
California	San Diego	3.012333e+05	3.128667e+05
Texas	Dallas	9.256667e+04	9.380000e+04
California	San Jose	4.414333e+05	4.577667e+05
Florida	Jacksonville	1.012333e+05	1.034333e+05
California	San Francisco	5.204333e+05	5.381667e+05
Texas	Austin	1.589667e+05	1.575000e+05
Michigan	Detroit	7.100000e+04	7.233333e+04
Ohio	Columbus	1.034000e+05	1.048000e+05
Tennessee	Memphis	7.633333e+04	7.676667e+04
North Carolina	Charlotte	1.343667e+05	1.353667e+05
Texas	El Paso	7.660000e+04	7.640000e+04
Massachusetts	Boston	2.825000e+05	2.893000e+05
Washington	Seattle	2.805000e+05	2.846000e+05
Maryland	Baltimore	6.366667e+04	6.490000e+04
Colorado	Denver	2.012333e+05	2.024333e+05
District of Columbia	Washington	1.805000e+05	1.933000e+05
Tennessee	Nashville	1.215667e+05	1.226333e+05
Wisconsin	Milwaukee	8.953333e+04	9.136667e+04
Arizona	Tucson	1.150000e+05	1.172000e+05
Oregon	Portland	1.707667e+05	1.741333e+05
Oklahoma	Oklahoma City	8.260000e+04	8.343333e+04

State	RegionName		
Nebraska	Omaha	1.180667e+05	1.176333e+05
New Mexico	Albuquerque	1.310667e+05	1.321000e+05
California	Fresno	1.140333e+05	1.185333e+05
...		...	...
Texas	Granite Shoals	NaN	NaN
Maryland	Piney Point	1.782667e+05	1.812000e+05
Wisconsin	Maribel	NaN	NaN
Idaho	Middleton	1.141000e+05	1.141667e+05
Colorado	Bennett	1.587333e+05	1.606333e+05
New Hampshire	East Hampstead	2.123000e+05	2.122333e+05
Missouri	Garden City	NaN	NaN
Arkansas	Mountainburg	6.533333e+04	6.600000e+04
Wisconsin	Oostburg	1.198667e+05	1.185667e+05
California	Twin Peaks	1.132000e+05	1.166000e+05
New York	Upper Brookville	1.536167e+06	1.562033e+06
Hawaii	Volcano	1.233000e+05	1.169000e+05
South Carolina	Wedgefield	NaN	NaN
Michigan	Williamston	1.786667e+05	1.793333e+05
Arkansas	Decatur	6.460000e+04	6.490000e+04
Tennessee	Briceville	4.446667e+04	4.340000e+04
Indiana	Edgewood	1.021667e+05	1.017667e+05
Tennessee	Palmyra	NaN	NaN
Maryland	Saint Inigoes	1.673000e+05	1.688000e+05
Indiana	Marysville	NaN	NaN
California	Forest Falls	1.187000e+05	1.250667e+05
Missouri	Bois D Arc	1.130667e+05	1.154000e+05
Virginia	Henrico	1.435333e+05	1.461333e+05
New Jersey	Diamond Beach	2.599333e+05	2.656333e+05
Tennessee	Gruetli Laager	4.156667e+04	4.163333e+04
Wisconsin	Town of Wrightstown	1.319000e+05	1.342000e+05
New York	Urbana	9.396667e+04	9.460000e+04
Wisconsin	New Denmark	1.531333e+05	1.567333e+05
California	Angels	1.840333e+05	1.861333e+05
Wisconsin	Holland	1.657667e+05	1.619667e+05

		...	2014q2 \
State	RegionName	...	
New York	New York	...	5.154667e+05
California	Los Angeles	...	4.980333e+05
Illinois	Chicago	...	1.926333e+05
Pennsylvania	Philadelphia	...	1.137333e+05
Arizona	Phoenix	...	1.642667e+05
Nevada	Las Vegas	...	1.700667e+05
California	San Diego	...	4.802000e+05
Texas	Dallas	...	1.066333e+05
California	San Jose	...	6.794000e+05
Florida	Jacksonville	...	1.207667e+05
California	San Francisco	...	9.269333e+05

Texas	Austin	...	2.488667e+05
Michigan	Detroit	...	3.730000e+04
Ohio	Columbus	...	1.031333e+05
Tennessee	Memphis	...	6.810000e+04
North Carolina	Charlotte	...	1.494667e+05
Texas	El Paso	...	1.118000e+05
Massachusetts	Boston	...	4.266667e+05
Washington	Seattle	...	4.418000e+05
Maryland	Baltimore	...	1.092333e+05
Colorado	Denver	...	2.708667e+05
District of Columbia	Washington	...	4.469333e+05
Tennessee	Nashville	...	1.607000e+05
Wisconsin	Milwaukee	...	9.216667e+04
Arizona	Tucson	...	1.424667e+05
Oregon	Portland	...	2.822333e+05
Oklahoma	Oklahoma City	...	1.180333e+05
Nebraska	Omaha	...	1.301000e+05
New Mexico	Albuquerque	...	1.632667e+05
California	Fresno	...	1.696333e+05
...		...	...
Texas	Granite Shoals	...	1.169667e+05
Maryland	Piney Point	...	2.964000e+05
Wisconsin	Maribel	...	1.306000e+05
Idaho	Middleton	...	1.443667e+05
Colorado	Bennett	...	1.514667e+05
New Hampshire	East Hampstead	...	2.495000e+05
Missouri	Garden City	...	1.055000e+05
Arkansas	Mountainburg	...	8.160000e+04
Wisconsin	Oostburg	...	1.295667e+05
California	Twin Peaks	...	1.501000e+05
New York	Upper Brookville	...	1.780633e+06
Hawaii	Volcano	...	2.064667e+05
South Carolina	Wedgefield	...	7.436667e+04
Michigan	Williamston	...	1.657000e+05
Arkansas	Decatur	...	8.966667e+04
Tennessee	Briceville	...	5.623333e+04
Indiana	Edgewood	...	9.213333e+04
Tennessee	Palmyra	...	1.227667e+05
Maryland	Saint Inigoes	...	2.822333e+05
Indiana	Marysville	...	1.166000e+05
California	Forest Falls	...	1.653667e+05
Missouri	Bois D Arc	...	1.375667e+05
Virginia	Henrico	...	2.016333e+05
New Jersey	Diamond Beach	...	3.818000e+05
Tennessee	Gruetli Laager	...	5.556667e+04
Wisconsin	Town of Wrightstown	...	1.448667e+05
New York	Urbana	...	1.321333e+05
Wisconsin	New Denmark	...	1.745667e+05

| California | Angels | ... | 2.444667e+05 |
| Wisconsin | Holland | ... | 2.012667e+05 |

| | | 2014q3 | 2014q4 | \ |
State	RegionName			
New York	New York	5.228000e+05	5.280667e+05	
California	Los Angeles	5.090667e+05	5.188667e+05	
Illinois	Chicago	1.957667e+05	2.012667e+05	
Pennsylvania	Philadelphia	1.153000e+05	1.156667e+05	
Arizona	Phoenix	1.653667e+05	1.685000e+05	
Nevada	Las Vegas	1.734000e+05	1.754667e+05	
California	San Diego	4.890333e+05	4.964333e+05	
Texas	Dallas	1.089000e+05	1.115333e+05	
California	San Jose	6.970333e+05	7.149333e+05	
Florida	Jacksonville	1.217333e+05	1.231667e+05	
California	San Francisco	9.545333e+05	9.687667e+05	
Texas	Austin	2.528000e+05	2.581333e+05	
Michigan	Detroit	3.710000e+04	3.713333e+04	
Ohio	Columbus	1.045000e+05	1.064333e+05	
Tennessee	Memphis	6.910000e+04	7.116667e+04	
North Carolina	Charlotte	1.506333e+05	1.527333e+05	
Texas	El Paso	1.117333e+05	1.117667e+05	
Massachusetts	Boston	4.314333e+05	4.407333e+05	
Washington	Seattle	4.515000e+05	4.591667e+05	
Maryland	Baltimore	1.095333e+05	1.073667e+05	
Colorado	Denver	2.775000e+05	2.872333e+05	
District of Columbia	Washington	4.530000e+05	4.603000e+05	
Tennessee	Nashville	1.623000e+05	1.669000e+05	
Wisconsin	Milwaukee	9.216667e+04	9.196667e+04	
Arizona	Tucson	1.434333e+05	1.442333e+05	
Oregon	Portland	2.872667e+05	2.955333e+05	
Oklahoma	Oklahoma City	1.189667e+05	1.201000e+05	
Nebraska	Omaha	1.303000e+05	1.325000e+05	
New Mexico	Albuquerque	1.640000e+05	1.648000e+05	
California	Fresno	1.736000e+05	1.781333e+05	
...		...	...	
Texas	Granite Shoals	1.175333e+05	1.175333e+05	
Maryland	Piney Point	3.090000e+05	3.092333e+05	
Wisconsin	Maribel	1.289667e+05	1.296333e+05	
Idaho	Middleton	1.457000e+05	1.462333e+05	
Colorado	Bennett	1.620667e+05	1.714000e+05	
New Hampshire	East Hampstead	2.521000e+05	2.557333e+05	
Missouri	Garden City	1.043000e+05	1.047667e+05	
Arkansas	Mountainburg	8.506667e+04	8.846667e+04	
Wisconsin	Oostburg	1.279333e+05	1.274333e+05	
California	Twin Peaks	1.475333e+05	1.460667e+05	
New York	Upper Brookville	1.749233e+06	1.729467e+06	
Hawaii	Volcano	2.276333e+05	2.332000e+05	

State	RegionName		
South Carolina	Wedgefield	7.026667e+04	7.206667e+04
Michigan	Williamston	1.689333e+05	1.708667e+05
Arkansas	Decatur	9.256667e+04	9.470000e+04
Tennessee	Briceville	5.423333e+04	5.260000e+04
Indiana	Edgewood	9.406667e+04	9.466667e+04
Tennessee	Palmyra	1.269333e+05	1.262333e+05
Maryland	Saint Inigoes	2.884333e+05	2.869667e+05
Indiana	Marysville	1.151000e+05	1.165000e+05
California	Forest Falls	1.675000e+05	1.771000e+05
Missouri	Bois D Arc	1.375667e+05	1.404000e+05
Virginia	Henrico	2.040000e+05	2.059000e+05
New Jersey	Diamond Beach	3.878667e+05	3.876667e+05
Tennessee	Gruetli Laager	5.636667e+04	5.713333e+04
Wisconsin	Town of Wrightstown	1.468667e+05	1.492333e+05
New York	Urbana	1.370333e+05	1.400667e+05
Wisconsin	New Denmark	1.811667e+05	1.861667e+05
California	Angels	2.540667e+05	2.599333e+05
Wisconsin	Holland	2.015667e+05	2.012667e+05

		2015q1	2015q2 \
State	RegionName		
New York	New York	5.322667e+05	5.408000e+05
California	Los Angeles	5.288000e+05	5.381667e+05
Illinois	Chicago	2.010667e+05	2.060333e+05
Pennsylvania	Philadelphia	1.162000e+05	1.179667e+05
Arizona	Phoenix	1.715333e+05	1.741667e+05
Nevada	Las Vegas	1.775000e+05	1.816000e+05
California	San Diego	5.033667e+05	5.120667e+05
Texas	Dallas	1.137000e+05	1.211333e+05
California	San Jose	7.314333e+05	7.567333e+05
Florida	Jacksonville	1.241667e+05	1.269000e+05
California	San Francisco	1.000733e+06	1.060800e+06
Texas	Austin	2.665000e+05	2.750333e+05
Michigan	Detroit	3.620000e+04	3.583333e+04
Ohio	Columbus	1.078667e+05	1.094333e+05
Tennessee	Memphis	7.053333e+04	6.870000e+04
North Carolina	Charlotte	1.551667e+05	1.579000e+05
Texas	El Paso	1.115000e+05	1.113000e+05
Massachusetts	Boston	4.485000e+05	4.553667e+05
Washington	Seattle	4.679333e+05	4.933667e+05
Maryland	Baltimore	1.080667e+05	1.114333e+05
Colorado	Denver	2.976333e+05	3.103667e+05
District of Columbia	Washington	4.661667e+05	4.810667e+05
Tennessee	Nashville	1.714667e+05	1.762667e+05
Wisconsin	Milwaukee	9.333333e+04	9.410000e+04
Arizona	Tucson	1.441667e+05	1.451333e+05
Oregon	Portland	3.019333e+05	3.119000e+05
Oklahoma	Oklahoma City	1.208000e+05	1.223667e+05

State	RegionName		
Nebraska	Omaha	1.330667e+05	1.344667e+05
New Mexico	Albuquerque	1.651667e+05	1.659000e+05
California	Fresno	1.804667e+05	1.820333e+05
...		...	...
Texas	Granite Shoals	1.171667e+05	1.191000e+05
Maryland	Piney Point	3.095667e+05	3.017000e+05
Wisconsin	Maribel	1.312667e+05	1.301333e+05
Idaho	Middleton	1.461667e+05	1.477333e+05
Colorado	Bennett	1.780333e+05	1.844333e+05
New Hampshire	East Hampstead	2.587333e+05	2.613667e+05
Missouri	Garden City	1.060333e+05	9.606667e+04
Arkansas	Mountainburg	8.903333e+04	8.556667e+04
Wisconsin	Oostburg	1.270667e+05	1.274000e+05
California	Twin Peaks	1.435000e+05	1.523000e+05
New York	Upper Brookville	1.749867e+06	1.789600e+06
Hawaii	Volcano	2.346333e+05	2.323667e+05
South Carolina	Wedgefield	7.570000e+04	7.206667e+04
Michigan	Williamston	1.744333e+05	1.758667e+05
Arkansas	Decatur	9.350000e+04	9.490000e+04
Tennessee	Briceville	4.963333e+04	4.590000e+04
Indiana	Edgewood	9.586667e+04	9.433333e+04
Tennessee	Palmyra	1.223000e+05	1.204667e+05
Maryland	Saint Inigoes	2.847000e+05	2.807667e+05
Indiana	Marysville	1.118667e+05	1.118000e+05
California	Forest Falls	1.765333e+05	1.818000e+05
Missouri	Bois D Arc	1.450333e+05	1.475667e+05
Virginia	Henrico	2.065667e+05	2.104333e+05
New Jersey	Diamond Beach	3.931667e+05	3.980000e+05
Tennessee	Gruetli Laager	5.890000e+04	6.536667e+04
Wisconsin	Town of Wrightstown	1.486667e+05	1.493333e+05
New York	Urbana	1.417000e+05	1.378667e+05
Wisconsin	New Denmark	1.876000e+05	1.886667e+05
California	Angels	2.601000e+05	2.506333e+05
Wisconsin	Holland	2.060000e+05	2.076000e+05

		2015q3	2015q4 \
State	RegionName		
New York	New York	5.572000e+05	5.728333e+05
California	Los Angeles	5.472667e+05	5.577333e+05
Illinois	Chicago	2.083000e+05	2.079000e+05
Pennsylvania	Philadelphia	1.212333e+05	1.222000e+05
Arizona	Phoenix	1.790667e+05	1.838333e+05
Nevada	Las Vegas	1.867667e+05	1.906333e+05
California	San Diego	5.197667e+05	5.254667e+05
Texas	Dallas	1.285667e+05	1.346000e+05
California	San Jose	7.764000e+05	7.891333e+05
Florida	Jacksonville	1.301333e+05	1.320000e+05
California	San Francisco	1.095100e+06	1.105467e+06

Texas	Austin	2.816333e+05	2.872333e+05
Michigan	Detroit	3.706667e+04	3.836667e+04
Ohio	Columbus	1.115667e+05	1.150000e+05
Tennessee	Memphis	6.866667e+04	6.953333e+04
North Carolina	Charlotte	1.601667e+05	1.628667e+05
Texas	El Paso	1.110667e+05	1.102667e+05
Massachusetts	Boston	4.639667e+05	4.716333e+05
Washington	Seattle	5.142667e+05	5.334667e+05
Maryland	Baltimore	1.139667e+05	1.139000e+05
Colorado	Denver	3.205000e+05	3.301000e+05
District of Columbia	Washington	4.934000e+05	5.009000e+05
Tennessee	Nashville	1.818000e+05	1.892000e+05
Wisconsin	Milwaukee	9.413333e+04	9.456667e+04
Arizona	Tucson	1.466000e+05	1.481667e+05
Oregon	Portland	3.257333e+05	3.430667e+05
Oklahoma	Oklahoma City	1.247000e+05	1.271000e+05
Nebraska	Omaha	1.367333e+05	1.400667e+05
New Mexico	Albuquerque	1.665333e+05	1.673333e+05
California	Fresno	1.857000e+05	1.874667e+05
...		...	...
Texas	Granite Shoals	1.216000e+05	1.280000e+05
Maryland	Piney Point	3.052333e+05	3.099667e+05
Wisconsin	Maribel	1.297333e+05	1.293000e+05
Idaho	Middleton	1.482000e+05	1.511333e+05
Colorado	Bennett	1.916667e+05	1.958000e+05
New Hampshire	East Hampstead	2.616000e+05	2.688000e+05
Missouri	Garden City	9.930000e+04	1.034333e+05
Arkansas	Mountainburg	8.370000e+04	9.043333e+04
Wisconsin	Oostburg	1.303333e+05	1.320333e+05
California	Twin Peaks	1.552667e+05	1.591667e+05
New York	Upper Brookville	1.777267e+06	1.834367e+06
Hawaii	Volcano	2.249667e+05	2.324333e+05
South Carolina	Wedgefield	7.033333e+04	6.903333e+04
Michigan	Williamston	1.794667e+05	1.823000e+05
Arkansas	Decatur	9.543333e+04	9.700000e+04
Tennessee	Briceville	4.793333e+04	4.360000e+04
Indiana	Edgewood	9.663333e+04	9.996667e+04
Tennessee	Palmyra	1.198000e+05	1.258000e+05
Maryland	Saint Inigoes	2.778333e+05	2.768333e+05
Indiana	Marysville	1.156667e+05	1.201667e+05
California	Forest Falls	1.911667e+05	1.987333e+05
Missouri	Bois D Arc	1.463000e+05	1.494333e+05
Virginia	Henrico	2.121000e+05	2.139667e+05
New Jersey	Diamond Beach	3.992333e+05	4.004333e+05
Tennessee	Gruetli Laager	6.950000e+04	7.170000e+04
Wisconsin	Town of Wrightstown	1.498667e+05	1.499333e+05
New York	Urbana	1.364667e+05	1.361667e+05
Wisconsin	New Denmark	1.884333e+05	1.889333e+05

State	RegionName		
California	Angels	2.635000e+05	2.795000e+05
Wisconsin	Holland	2.128667e+05	2.178333e+05

		2016q1	2016q2 \
State	RegionName		
New York	New York	5.828667e+05	5.916333e+05
California	Los Angeles	5.660333e+05	5.774667e+05
Illinois	Chicago	2.060667e+05	2.082000e+05
Pennsylvania	Philadelphia	1.234333e+05	1.269333e+05
Arizona	Phoenix	1.879000e+05	1.914333e+05
Nevada	Las Vegas	1.946000e+05	1.972000e+05
California	San Diego	5.293333e+05	5.362333e+05
Texas	Dallas	1.405000e+05	1.446000e+05
California	San Jose	8.036000e+05	8.189333e+05
Florida	Jacksonville	1.339667e+05	1.372000e+05
California	San Francisco	1.121767e+06	1.119267e+06
Texas	Austin	2.935000e+05	3.014333e+05
Michigan	Detroit	3.796667e+04	3.746667e+04
Ohio	Columbus	1.167000e+05	1.182000e+05
Tennessee	Memphis	7.090000e+04	7.416667e+04
North Carolina	Charlotte	1.664667e+05	1.694333e+05
Texas	El Paso	1.106667e+05	1.114667e+05
Massachusetts	Boston	4.826000e+05	4.903667e+05
Washington	Seattle	5.517333e+05	5.755333e+05
Maryland	Baltimore	1.146667e+05	1.147333e+05
Colorado	Denver	3.355667e+05	3.427667e+05
District of Columbia	Washington	5.041000e+05	5.058000e+05
Tennessee	Nashville	1.950667e+05	2.003667e+05
Wisconsin	Milwaukee	9.466667e+04	9.636667e+04
Arizona	Tucson	1.495333e+05	1.511667e+05
Oregon	Portland	3.560000e+05	3.698000e+05
Oklahoma	Oklahoma City	1.279000e+05	1.293000e+05
Nebraska	Omaha	1.416333e+05	1.426667e+05
New Mexico	Albuquerque	1.691000e+05	1.706333e+05
California	Fresno	1.890333e+05	1.927333e+05
...		...	...
Texas	Granite Shoals	1.337667e+05	1.400667e+05
Maryland	Piney Point	3.195000e+05	3.241667e+05
Wisconsin	Maribel	1.278333e+05	1.292667e+05
Idaho	Middleton	1.539000e+05	1.571667e+05
Colorado	Bennett	1.997667e+05	2.074667e+05
New Hampshire	East Hampstead	2.725333e+05	2.778000e+05
Missouri	Garden City	1.062667e+05	1.116667e+05
Arkansas	Mountainburg	9.833333e+04	1.019000e+05
Wisconsin	Oostburg	1.327667e+05	1.341000e+05
California	Twin Peaks	1.641667e+05	1.679667e+05
New York	Upper Brookville	1.904500e+06	1.944067e+06
Hawaii	Volcano	2.420667e+05	2.489667e+05

State	RegionName		
South Carolina	Wedgefield	6.886667e+04	7.426667e+04
Michigan	Williamston	1.814667e+05	1.824000e+05
Arkansas	Decatur	9.650000e+04	9.663333e+04
Tennessee	Briceville	4.080000e+04	4.180000e+04
Indiana	Edgewood	9.943333e+04	9.996667e+04
Tennessee	Palmyra	1.276667e+05	1.328667e+05
Maryland	Saint Inigoes	2.793333e+05	2.826333e+05
Indiana	Marysville	1.282333e+05	1.232333e+05
California	Forest Falls	1.886333e+05	1.898667e+05
Missouri	Bois D Arc	1.468667e+05	1.437667e+05
Virginia	Henrico	2.160333e+05	2.162000e+05
New Jersey	Diamond Beach	4.045333e+05	4.039000e+05
Tennessee	Gruetli Laager	7.533333e+04	7.646667e+04
Wisconsin	Town of Wrightstown	1.498333e+05	1.512667e+05
New York	Urbana	1.389667e+05	1.442000e+05
Wisconsin	New Denmark	1.910667e+05	1.928333e+05
California	Angels	2.765333e+05	2.716000e+05
Wisconsin	Holland	2.219667e+05	2.280333e+05

State	RegionName	2016q3
New York	New York	587200.0
California	Los Angeles	584050.0
Illinois	Chicago	212000.0
Pennsylvania	Philadelphia	128700.0
Arizona	Phoenix	195200.0
Nevada	Las Vegas	199950.0
California	San Diego	539750.0
Texas	Dallas	149300.0
California	San Jose	822200.0
Florida	Jacksonville	139900.0
California	San Francisco	1106400.0
Texas	Austin	304450.0
Michigan	Detroit	37900.0
Ohio	Columbus	120100.0
Tennessee	Memphis	75900.0
North Carolina	Charlotte	172400.0
Texas	El Paso	112200.0
Massachusetts	Boston	501700.0
Washington	Seattle	589700.0
Maryland	Baltimore	115150.0
Colorado	Denver	351550.0
District of Columbia	Washington	516250.0
Tennessee	Nashville	206100.0
Wisconsin	Milwaukee	98850.0
Arizona	Tucson	152700.0
Oregon	Portland	387050.0
Oklahoma	Oklahoma City	130300.0

```
Nebraska            Omaha               143450.0
New Mexico          Albuquerque         171900.0
California          Fresno              196450.0
...                                          ...
Texas               Granite Shoals      146450.0
Maryland            Piney Point         324600.0
Wisconsin           Maribel             134200.0
Idaho               Middleton           160750.0
Colorado            Bennett             212600.0
New Hampshire       East Hampstead      282450.0
Missouri            Garden City         113600.0
Arkansas            Mountainburg        103400.0
Wisconsin           Oostburg            136350.0
California          Twin Peaks          173500.0
New York            Upper Brookville   1968800.0
Hawaii              Volcano             247850.0
South Carolina      Wedgefield           80700.0
Michigan            Williamston         183000.0
Arkansas            Decatur              96850.0
Tennessee           Briceville           40850.0
Indiana             Edgewood            100950.0
Tennessee           Palmyra             137750.0
Maryland            Saint Inigoes       281400.0
Indiana             Marysville          124200.0
California          Forest Falls        186650.0
Missouri            Bois D Arc          144000.0
Virginia            Henrico             220150.0
New Jersey          Diamond Beach       399000.0
Tennessee           Gruetli Laager       77500.0
Wisconsin           Town of Wrightstown 155000.0
New York            Urbana              143000.0
Wisconsin           New Denmark         197600.0
California          Angels              269950.0
Wisconsin           Holland             234950.0

[10730 rows x 67 columns]
```

In [10]: def run_ttest():
```
        '''First creates new data showing the decline or growth of housing prices
        between the recession start and the recession bottom. Then runs a ttest
        comparing the university town values to the non-university towns values,
        return whether the alternative hypothesis (that the two groups are the same)
        is true or not as well as the p-value of the confidence.

        Return the tuple (different, p, better) where different=True if the t-test is
        True at a p<0.01 (we reject the null hypothesis), or different=False if
        otherwise (we cannot reject the null hypothesis). The variable p should
        be equal to the exact p value returned from scipy.stats.ttest_ind(). The
```

```python
    value for better should be either "university town" or "non-university town"
    depending on which has a lower mean price ratio (which is equivilent to a
    reduced market loss).'''

    town_data = get_list_of_university_towns()
    recess_bottom = get_recession_bottom()
    recess_start = get_recession_start()
    house_data = convert_housing_data_to_quarters()
    bstart = house_data.columns[house_data.columns.get_loc(recess_start) -1]

    house_data['ratio'] = house_data[recess_bottom] - house_data[bstart]
    house_data = house_data[[recess_bottom,bstart,'ratio']]
    house_data = house_data.reset_index()
    town_data_house_data = pd.merge(house_data,town_data,how='inner',on=['State','Regio
    town_data_house_data['uni'] = True
    house_data2 = pd.merge(house_data,town_data_house_data,how='outer',on=['State','Reg
    house_data2['uni'] = house_data2['uni'].fillna(False)

    ut = house_data2[house_data2['uni'] == True]
    nut = house_data2[house_data2['uni'] == False]

    t,p = ttest_ind(ut['ratio'].dropna(),nut['ratio'].dropna())

    difference = True if p < 0.01 else False

    better = "non-university towns" if ut['ratio'].mean() < nut['ratio'].mean() else "u

    return difference, p, better

run_ttest()
```

```
Out[10]: (True, 0.002099659657952052, 'university towns')
```

```
In [ ]:
```