

Week 3

May 3, 2020

1 Merging Dataframes

```
In [1]: import pandas as pd
```

```
df = pd.DataFrame([{'Name': 'Chris', 'Item Purchased': 'Sponge', 'Cost': 22.50},
                    {'Name': 'Kevyn', 'Item Purchased': 'Kitty Litter', 'Cost': 2.50},
                    {'Name': 'Filip', 'Item Purchased': 'Spoon', 'Cost': 5.00}],
                    index=['Store 1', 'Store 1', 'Store 2'])

df
```

```
Out[1]:
```

	Cost	Item Purchased	Name
Store 1	22.5	Sponge	Chris
Store 1	2.5	Kitty Litter	Kevyn
Store 2	5.0	Spoon	Filip

```
In [2]: df['Date'] = ['December 1', 'January 1', 'mid-May']
df
```

```
Out[2]:
```

	Cost	Item Purchased	Name	Date
Store 1	22.5	Sponge	Chris	December 1
Store 1	2.5	Kitty Litter	Kevyn	January 1
Store 2	5.0	Spoon	Filip	mid-May

```
In [3]: df['Delivered'] = True
df
```

```
Out[3]:
```

	Cost	Item Purchased	Name	Date	Delivered
Store 1	22.5	Sponge	Chris	December 1	True
Store 1	2.5	Kitty Litter	Kevyn	January 1	True
Store 2	5.0	Spoon	Filip	mid-May	True

```
In [4]: df['Feedback'] = ['Positive', None, 'Negative']
df
```

```
Out[4]:
```

	Cost	Item Purchased	Name	Date	Delivered	Feedback
Store 1	22.5	Sponge	Chris	December 1	True	Positive
Store 1	2.5	Kitty Litter	Kevyn	January 1	True	None
Store 2	5.0	Spoon	Filip	mid-May	True	Negative

```
In [5]: adf = df.reset_index()
adf['Date'] = pd.Series({0: 'December 1', 2: 'mid-May'})
adf
```

```
Out[5]:
```

	index	Cost	Item Purchased	Name	Date Delivered	Feedback
0	Store 1	22.5	Sponge	Chris	December 1	True Positive
1	Store 1	2.5	Kitty Litter	Kevyn	NaN	True None
2	Store 2	5.0	Spoon	Filip	mid-May	True Negative

```
In [6]: staff_df = pd.DataFrame([{'Name': 'Kelly', 'Role': 'Director of HR'},
                                {'Name': 'Sally', 'Role': 'Course liasion'},
                                {'Name': 'James', 'Role': 'Grader'}])
staff_df = staff_df.set_index('Name')
student_df = pd.DataFrame([{'Name': 'James', 'School': 'Business'},
                            {'Name': 'Mike', 'School': 'Law'},
                            {'Name': 'Sally', 'School': 'Engineering'}])
student_df = student_df.set_index('Name')
print(staff_df.head())
print()
print(student_df.head())
```

	Role
Name	
Kelly	Director of HR
Sally	Course liasion
James	Grader

	School
Name	
James	Business
Mike	Law
Sally	Engineering

```
In [7]: pd.merge(staff_df, student_df, how='outer', left_index=True, right_index=True)
```

```
Out[7]:
```

	Role	School
Name		
James	Grader	Business
Kelly	Director of HR	NaN
Mike	NaN	Law
Sally	Course liasion	Engineering

```
In [8]: pd.merge(staff_df, student_df, how='inner', left_index=True, right_index=True)
```

```
Out[8]:
```

	Role	School
Name		
James	Grader	Business
Sally	Course liasion	Engineering

```
In [9]: pd.merge(staff_df, student_df, how='left', left_index=True, right_index=True)
```

```
Out[9]:
```

	Role	School
Name		
Kelly	Director of HR	NaN
Sally	Course liasion	Engineering
James	Grader	Business

```
In [10]: pd.merge(staff_df, student_df, how='right', left_index=True, right_index=True)
```

```
Out[10]:
```

	Role	School
Name		
James	Grader	Business
Mike	NaN	Law
Sally	Course liasion	Engineering

```
In [11]: staff_df = staff_df.reset_index()
student_df = student_df.reset_index()
pd.merge(staff_df, student_df, how='left', left_on='Name', right_on='Name')
```

```
Out[11]:
```

	Name	Role	School
0	Kelly	Director of HR	NaN
1	Sally	Course liasion	Engineering
2	James	Grader	Business

```
In [12]: staff_df = pd.DataFrame([{'Name': 'Kelly', 'Role': 'Director of HR', 'Location': 'State Street'},
                                   {'Name': 'Sally', 'Role': 'Course liasion', 'Location': 'Washington Avenue'},
                                   {'Name': 'James', 'Role': 'Grader', 'Location': 'Washington Avenue'}])
student_df = pd.DataFrame([{'Name': 'James', 'School': 'Business', 'Location': '1024 Billiard Avenue'},
                             {'Name': 'Mike', 'School': 'Law', 'Location': 'Fraternity House'},
                             {'Name': 'Sally', 'School': 'Engineering', 'Location': '512 Wilson Crescent'}])
pd.merge(staff_df, student_df, how='left', left_on='Name', right_on='Name')
```

```
Out[12]:
```

	Location_x	Name	Role	Location_y	School
0	State Street	Kelly	Director of HR	NaN	NaN
1	Washington Avenue	Sally	Course liasion	512 Wilson Crescent	Engineering
2	Washington Avenue	James	Grader	1024 Billiard Avenue	Business

```
In [13]: staff_df = pd.DataFrame([{'First Name': 'Kelly', 'Last Name': 'Desjardins', 'Role': 'Director of HR', 'Location': 'State Street'},
                                   {'First Name': 'Sally', 'Last Name': 'Brooks', 'Role': 'Course liasion', 'Location': 'Washington Avenue'},
                                   {'First Name': 'James', 'Last Name': 'Wilde', 'Role': 'Grader', 'Location': 'Washington Avenue'}])
student_df = pd.DataFrame([{'First Name': 'James', 'Last Name': 'Hammond', 'School': 'Business', 'Location': '1024 Billiard Avenue'},
                             {'First Name': 'Mike', 'Last Name': 'Smith', 'School': 'Law', 'Location': 'Fraternity House'},
                             {'First Name': 'Sally', 'Last Name': 'Brooks', 'School': 'Engineering', 'Location': '512 Wilson Crescent'}])

staff_df
student_df
pd.merge(staff_df, student_df, how='inner', left_on=['First Name', 'Last Name'], right_on=['First Name', 'Last Name'])
```

```
Out[13]:
```

	First Name	Last Name	Role	School
0	Sally	Brooks	Course liasion	Engineering

2 Idiomatic Pandas: Making Code Pandorable

```
In [14]: import pandas as pd
         df = pd.read_csv('census.csv')
         df
```

```
Out[14]:
```

	SUMLEV	REGION	DIVISION	STATE	COUNTY	STNAME	CTYNAME \
0	40	3	6	1	0	Alabama	Alabama
1	50	3	6	1	1	Alabama	Autauga County
2	50	3	6	1	3	Alabama	Baldwin County
3	50	3	6	1	5	Alabama	Barbour County
4	50	3	6	1	7	Alabama	Bibb County
5	50	3	6	1	9	Alabama	Blount County
6	50	3	6	1	11	Alabama	Bullock County
7	50	3	6	1	13	Alabama	Butler County
8	50	3	6	1	15	Alabama	Calhoun County
9	50	3	6	1	17	Alabama	Chambers County
10	50	3	6	1	19	Alabama	Cherokee County
11	50	3	6	1	21	Alabama	Chilton County
12	50	3	6	1	23	Alabama	Choctaw County
13	50	3	6	1	25	Alabama	Clarke County
14	50	3	6	1	27	Alabama	Clay County
15	50	3	6	1	29	Alabama	Cleburne County
16	50	3	6	1	31	Alabama	Coffee County
17	50	3	6	1	33	Alabama	Colbert County
18	50	3	6	1	35	Alabama	Conecuh County
19	50	3	6	1	37	Alabama	Coosa County
20	50	3	6	1	39	Alabama	Covington County
21	50	3	6	1	41	Alabama	Crenshaw County
22	50	3	6	1	43	Alabama	Cullman County
23	50	3	6	1	45	Alabama	Dale County
24	50	3	6	1	47	Alabama	Dallas County
25	50	3	6	1	49	Alabama	DeKalb County
26	50	3	6	1	51	Alabama	Elmore County
27	50	3	6	1	53	Alabama	Escambia County
28	50	3	6	1	55	Alabama	Etowah County
29	50	3	6	1	57	Alabama	Fayette County
...
3163	50	2	3	55	131	Wisconsin	Washington County
3164	50	2	3	55	133	Wisconsin	Waukesha County
3165	50	2	3	55	135	Wisconsin	Waupaca County
3166	50	2	3	55	137	Wisconsin	Waushara County
3167	50	2	3	55	139	Wisconsin	Winnebago County
3168	50	2	3	55	141	Wisconsin	Wood County
3169	40	4	8	56	0	Wyoming	Wyoming
3170	50	4	8	56	1	Wyoming	Albany County
3171	50	4	8	56	3	Wyoming	Big Horn County
3172	50	4	8	56	5	Wyoming	Campbell County

3173	50	4	8	56	7	Wyoming	Carbon County
3174	50	4	8	56	9	Wyoming	Converse County
3175	50	4	8	56	11	Wyoming	Crook County
3176	50	4	8	56	13	Wyoming	Fremont County
3177	50	4	8	56	15	Wyoming	Goshen County
3178	50	4	8	56	17	Wyoming	Hot Springs County
3179	50	4	8	56	19	Wyoming	Johnson County
3180	50	4	8	56	21	Wyoming	Laramie County
3181	50	4	8	56	23	Wyoming	Lincoln County
3182	50	4	8	56	25	Wyoming	Natrona County
3183	50	4	8	56	27	Wyoming	Niobrara County
3184	50	4	8	56	29	Wyoming	Park County
3185	50	4	8	56	31	Wyoming	Platte County
3186	50	4	8	56	33	Wyoming	Sheridan County
3187	50	4	8	56	35	Wyoming	Sublette County
3188	50	4	8	56	37	Wyoming	Sweetwater County
3189	50	4	8	56	39	Wyoming	Teton County
3190	50	4	8	56	41	Wyoming	Uinta County
3191	50	4	8	56	43	Wyoming	Washakie County
3192	50	4	8	56	45	Wyoming	Weston County

	CENSUS2010POP	ESTIMATESBASE2010	POPESTIMATE2010	...	\
0	4779736	4780127	4785161	...	
1	54571	54571	54660	...	
2	182265	182265	183193	...	
3	27457	27457	27341	...	
4	22915	22919	22861	...	
5	57322	57322	57373	...	
6	10914	10915	10887	...	
7	20947	20946	20944	...	
8	118572	118586	118437	...	
9	34215	34170	34098	...	
10	25989	25986	25976	...	
11	43643	43631	43665	...	
12	13859	13858	13841	...	
13	25833	25840	25767	...	
14	13932	13932	13880	...	
15	14972	14972	14973	...	
16	49948	49948	50177	...	
17	54428	54428	54514	...	
18	13228	13228	13208	...	
19	11539	11758	11758	...	
20	37765	37765	37796	...	
21	13906	13906	13853	...	
22	80406	80410	80473	...	
23	50251	50251	50358	...	
24	43820	43820	43803	...	
25	71109	71115	71142	...	

26	79303	79296	79465	...
27	38319	38319	38309	...
28	104430	104427	104442	...
29	17241	17241	17231	...
...
3163	131887	131885	131967	...
3164	389891	389938	390076	...
3165	52410	52410	52422	...
3166	24496	24496	24506	...
3167	166994	166994	167059	...
3168	74749	74749	74807	...
3169	563626	563767	564516	...
3170	36299	36299	36428	...
3171	11668	11668	11672	...
3172	46133	46133	46244	...
3173	15885	15885	15837	...
3174	13833	13833	13826	...
3175	7083	7083	7114	...
3176	40123	40123	40222	...
3177	13249	13247	13408	...
3178	4812	4812	4813	...
3179	8569	8569	8581	...
3180	91738	91881	92271	...
3181	18106	18106	18091	...
3182	75450	75450	75472	...
3183	2484	2484	2492	...
3184	28205	28205	28259	...
3185	8667	8667	8678	...
3186	29116	29116	29146	...
3187	10247	10247	10244	...
3188	43806	43806	43593	...
3189	21294	21294	21297	...
3190	21118	21118	21102	...
3191	8533	8533	8545	...
3192	7208	7208	7181	...

	RDOMESTICMIG2011	RDOMESTICMIG2012	RDOMESTICMIG2013	RDOMESTICMIG2014 \
0	0.002295	-0.193196	0.381066	0.582002
1	7.242091	-2.915927	-3.012349	2.265971
2	14.832960	17.647293	21.845705	19.243287
3	-4.728132	-2.500690	-7.056824	-3.904217
4	-5.527043	-5.068871	-6.201001	-0.177537
5	1.807375	-1.177622	-1.748766	-2.062535
6	-30.953709	-5.180127	-1.130263	14.354290
7	-14.032727	-11.684234	-5.655413	1.085428
8	-6.155670	-4.611706	-5.524649	-4.463211
9	-2.731639	3.849092	2.872721	-2.287222
10	6.339327	1.113180	5.488706	-0.076806

11	-1.372935	-2.653369	0.480044	0.456017
12	-15.455274	-0.737028	-8.766391	-1.274984
13	-6.194363	-17.667705	-0.318345	-8.686428
14	-10.744102	-13.345130	4.902871	5.702648
15	-3.673524	-5.151880	7.345821	3.654485
16	0.377640	7.675579	-13.146535	-3.602859
17	-0.073423	1.065051	1.762390	1.835688
18	-4.861559	-7.504690	-6.107224	-14.645416
19	-33.930581	-10.291443	-4.313831	-22.958017
20	6.696899	-4.612668	0.740271	3.697932
21	1.729792	3.950156	-1.864936	3.084648
22	-1.404233	-1.019628	4.071247	5.087142
23	-10.749798	-5.277150	-15.236079	-11.979785
24	-15.635599	-11.308243	-16.745678	-9.344789
25	0.294677	-9.302391	-1.748807	0.267830
26	3.235576	0.822717	1.760531	-1.507057
27	-3.449988	-3.855889	-4.822706	-1.189831
28	-1.015919	2.062637	-1.931884	-1.726932
29	-5.015601	-0.646640	-3.725937	0.296745
...
3163	-0.794876	0.785279	-2.215465	1.601149
3164	-0.765799	2.128860	0.038132	0.760109
3165	3.111756	-2.241873	6.292687	-0.441031
3166	4.930022	-2.404973	-4.097017	-4.906711
3167	0.316712	2.889873	0.833819	-2.406192
3168	-4.081523	-5.019090	-6.901200	-5.596471
3169	-0.381530	9.636214	4.487115	-4.788275
3170	3.708956	2.637812	-3.544634	-3.334877
3171	4.868258	2.804930	16.815908	-8.026420
3172	-2.843479	15.601020	-5.895711	-8.550911
3173	-7.581980	-13.081441	3.178134	-2.970641
3174	-12.847499	15.493820	19.035533	-20.550587
3175	-1.544618	-4.202564	1.397819	6.378258
3176	2.747083	7.782673	-4.990688	-12.331633
3177	14.293649	3.961413	-8.079028	-7.017803
3178	3.322604	6.208609	3.095336	-6.017222
3179	4.995063	-4.058912	-0.812583	-10.715742
3180	-1.200428	15.547274	4.787847	-1.226133
3181	-9.802564	-11.566801	13.564556	6.125989
3182	7.189319	23.066162	24.322042	-0.958472
3183	-0.401849	0.806452	29.066295	-12.603387
3184	4.582951	8.057765	7.641997	-9.252437
3185	4.373094	5.392073	2.634593	6.055759
3186	0.958559	8.425487	4.546373	3.678069
3187	-23.741784	15.272374	-40.870074	-16.596273
3188	1.072643	16.243199	-5.339774	-14.252889
3189	-1.589565	0.972695	19.525929	14.143021
3190	-17.755986	-4.916350	-6.902954	-14.215862

3191	-11.637475	-0.827815	-2.013502	-17.781491
3192	-11.752361	-8.040059	12.372583	1.533635

	RDOMESTICMIG2015	RNETMIG2011	RNETMIG2012	RNETMIG2013	RNETMIG2014 \
0	-0.467369	1.030015	0.826644	1.383282	1.724718
1	-2.530799	7.606016	-2.626146	-2.722002	2.592270
2	17.197872	15.844176	18.559627	22.727626	20.317142
3	-10.543299	-4.874741	-2.758113	-7.167664	-3.978583
4	0.177258	-5.088389	-4.363636	-5.403729	0.754533
5	-1.369970	1.859511	-0.848580	-1.402476	-1.577232
6	-16.167247	-29.001673	-2.825524	1.507017	17.243790
7	-6.529805	-13.936612	-11.586865	-5.557058	1.184103
8	-3.376322	-5.791579	-4.092677	-5.062836	-3.912834
9	1.349468	-1.821092	4.701181	3.781439	-1.290228
10	-3.239866	6.416167	1.420264	5.757384	0.230419
11	-2.253483	-0.823761	-2.447504	0.868651	0.957636
12	-5.291205	-15.528177	-0.737028	-8.766391	-1.274984
13	-5.613667	-6.077488	-17.509958	-0.159172	-8.486280
14	3.912450	-10.816697	-13.345130	4.977157	5.776708
15	-3.123961	-3.673524	-5.151880	7.345821	3.654485
16	2.214774	2.166460	11.513368	-10.438741	-0.767822
17	-0.110260	0.513964	1.469035	2.276420	2.533249
18	2.684140	-4.861559	-7.504690	-6.107224	-14.645416
19	-5.387581	-34.017138	-10.380162	-4.403703	-23.049483
20	-0.316945	6.881460	-4.559952	0.793147	3.750759
21	3.439504	2.666763	5.099293	-0.502098	4.734577
22	7.915406	-1.031427	-0.634159	4.542916	5.593387
23	-5.107706	-9.575283	-0.776637	-12.640155	-9.503292
24	-14.687232	-15.727573	-11.378047	-16.792849	-9.368689
25	0.028141	1.375159	-8.656001	-1.029539	1.198187
26	2.067820	3.674511	1.558176	2.306047	-0.951175
27	1.190902	-3.397716	-3.803428	-4.769999	-1.136950
28	-2.082234	-0.632554	2.446383	-1.518596	-1.234901
29	-2.797536	-5.132243	-0.705426	-3.785079	0.237396
...
3163	-0.434498	-0.431504	1.162817	-1.763330	2.104796
3164	-0.719858	0.102448	3.180527	1.189727	2.077633
3165	-0.480617	3.359933	-2.011937	6.561277	-0.134227
3166	-4.397793	5.174486	-2.160399	-3.810226	-4.535615
3167	-4.557985	0.842573	3.502335	1.531624	-1.545153
3168	-3.958322	-3.733590	-4.562809	-6.442917	-5.040889
3169	-3.221091	0.289680	10.694870	5.440390	-3.727831
3170	-9.911169	6.736119	6.433032	0.719587	1.429233
3171	5.095861	4.868258	3.144921	17.236306	-7.608378
3172	10.916963	-2.649606	15.558684	-5.916543	-8.509402
3173	-23.300971	-7.392431	-12.636926	3.623073	-2.338590
3174	-0.070403	-12.774915	16.502720	20.093063	-19.358233
3175	18.629317	-0.982939	-3.642222	2.096729	7.071547

3176	-13.673610	3.093562	8.027411	-4.747240	-12.013555
3177	-11.899450	14.886132	4.841727	-6.903896	-5.761986
3178	-5.454164	5.191569	6.001656	2.888981	-6.224712
3179	0.933652	5.227392	-4.058912	-0.812583	-10.715742
3180	0.278940	-0.973320	17.914554	6.003143	-0.207819
3181	1.555544	-9.691801	-11.566801	13.619696	6.234414
3182	-0.061057	7.689674	23.749508	25.085233	-0.110593
3183	7.492114	-0.401849	0.806452	29.066295	-12.603387
3184	-2.878980	6.486639	11.127389	10.877797	-5.585731
3185	4.662270	4.373094	4.933173	2.176403	5.598720
3186	-3.298406	2.122524	9.342778	5.523001	4.781489
3187	-22.870900	-21.092907	16.828794	-39.211861	-14.409938
3188	-14.248864	1.255221	16.243199	-5.295460	-14.075283
3189	-0.564849	0.654527	2.408578	21.160658	16.308671
3190	-12.127022	-18.136812	-5.536861	-7.521840	-14.740608
3191	1.682288	-11.990126	-1.182592	-2.250385	-18.020168
3192	6.935294	-12.032179	-8.040059	12.372583	1.533635

RNETMIG2015

0	0.712594
1	-2.187333
2	18.293499
3	-10.543299
4	1.107861
5	-0.884411
6	-13.193961
7	-6.430868
8	-2.806406
9	2.346901
10	-2.931307
11	-1.752709
12	-5.291205
13	-5.411736
14	3.986270
15	-3.123961
16	5.350738
17	0.588052
18	2.684140
19	-5.387581
20	-0.264121
21	5.087600
22	8.417777
23	-1.998668
24	-14.711389
25	0.956790
26	2.757093
27	1.243830
28	-1.588308

```

29      -2.857058
...
3163     0.059931
3164     0.593567
3165    -0.173022
3166    -4.024395
3167    -3.685304
3168    -3.414223
3169    -2.091573
3170    -5.166460
3171     5.513554
3172    10.978525
3173   -22.600668
3174     1.126443
3175    19.309219
3176   -13.352750
3177   -10.635133
3178    -5.663940
3179     0.933652
3180     1.673640
3181     1.662823
3182     0.793743
3183     7.492114
3184     0.856839
3185     4.207414
3186    -2.198937
3187   -20.664059
3188   -14.070195
3189     1.520747
3190   -12.606351
3191     1.441961
3192     6.935294

```

```
[3193 rows x 100 columns]
```

```

In [15]: (df.where(df['SUMLEV']==50)
         .dropna()
         .set_index(['STNAME','CTYNAME'])
         .rename(columns={'ESTIMATESBASE2010': 'Estimates Base 2010'}))

```

```

Out[15]:

```

		SUMLEV	REGION	DIVISION	STATE	COUNTY	\
STNAME	CTYNAME						
Alabama	Autauga County	50.0	3.0	6.0	1.0	1.0	
	Baldwin County	50.0	3.0	6.0	1.0	3.0	
	Barbour County	50.0	3.0	6.0	1.0	5.0	
	Bibb County	50.0	3.0	6.0	1.0	7.0	
	Blount County	50.0	3.0	6.0	1.0	9.0	
	Bullock County	50.0	3.0	6.0	1.0	11.0	

	Butler County	50.0	3.0	6.0	1.0	13.0
	Calhoun County	50.0	3.0	6.0	1.0	15.0
	Chambers County	50.0	3.0	6.0	1.0	17.0
	Cherokee County	50.0	3.0	6.0	1.0	19.0
	Chilton County	50.0	3.0	6.0	1.0	21.0
	Choctaw County	50.0	3.0	6.0	1.0	23.0
	Clarke County	50.0	3.0	6.0	1.0	25.0
	Clay County	50.0	3.0	6.0	1.0	27.0
	Cleburne County	50.0	3.0	6.0	1.0	29.0
	Coffee County	50.0	3.0	6.0	1.0	31.0
	Colbert County	50.0	3.0	6.0	1.0	33.0
	Conecuh County	50.0	3.0	6.0	1.0	35.0
	Coosa County	50.0	3.0	6.0	1.0	37.0
	Covington County	50.0	3.0	6.0	1.0	39.0
	Crenshaw County	50.0	3.0	6.0	1.0	41.0
	Cullman County	50.0	3.0	6.0	1.0	43.0
	Dale County	50.0	3.0	6.0	1.0	45.0
	Dallas County	50.0	3.0	6.0	1.0	47.0
	DeKalb County	50.0	3.0	6.0	1.0	49.0
	Elmore County	50.0	3.0	6.0	1.0	51.0
	Escambia County	50.0	3.0	6.0	1.0	53.0
	Etowah County	50.0	3.0	6.0	1.0	55.0
	Fayette County	50.0	3.0	6.0	1.0	57.0
	Franklin County	50.0	3.0	6.0	1.0	59.0
...
Wisconsin	Washburn County	50.0	2.0	3.0	55.0	129.0
	Washington County	50.0	2.0	3.0	55.0	131.0
	Waukesha County	50.0	2.0	3.0	55.0	133.0
	Waupaca County	50.0	2.0	3.0	55.0	135.0
	Waushara County	50.0	2.0	3.0	55.0	137.0
	Winnebago County	50.0	2.0	3.0	55.0	139.0
	Wood County	50.0	2.0	3.0	55.0	141.0
Wyoming	Albany County	50.0	4.0	8.0	56.0	1.0
	Big Horn County	50.0	4.0	8.0	56.0	3.0
	Campbell County	50.0	4.0	8.0	56.0	5.0
	Carbon County	50.0	4.0	8.0	56.0	7.0
	Converse County	50.0	4.0	8.0	56.0	9.0
	Crook County	50.0	4.0	8.0	56.0	11.0
	Fremont County	50.0	4.0	8.0	56.0	13.0
	Goshen County	50.0	4.0	8.0	56.0	15.0
	Hot Springs County	50.0	4.0	8.0	56.0	17.0
	Johnson County	50.0	4.0	8.0	56.0	19.0
	Laramie County	50.0	4.0	8.0	56.0	21.0
	Lincoln County	50.0	4.0	8.0	56.0	23.0
	Natrona County	50.0	4.0	8.0	56.0	25.0
	Niobrara County	50.0	4.0	8.0	56.0	27.0
	Park County	50.0	4.0	8.0	56.0	29.0
	Platte County	50.0	4.0	8.0	56.0	31.0

Sheridan County	50.0	4.0	8.0	56.0	33.0
Sublette County	50.0	4.0	8.0	56.0	35.0
Sweetwater County	50.0	4.0	8.0	56.0	37.0
Teton County	50.0	4.0	8.0	56.0	39.0
Uinta County	50.0	4.0	8.0	56.0	41.0
Washakie County	50.0	4.0	8.0	56.0	43.0
Weston County	50.0	4.0	8.0	56.0	45.0

STNAME	CTYNAME	CENSUS2010POP	Estimates Base 2010 \
Alabama	Autauga County	54571.0	54571.0
	Baldwin County	182265.0	182265.0
	Barbour County	27457.0	27457.0
	Bibb County	22915.0	22919.0
	Blount County	57322.0	57322.0
	Bullock County	10914.0	10915.0
	Butler County	20947.0	20946.0
	Calhoun County	118572.0	118586.0
	Chambers County	34215.0	34170.0
	Cherokee County	25989.0	25986.0
	Chilton County	43643.0	43631.0
	Choctaw County	13859.0	13858.0
	Clarke County	25833.0	25840.0
	Clay County	13932.0	13932.0
	Cleburne County	14972.0	14972.0
	Coffee County	49948.0	49948.0
	Colbert County	54428.0	54428.0
	Conecuh County	13228.0	13228.0
	Coosa County	11539.0	11758.0
	Covington County	37765.0	37765.0
	Crenshaw County	13906.0	13906.0
	Cullman County	80406.0	80410.0
	Dale County	50251.0	50251.0
	Dallas County	43820.0	43820.0
	DeKalb County	71109.0	71115.0
	Elmore County	79303.0	79296.0
	Escambia County	38319.0	38319.0
	Etowah County	104430.0	104427.0
	Fayette County	17241.0	17241.0
	Franklin County	31704.0	31709.0
...
Wisconsin	Washburn County	15911.0	15911.0
	Washington County	131887.0	131885.0
	Waukesha County	389891.0	389938.0
	Waupaca County	52410.0	52410.0
	Waushara County	24496.0	24496.0
	Winnebago County	166994.0	166994.0
	Wood County	74749.0	74749.0

Wyoming	Albany County	36299.0	36299.0
	Big Horn County	11668.0	11668.0
	Campbell County	46133.0	46133.0
	Carbon County	15885.0	15885.0
	Converse County	13833.0	13833.0
	Crook County	7083.0	7083.0
	Fremont County	40123.0	40123.0
	Goshen County	13249.0	13247.0
	Hot Springs County	4812.0	4812.0
	Johnson County	8569.0	8569.0
	Laramie County	91738.0	91881.0
	Lincoln County	18106.0	18106.0
	Natrona County	75450.0	75450.0
	Niobrara County	2484.0	2484.0
	Park County	28205.0	28205.0
	Platte County	8667.0	8667.0
	Sheridan County	29116.0	29116.0
	Sublette County	10247.0	10247.0
	Sweetwater County	43806.0	43806.0
	Teton County	21294.0	21294.0
	Uinta County	21118.0	21118.0
	Washakie County	8533.0	8533.0
	Weston County	7208.0	7208.0

STNAME	CTYNAME	POPESTIMATE2010	POPESTIMATE2011 \
Alabama	Autauga County	54660.0	55253.0
	Baldwin County	183193.0	186659.0
	Barbour County	27341.0	27226.0
	Bibb County	22861.0	22733.0
	Blount County	57373.0	57711.0
	Bullock County	10887.0	10629.0
	Butler County	20944.0	20673.0
	Calhoun County	118437.0	117768.0
	Chambers County	34098.0	33993.0
	Cherokee County	25976.0	26080.0
	Chilton County	43665.0	43739.0
	Choctaw County	13841.0	13593.0
	Clarke County	25767.0	25570.0
	Clay County	13880.0	13670.0
	Cleburne County	14973.0	14971.0
	Coffee County	50177.0	50448.0
	Colbert County	54514.0	54443.0
	Conecuh County	13208.0	13121.0
	Coosa County	11758.0	11348.0
	Covington County	37796.0	38060.0
	Crenshaw County	13853.0	13896.0
	Cullman County	80473.0	80469.0

	Dale County	50358.0	50109.0
	Dallas County	43803.0	43178.0
	DeKalb County	71142.0	71387.0
	Elmore County	79465.0	80012.0
	Escambia County	38309.0	38213.0
	Etowah County	104442.0	104236.0
	Fayette County	17231.0	17062.0
	Franklin County	31734.0	31729.0
...	
Wisconsin	Washburn County	15930.0	15784.0
	Washington County	131967.0	132225.0
	Waukesha County	390076.0	390808.0
	Waupaca County	52422.0	52342.0
	Waushara County	24506.0	24581.0
	Winnebago County	167059.0	167630.0
	Wood County	74807.0	74647.0
Wyoming	Albany County	36428.0	36908.0
	Big Horn County	11672.0	11745.0
	Campbell County	46244.0	46600.0
	Carbon County	15837.0	15817.0
	Converse County	13826.0	13728.0
	Crook County	7114.0	7129.0
	Fremont County	40222.0	40591.0
	Goshen County	13408.0	13597.0
	Hot Springs County	4813.0	4818.0
	Johnson County	8581.0	8636.0
	Laramie County	92271.0	92663.0
	Lincoln County	18091.0	18022.0
	Natrona County	75472.0	76420.0
	Niobrara County	2492.0	2485.0
	Park County	28259.0	28473.0
	Platte County	8678.0	8701.0
	Sheridan County	29146.0	29275.0
	Sublette County	10244.0	10142.0
	Sweetwater County	43593.0	44041.0
	Teton County	21297.0	21482.0
	Uinta County	21102.0	20912.0
	Washakie County	8545.0	8469.0
	Weston County	7181.0	7114.0

STNAME	CTYNAME	POPESTIMATE2012	...	RDOMESTICMIG2011 \
Alabama	Autauga County	55175.0	...	7.242091
	Baldwin County	190396.0	...	14.832960
	Barbour County	27159.0	...	-4.728132
	Bibb County	22642.0	...	-5.527043
	Blount County	57776.0	...	1.807375
	Bullock County	10606.0	...	-30.953709

	Butler County	20408.0	...	-14.032727
	Calhoun County	117286.0	...	-6.155670
	Chambers County	34075.0	...	-2.731639
	Cherokee County	26023.0	...	6.339327
	Chilton County	43697.0	...	-1.372935
	Choctaw County	13543.0	...	-15.455274
	Clarke County	25144.0	...	-6.194363
	Clay County	13456.0	...	-10.744102
	Cleburne County	14921.0	...	-3.673524
	Coffee County	51173.0	...	0.377640
	Colbert County	54472.0	...	-0.073423
	Conecuh County	12996.0	...	-4.861559
	Coosa County	11195.0	...	-33.930581
	Covington County	37818.0	...	6.696899
	Crenshaw County	13951.0	...	1.729792
	Cullman County	80374.0	...	-1.404233
	Dale County	50324.0	...	-10.749798
	Dallas County	42777.0	...	-15.635599
	DeKalb County	70942.0	...	0.294677
	Elmore County	80432.0	...	3.235576
	Escambia County	38034.0	...	-3.449988
	Etowah County	104235.0	...	-1.015919
	Fayette County	16960.0	...	-5.015601
	Franklin County	31648.0	...	-1.638750
...
Wisconsin	Washburn County	15831.0	...	-6.873936
	Washington County	132649.0	...	-0.794876
	Waukesha County	392710.0	...	-0.765799
	Waupaca County	52035.0	...	3.111756
	Waushara County	24484.0	...	4.930022
	Winnebago County	168717.0	...	0.316712
	Wood County	74384.0	...	-4.081523
Wyoming	Albany County	37396.0	...	3.708956
	Big Horn County	11785.0	...	4.868258
	Campbell County	47881.0	...	-2.843479
	Carbon County	15678.0	...	-7.581980
	Converse County	14025.0	...	-12.847499
	Crook County	7148.0	...	-1.544618
	Fremont County	41129.0	...	2.747083
	Goshen County	13666.0	...	14.293649
	Hot Springs County	4846.0	...	3.322604
	Johnson County	8610.0	...	4.995063
	Laramie County	94894.0	...	-1.200428
	Lincoln County	17943.0	...	-9.802564
	Natrona County	78699.0	...	7.189319
	Niobrara County	2475.0	...	-0.401849
	Park County	28863.0	...	4.582951
	Platte County	8732.0	...	4.373094

Sheridan County	29594.0	...	0.958559
Sublette County	10418.0	...	-23.741784
Sweetwater County	45104.0	...	1.072643
Teton County	21697.0	...	-1.589565
Uinta County	20989.0	...	-17.755986
Washakie County	8443.0	...	-11.637475
Weston County	7065.0	...	-11.752361

STNAME	CTYNAME	RDOMESTICMIG2012	RDOMESTICMIG2013 \
Alabama	Autauga County	-2.915927	-3.012349
	Baldwin County	17.647293	21.845705
	Barbour County	-2.500690	-7.056824
	Bibb County	-5.068871	-6.201001
	Blount County	-1.177622	-1.748766
	Bullock County	-5.180127	-1.130263
	Butler County	-11.684234	-5.655413
	Calhoun County	-4.611706	-5.524649
	Chambers County	3.849092	2.872721
	Cherokee County	1.113180	5.488706
	Chilton County	-2.653369	0.480044
	Choctaw County	-0.737028	-8.766391
	Clarke County	-17.667705	-0.318345
	Clay County	-13.345130	4.902871
	Cleburne County	-5.151880	7.345821
	Coffee County	7.675579	-13.146535
	Colbert County	1.065051	1.762390
	Conecuh County	-7.504690	-6.107224
	Coosa County	-10.291443	-4.313831
	Covington County	-4.612668	0.740271
	Crenshaw County	3.950156	-1.864936
	Cullman County	-1.019628	4.071247
	Dale County	-5.277150	-15.236079
	Dallas County	-11.308243	-16.745678
	DeKalb County	-9.302391	-1.748807
	Elmore County	0.822717	1.760531
	Escambia County	-3.855889	-4.822706
	Etowah County	2.062637	-1.931884
	Fayette County	-0.646640	-3.725937
	Franklin County	-5.459394	-8.043702
...
Wisconsin	Washburn County	7.338289	-6.732724
	Washington County	0.785279	-2.215465
	Waukesha County	2.128860	0.038132
	Waupaca County	-2.241873	6.292687
	Waushara County	-2.404973	-4.097017
	Winnebago County	2.889873	0.833819
	Wood County	-5.019090	-6.901200

Wyoming	Albany County	2.637812	-3.544634
	Big Horn County	2.804930	16.815908
	Campbell County	15.601020	-5.895711
	Carbon County	-13.081441	3.178134
	Converse County	15.493820	19.035533
	Crook County	-4.202564	1.397819
	Fremont County	7.782673	-4.990688
	Goshen County	3.961413	-8.079028
	Hot Springs County	6.208609	3.095336
	Johnson County	-4.058912	-0.812583
	Laramie County	15.547274	4.787847
	Lincoln County	-11.566801	13.564556
	Natrona County	23.066162	24.322042
	Niobrara County	0.806452	29.066295
	Park County	8.057765	7.641997
	Platte County	5.392073	2.634593
	Sheridan County	8.425487	4.546373
	Sublette County	15.272374	-40.870074
	Sweetwater County	16.243199	-5.339774
	Teton County	0.972695	19.525929
	Uinta County	-4.916350	-6.902954
	Washakie County	-0.827815	-2.013502
	Weston County	-8.040059	12.372583

STNAME	CTYNAME	RDOMESTICMIG2014	RDOMESTICMIG2015	RNETMIG2011 \
Alabama	Autauga County	2.265971	-2.530799	7.606016
	Baldwin County	19.243287	17.197872	15.844176
	Barbour County	-3.904217	-10.543299	-4.874741
	Bibb County	-0.177537	0.177258	-5.088389
	Blount County	-2.062535	-1.369970	1.859511
	Bullock County	14.354290	-16.167247	-29.001673
	Butler County	1.085428	-6.529805	-13.936612
	Calhoun County	-4.463211	-3.376322	-5.791579
	Chambers County	-2.287222	1.349468	-1.821092
	Cherokee County	-0.076806	-3.239866	6.416167
	Chilton County	0.456017	-2.253483	-0.823761
	Choctaw County	-1.274984	-5.291205	-15.528177
	Clarke County	-8.686428	-5.613667	-6.077488
	Clay County	5.702648	3.912450	-10.816697
	Cleburne County	3.654485	-3.123961	-3.673524
	Coffee County	-3.602859	2.214774	2.166460
	Colbert County	1.835688	-0.110260	0.513964
	Conecuh County	-14.645416	2.684140	-4.861559
	Coosa County	-22.958017	-5.387581	-34.017138
	Covington County	3.697932	-0.316945	6.881460
	Crenshaw County	3.084648	3.439504	2.666763
	Cullman County	5.087142	7.915406	-1.031427

	Dale County	-11.979785	-5.107706	-9.575283
	Dallas County	-9.344789	-14.687232	-15.727573
	DeKalb County	0.267830	0.028141	1.375159
	Elmore County	-1.507057	2.067820	3.674511
	Escambia County	-1.189831	1.190902	-3.397716
	Etowah County	-1.726932	-2.082234	-0.632554
	Fayette County	0.296745	-2.797536	-5.132243
	Franklin County	-1.267849	-2.401719	0.063029
...	
Wisconsin	Washburn County	3.510452	-5.123279	-6.747809
	Washington County	1.601149	-0.434498	-0.431504
	Waukesha County	0.760109	-0.719858	0.102448
	Waupaca County	-0.441031	-0.480617	3.359933
	Waushara County	-4.906711	-4.397793	5.174486
	Winnebago County	-2.406192	-4.557985	0.842573
	Wood County	-5.596471	-3.958322	-3.733590
Wyoming	Albany County	-3.334877	-9.911169	6.736119
	Big Horn County	-8.026420	5.095861	4.868258
	Campbell County	-8.550911	10.916963	-2.649606
	Carbon County	-2.970641	-23.300971	-7.392431
	Converse County	-20.550587	-0.070403	-12.774915
	Crook County	6.378258	18.629317	-0.982939
	Fremont County	-12.331633	-13.673610	3.093562
	Goshen County	-7.017803	-11.899450	14.886132
	Hot Springs County	-6.017222	-5.454164	5.191569
	Johnson County	-10.715742	0.933652	5.227392
	Laramie County	-1.226133	0.278940	-0.973320
	Lincoln County	6.125989	1.555544	-9.691801
	Natrona County	-0.958472	-0.061057	7.689674
	Niobrara County	-12.603387	7.492114	-0.401849
	Park County	-9.252437	-2.878980	6.486639
	Platte County	6.055759	4.662270	4.373094
	Sheridan County	3.678069	-3.298406	2.122524
	Sublette County	-16.596273	-22.870900	-21.092907
	Sweetwater County	-14.252889	-14.248864	1.255221
	Teton County	14.143021	-0.564849	0.654527
	Uinta County	-14.215862	-12.127022	-18.136812
	Washakie County	-17.781491	1.682288	-11.990126
	Weston County	1.533635	6.935294	-12.032179

STNAME	CTYNAME	RNETMIG2012	RNETMIG2013	RNETMIG2014 \
Alabama	Autauga County	-2.626146	-2.722002	2.592270
	Baldwin County	18.559627	22.727626	20.317142
	Barbour County	-2.758113	-7.167664	-3.978583
	Bibb County	-4.363636	-5.403729	0.754533
	Blount County	-0.848580	-1.402476	-1.577232
	Bullock County	-2.825524	1.507017	17.243790

	Butler County	-11.586865	-5.557058	1.184103
	Calhoun County	-4.092677	-5.062836	-3.912834
	Chambers County	4.701181	3.781439	-1.290228
	Cherokee County	1.420264	5.757384	0.230419
	Chilton County	-2.447504	0.868651	0.957636
	Choctaw County	-0.737028	-8.766391	-1.274984
	Clarke County	-17.509958	-0.159172	-8.486280
	Clay County	-13.345130	4.977157	5.776708
	Cleburne County	-5.151880	7.345821	3.654485
	Coffee County	11.513368	-10.438741	-0.767822
	Colbert County	1.469035	2.276420	2.533249
	Conecuh County	-7.504690	-6.107224	-14.645416
	Coosa County	-10.380162	-4.403703	-23.049483
	Covington County	-4.559952	0.793147	3.750759
	Crenshaw County	5.099293	-0.502098	4.734577
	Cullman County	-0.634159	4.542916	5.593387
	Dale County	-0.776637	-12.640155	-9.503292
	Dallas County	-11.378047	-16.792849	-9.368689
	DeKalb County	-8.656001	-1.029539	1.198187
	Elmore County	1.558176	2.306047	-0.951175
	Escambia County	-3.803428	-4.769999	-1.136950
	Etowah County	2.446383	-1.518596	-1.234901
	Fayette County	-0.705426	-3.785079	0.237396
	Franklin County	-3.471291	-5.700261	1.553115
...	
Wisconsin	Washburn County	7.464811	-6.605691	3.638104
	Washington County	1.162817	-1.763330	2.104796
	Waukesha County	3.180527	1.189727	2.077633
	Waupaca County	-2.011937	6.561277	-0.134227
	Waushara County	-2.160399	-3.810226	-4.535615
	Winnebago County	3.502335	1.531624	-1.545153
	Wood County	-4.562809	-6.442917	-5.040889
Wyoming	Albany County	6.433032	0.719587	1.429233
	Big Horn County	3.144921	17.236306	-7.608378
	Campbell County	15.558684	-5.916543	-8.509402
	Carbon County	-12.636926	3.623073	-2.338590
	Converse County	16.502720	20.093063	-19.358233
	Crook County	-3.642222	2.096729	7.071547
	Fremont County	8.027411	-4.747240	-12.013555
	Goshen County	4.841727	-6.903896	-5.761986
	Hot Springs County	6.001656	2.888981	-6.224712
	Johnson County	-4.058912	-0.812583	-10.715742
	Laramie County	17.914554	6.003143	-0.207819
	Lincoln County	-11.566801	13.619696	6.234414
	Natrona County	23.749508	25.085233	-0.110593
	Niobrara County	0.806452	29.066295	-12.603387
	Park County	11.127389	10.877797	-5.585731
	Platte County	4.933173	2.176403	5.598720

Sheridan County	9.342778	5.523001	4.781489
Sublette County	16.828794	-39.211861	-14.409938
Sweetwater County	16.243199	-5.295460	-14.075283
Teton County	2.408578	21.160658	16.308671
Uinta County	-5.536861	-7.521840	-14.740608
Washakie County	-1.182592	-2.250385	-18.020168
Weston County	-8.040059	12.372583	1.533635

RNETMIG2015

STNAME	CTYNAME	
Alabama	Autauga County	-2.187333
	Baldwin County	18.293499
	Barbour County	-10.543299
	Bibb County	1.107861
	Blount County	-0.884411
	Bullock County	-13.193961
	Butler County	-6.430868
	Calhoun County	-2.806406
	Chambers County	2.346901
	Cherokee County	-2.931307
	Chilton County	-1.752709
	Choctaw County	-5.291205
	Clarke County	-5.411736
	Clay County	3.986270
	Cleburne County	-3.123961
	Coffee County	5.350738
	Colbert County	0.588052
	Conecuh County	2.684140
	Coosa County	-5.387581
	Covington County	-0.264121
	Crenshaw County	5.087600
	Cullman County	8.417777
	Dale County	-1.998668
	Dallas County	-14.711389
	DeKalb County	0.956790
	Elmore County	2.757093
	Escambia County	1.243830
	Etowah County	-1.588308
	Fayette County	-2.857058
	Franklin County	0.442422
...	...	
Wisconsin	Washburn County	-4.995197
	Washington County	0.059931
	Waukesha County	0.593567
	Waupaca County	-0.173022
	Waushara County	-4.024395
	Winnebago County	-3.685304
	Wood County	-3.414223

Wyoming	Albany County	-5.166460
	Big Horn County	5.513554
	Campbell County	10.978525
	Carbon County	-22.600668
	Converse County	1.126443
	Crook County	19.309219
	Fremont County	-13.352750
	Goshen County	-10.635133
	Hot Springs County	-5.663940
	Johnson County	0.933652
	Laramie County	1.673640
	Lincoln County	1.662823
	Natrona County	0.793743
	Niobrara County	7.492114
	Park County	0.856839
	Platte County	4.207414
	Sheridan County	-2.198937
	Sublette County	-20.664059
	Sweetwater County	-14.070195
	Teton County	1.520747
	Uinta County	-12.606351
	Washakie County	1.441961
	Weston County	6.935294

[3142 rows x 98 columns]

```
In [16]: df = df[df['SUMLEV']==50]
df.set_index(['STNAME', 'CTYNAME'], inplace=True)
df.rename(columns={'ESTIMATESBASE2010': 'Estimates Base 2010'})
```

```
Out[16]:
```

	STNAME	CTYNAME	SUMLEV	REGION	DIVISION	STATE	COUNTY \
	Alabama	Autauga County	50	3	6	1	1
		Baldwin County	50	3	6	1	3
		Barbour County	50	3	6	1	5
		Bibb County	50	3	6	1	7
		Blount County	50	3	6	1	9
		Bullock County	50	3	6	1	11
		Butler County	50	3	6	1	13
		Calhoun County	50	3	6	1	15
		Chambers County	50	3	6	1	17
		Cherokee County	50	3	6	1	19
		Chilton County	50	3	6	1	21
		Choctaw County	50	3	6	1	23
		Clarke County	50	3	6	1	25
		Clay County	50	3	6	1	27
		Cleburne County	50	3	6	1	29
		Coffee County	50	3	6	1	31

	Colbert County	50	3	6	1	33
	Conecuh County	50	3	6	1	35
	Coosa County	50	3	6	1	37
	Covington County	50	3	6	1	39
	Crenshaw County	50	3	6	1	41
	Cullman County	50	3	6	1	43
	Dale County	50	3	6	1	45
	Dallas County	50	3	6	1	47
	DeKalb County	50	3	6	1	49
	Elmore County	50	3	6	1	51
	Escambia County	50	3	6	1	53
	Etowah County	50	3	6	1	55
	Fayette County	50	3	6	1	57
	Franklin County	50	3	6	1	59
...	
Wisconsin	Washburn County	50	2	3	55	129
	Washington County	50	2	3	55	131
	Waukesha County	50	2	3	55	133
	Waupaca County	50	2	3	55	135
	Waushara County	50	2	3	55	137
	Winnebago County	50	2	3	55	139
	Wood County	50	2	3	55	141
Wyoming	Albany County	50	4	8	56	1
	Big Horn County	50	4	8	56	3
	Campbell County	50	4	8	56	5
	Carbon County	50	4	8	56	7
	Converse County	50	4	8	56	9
	Crook County	50	4	8	56	11
	Fremont County	50	4	8	56	13
	Goshen County	50	4	8	56	15
	Hot Springs County	50	4	8	56	17
	Johnson County	50	4	8	56	19
	Laramie County	50	4	8	56	21
	Lincoln County	50	4	8	56	23
	Natrona County	50	4	8	56	25
	Niobrara County	50	4	8	56	27
	Park County	50	4	8	56	29
	Platte County	50	4	8	56	31
	Sheridan County	50	4	8	56	33
	Sublette County	50	4	8	56	35
	Sweetwater County	50	4	8	56	37
	Teton County	50	4	8	56	39
	Uinta County	50	4	8	56	41
	Washakie County	50	4	8	56	43
	Weston County	50	4	8	56	45

CENSUS2010POP Estimates Base 2010 \

STNAME CTYNAME

Alabama	Autauga County	54571	54571
	Baldwin County	182265	182265
	Barbour County	27457	27457
	Bibb County	22915	22919
	Blount County	57322	57322
	Bullock County	10914	10915
	Butler County	20947	20946
	Calhoun County	118572	118586
	Chambers County	34215	34170
	Cherokee County	25989	25986
	Chilton County	43643	43631
	Choctaw County	13859	13858
	Clarke County	25833	25840
	Clay County	13932	13932
	Cleburne County	14972	14972
	Coffee County	49948	49948
	Colbert County	54428	54428
	Conecuh County	13228	13228
	Coosa County	11539	11758
	Covington County	37765	37765
	Crenshaw County	13906	13906
	Cullman County	80406	80410
	Dale County	50251	50251
	Dallas County	43820	43820
	DeKalb County	71109	71115
	Elmore County	79303	79296
	Escambia County	38319	38319
	Etowah County	104430	104427
	Fayette County	17241	17241
	Franklin County	31704	31709
...
Wisconsin	Washburn County	15911	15911
	Washington County	131887	131885
	Waukesha County	389891	389938
	Waupaca County	52410	52410
	Waushara County	24496	24496
	Winnebago County	166994	166994
	Wood County	74749	74749
Wyoming	Albany County	36299	36299
	Big Horn County	11668	11668
	Campbell County	46133	46133
	Carbon County	15885	15885
	Converse County	13833	13833
	Crook County	7083	7083
	Fremont County	40123	40123
	Goshen County	13249	13247
	Hot Springs County	4812	4812
	Johnson County	8569	8569

Laramie County	91738	91881
Lincoln County	18106	18106
Natrona County	75450	75450
Niobrara County	2484	2484
Park County	28205	28205
Platte County	8667	8667
Sheridan County	29116	29116
Sublette County	10247	10247
Sweetwater County	43806	43806
Teton County	21294	21294
Uinta County	21118	21118
Washakie County	8533	8533
Weston County	7208	7208

STNAME	CTYNAME	POPESTIMATE2010	POPESTIMATE2011 \
Alabama	Autauga County	54660	55253
	Baldwin County	183193	186659
	Barbour County	27341	27226
	Bibb County	22861	22733
	Blount County	57373	57711
	Bullock County	10887	10629
	Butler County	20944	20673
	Calhoun County	118437	117768
	Chambers County	34098	33993
	Cherokee County	25976	26080
	Chilton County	43665	43739
	Choctaw County	13841	13593
	Clarke County	25767	25570
	Clay County	13880	13670
	Cleburne County	14973	14971
	Coffee County	50177	50448
	Colbert County	54514	54443
	Conecuh County	13208	13121
	Coosa County	11758	11348
	Covington County	37796	38060
	Crenshaw County	13853	13896
	Cullman County	80473	80469
	Dale County	50358	50109
	Dallas County	43803	43178
	DeKalb County	71142	71387
	Elmore County	79465	80012
	Escambia County	38309	38213
	Etowah County	104442	104236
	Fayette County	17231	17062
	Franklin County	31734	31729
...
Wisconsin	Washburn County	15930	15784

	Washington County	131967	132225
	Waukesha County	390076	390808
	Waupaca County	52422	52342
	Waushara County	24506	24581
	Winnebago County	167059	167630
	Wood County	74807	74647
Wyoming	Albany County	36428	36908
	Big Horn County	11672	11745
	Campbell County	46244	46600
	Carbon County	15837	15817
	Converse County	13826	13728
	Crook County	7114	7129
	Fremont County	40222	40591
	Goshen County	13408	13597
	Hot Springs County	4813	4818
	Johnson County	8581	8636
	Laramie County	92271	92663
	Lincoln County	18091	18022
	Natrona County	75472	76420
	Niobrara County	2492	2485
	Park County	28259	28473
	Platte County	8678	8701
	Sheridan County	29146	29275
	Sublette County	10244	10142
	Sweetwater County	43593	44041
	Teton County	21297	21482
	Uinta County	21102	20912
	Washakie County	8545	8469
	Weston County	7181	7114

STNAME	CTYNAME	POPESTIMATE2012	...	RDOMESTICMIG2011 \
Alabama	Autauga County	55175	...	7.242091
	Baldwin County	190396	...	14.832960
	Barbour County	27159	...	-4.728132
	Bibb County	22642	...	-5.527043
	Blount County	57776	...	1.807375
	Bullock County	10606	...	-30.953709
	Butler County	20408	...	-14.032727
	Calhoun County	117286	...	-6.155670
	Chambers County	34075	...	-2.731639
	Cherokee County	26023	...	6.339327
	Chilton County	43697	...	-1.372935
	Choctaw County	13543	...	-15.455274
	Clarke County	25144	...	-6.194363
	Clay County	13456	...	-10.744102
	Cleburne County	14921	...	-3.673524
	Coffee County	51173	...	0.377640

	Colbert County	54472	...	-0.073423
	Conecuh County	12996	...	-4.861559
	Coosa County	11195	...	-33.930581
	Covington County	37818	...	6.696899
	Crenshaw County	13951	...	1.729792
	Cullman County	80374	...	-1.404233
	Dale County	50324	...	-10.749798
	Dallas County	42777	...	-15.635599
	DeKalb County	70942	...	0.294677
	Elmore County	80432	...	3.235576
	Escambia County	38034	...	-3.449988
	Etowah County	104235	...	-1.015919
	Fayette County	16960	...	-5.015601
	Franklin County	31648	...	-1.638750
...
Wisconsin	Washburn County	15831	...	-6.873936
	Washington County	132649	...	-0.794876
	Waukesha County	392710	...	-0.765799
	Waupaca County	52035	...	3.111756
	Waushara County	24484	...	4.930022
	Winnebago County	168717	...	0.316712
	Wood County	74384	...	-4.081523
Wyoming	Albany County	37396	...	3.708956
	Big Horn County	11785	...	4.868258
	Campbell County	47881	...	-2.843479
	Carbon County	15678	...	-7.581980
	Converse County	14025	...	-12.847499
	Crook County	7148	...	-1.544618
	Fremont County	41129	...	2.747083
	Goshen County	13666	...	14.293649
	Hot Springs County	4846	...	3.322604
	Johnson County	8610	...	4.995063
	Laramie County	94894	...	-1.200428
	Lincoln County	17943	...	-9.802564
	Natrona County	78699	...	7.189319
	Niobrara County	2475	...	-0.401849
	Park County	28863	...	4.582951
	Platte County	8732	...	4.373094
	Sheridan County	29594	...	0.958559
	Sublette County	10418	...	-23.741784
	Sweetwater County	45104	...	1.072643
	Teton County	21697	...	-1.589565
	Uinta County	20989	...	-17.755986
	Washakie County	8443	...	-11.637475
	Weston County	7065	...	-11.752361

RDOMESTICMIG2012 RDOMESTICMIG2013 \

STNAME CTYNAME

Alabama	Autauga County	-2.915927	-3.012349
	Baldwin County	17.647293	21.845705
	Barbour County	-2.500690	-7.056824
	Bibb County	-5.068871	-6.201001
	Blount County	-1.177622	-1.748766
	Bullock County	-5.180127	-1.130263
	Butler County	-11.684234	-5.655413
	Calhoun County	-4.611706	-5.524649
	Chambers County	3.849092	2.872721
	Cherokee County	1.113180	5.488706
	Chilton County	-2.653369	0.480044
	Choctaw County	-0.737028	-8.766391
	Clarke County	-17.667705	-0.318345
	Clay County	-13.345130	4.902871
	Cleburne County	-5.151880	7.345821
	Coffee County	7.675579	-13.146535
	Colbert County	1.065051	1.762390
	Conecuh County	-7.504690	-6.107224
	Coosa County	-10.291443	-4.313831
	Covington County	-4.612668	0.740271
	Crenshaw County	3.950156	-1.864936
	Cullman County	-1.019628	4.071247
	Dale County	-5.277150	-15.236079
	Dallas County	-11.308243	-16.745678
	DeKalb County	-9.302391	-1.748807
	Elmore County	0.822717	1.760531
	Escambia County	-3.855889	-4.822706
	Etowah County	2.062637	-1.931884
	Fayette County	-0.646640	-3.725937
	Franklin County	-5.459394	-8.043702
...
Wisconsin	Washburn County	7.338289	-6.732724
	Washington County	0.785279	-2.215465
	Waukesha County	2.128860	0.038132
	Waupaca County	-2.241873	6.292687
	Waushara County	-2.404973	-4.097017
	Winnebago County	2.889873	0.833819
	Wood County	-5.019090	-6.901200
Wyoming	Albany County	2.637812	-3.544634
	Big Horn County	2.804930	16.815908
	Campbell County	15.601020	-5.895711
	Carbon County	-13.081441	3.178134
	Converse County	15.493820	19.035533
	Crook County	-4.202564	1.397819
	Fremont County	7.782673	-4.990688
	Goshen County	3.961413	-8.079028
	Hot Springs County	6.208609	3.095336
	Johnson County	-4.058912	-0.812583

Laramie County	15.547274	4.787847
Lincoln County	-11.566801	13.564556
Natrona County	23.066162	24.322042
Niobrara County	0.806452	29.066295
Park County	8.057765	7.641997
Platte County	5.392073	2.634593
Sheridan County	8.425487	4.546373
Sublette County	15.272374	-40.870074
Sweetwater County	16.243199	-5.339774
Teton County	0.972695	19.525929
Uinta County	-4.916350	-6.902954
Washakie County	-0.827815	-2.013502
Weston County	-8.040059	12.372583

STNAME	CTYNAME	RDOMESTICMIG2014	RDOMESTICMIG2015	RNETMIG2011 \
Alabama	Autauga County	2.265971	-2.530799	7.606016
	Baldwin County	19.243287	17.197872	15.844176
	Barbour County	-3.904217	-10.543299	-4.874741
	Bibb County	-0.177537	0.177258	-5.088389
	Blount County	-2.062535	-1.369970	1.859511
	Bullock County	14.354290	-16.167247	-29.001673
	Butler County	1.085428	-6.529805	-13.936612
	Calhoun County	-4.463211	-3.376322	-5.791579
	Chambers County	-2.287222	1.349468	-1.821092
	Cherokee County	-0.076806	-3.239866	6.416167
	Chilton County	0.456017	-2.253483	-0.823761
	Choctaw County	-1.274984	-5.291205	-15.528177
	Clarke County	-8.686428	-5.613667	-6.077488
	Clay County	5.702648	3.912450	-10.816697
	Cleburne County	3.654485	-3.123961	-3.673524
	Coffee County	-3.602859	2.214774	2.166460
	Colbert County	1.835688	-0.110260	0.513964
	Conecuh County	-14.645416	2.684140	-4.861559
	Coosa County	-22.958017	-5.387581	-34.017138
	Covington County	3.697932	-0.316945	6.881460
	Crenshaw County	3.084648	3.439504	2.666763
	Cullman County	5.087142	7.915406	-1.031427
	Dale County	-11.979785	-5.107706	-9.575283
	Dallas County	-9.344789	-14.687232	-15.727573
	DeKalb County	0.267830	0.028141	1.375159
	Elmore County	-1.507057	2.067820	3.674511
	Escambia County	-1.189831	1.190902	-3.397716
	Etowah County	-1.726932	-2.082234	-0.632554
	Fayette County	0.296745	-2.797536	-5.132243
	Franklin County	-1.267849	-2.401719	0.063029
...
Wisconsin	Washburn County	3.510452	-5.123279	-6.747809

Wyoming	Washington County	1.601149	-0.434498	-0.431504
	Waukesha County	0.760109	-0.719858	0.102448
	Waupaca County	-0.441031	-0.480617	3.359933
	Waushara County	-4.906711	-4.397793	5.174486
	Winnebago County	-2.406192	-4.557985	0.842573
	Wood County	-5.596471	-3.958322	-3.733590
	Albany County	-3.334877	-9.911169	6.736119
	Big Horn County	-8.026420	5.095861	4.868258
	Campbell County	-8.550911	10.916963	-2.649606
	Carbon County	-2.970641	-23.300971	-7.392431
	Converse County	-20.550587	-0.070403	-12.774915
	Crook County	6.378258	18.629317	-0.982939
	Fremont County	-12.331633	-13.673610	3.093562
	Goshen County	-7.017803	-11.899450	14.886132
	Hot Springs County	-6.017222	-5.454164	5.191569
	Johnson County	-10.715742	0.933652	5.227392
	Laramie County	-1.226133	0.278940	-0.973320
	Lincoln County	6.125989	1.555544	-9.691801
	Natrona County	-0.958472	-0.061057	7.689674
	Niobrara County	-12.603387	7.492114	-0.401849
	Park County	-9.252437	-2.878980	6.486639
	Platte County	6.055759	4.662270	4.373094
	Sheridan County	3.678069	-3.298406	2.122524
	Sublette County	-16.596273	-22.870900	-21.092907
	Sweetwater County	-14.252889	-14.248864	1.255221
	Teton County	14.143021	-0.564849	0.654527
	Uinta County	-14.215862	-12.127022	-18.136812
	Washakie County	-17.781491	1.682288	-11.990126
	Weston County	1.533635	6.935294	-12.032179

STNAME	CTYNAME	RNETMIG2012	RNETMIG2013	RNETMIG2014	\
Alabama	Autauga County	-2.626146	-2.722002	2.592270	
	Baldwin County	18.559627	22.727626	20.317142	
	Barbour County	-2.758113	-7.167664	-3.978583	
	Bibb County	-4.363636	-5.403729	0.754533	
	Blount County	-0.848580	-1.402476	-1.577232	
	Bullock County	-2.825524	1.507017	17.243790	
	Butler County	-11.586865	-5.557058	1.184103	
	Calhoun County	-4.092677	-5.062836	-3.912834	
	Chambers County	4.701181	3.781439	-1.290228	
	Cherokee County	1.420264	5.757384	0.230419	
	Chilton County	-2.447504	0.868651	0.957636	
	Choctaw County	-0.737028	-8.766391	-1.274984	
	Clarke County	-17.509958	-0.159172	-8.486280	
	Clay County	-13.345130	4.977157	5.776708	
	Cleburne County	-5.151880	7.345821	3.654485	
	Coffee County	11.513368	-10.438741	-0.767822	

	Colbert County	1.469035	2.276420	2.533249
	Conecuh County	-7.504690	-6.107224	-14.645416
	Coosa County	-10.380162	-4.403703	-23.049483
	Covington County	-4.559952	0.793147	3.750759
	Crenshaw County	5.099293	-0.502098	4.734577
	Cullman County	-0.634159	4.542916	5.593387
	Dale County	-0.776637	-12.640155	-9.503292
	Dallas County	-11.378047	-16.792849	-9.368689
	DeKalb County	-8.656001	-1.029539	1.198187
	Elmore County	1.558176	2.306047	-0.951175
	Escambia County	-3.803428	-4.769999	-1.136950
	Etowah County	2.446383	-1.518596	-1.234901
	Fayette County	-0.705426	-3.785079	0.237396
	Franklin County	-3.471291	-5.700261	1.553115
...	
Wisconsin	Washburn County	7.464811	-6.605691	3.638104
	Washington County	1.162817	-1.763330	2.104796
	Waukesha County	3.180527	1.189727	2.077633
	Waupaca County	-2.011937	6.561277	-0.134227
	Waushara County	-2.160399	-3.810226	-4.535615
	Winnebago County	3.502335	1.531624	-1.545153
	Wood County	-4.562809	-6.442917	-5.040889
Wyoming	Albany County	6.433032	0.719587	1.429233
	Big Horn County	3.144921	17.236306	-7.608378
	Campbell County	15.558684	-5.916543	-8.509402
	Carbon County	-12.636926	3.623073	-2.338590
	Converse County	16.502720	20.093063	-19.358233
	Crook County	-3.642222	2.096729	7.071547
	Fremont County	8.027411	-4.747240	-12.013555
	Goshen County	4.841727	-6.903896	-5.761986
	Hot Springs County	6.001656	2.888981	-6.224712
	Johnson County	-4.058912	-0.812583	-10.715742
	Laramie County	17.914554	6.003143	-0.207819
	Lincoln County	-11.566801	13.619696	6.234414
	Natrona County	23.749508	25.085233	-0.110593
	Niobrara County	0.806452	29.066295	-12.603387
	Park County	11.127389	10.877797	-5.585731
	Platte County	4.933173	2.176403	5.598720
	Sheridan County	9.342778	5.523001	4.781489
	Sublette County	16.828794	-39.211861	-14.409938
	Sweetwater County	16.243199	-5.295460	-14.075283
	Teton County	2.408578	21.160658	16.308671
	Uinta County	-5.536861	-7.521840	-14.740608
	Washakie County	-1.182592	-2.250385	-18.020168
	Weston County	-8.040059	12.372583	1.533635

RNETMIG2015

STNAME CTYNAME

Alabama	Autauga County	-2.187333
	Baldwin County	18.293499
	Barbour County	-10.543299
	Bibb County	1.107861
	Blount County	-0.884411
	Bullock County	-13.193961
	Butler County	-6.430868
	Calhoun County	-2.806406
	Chambers County	2.346901
	Cherokee County	-2.931307
	Chilton County	-1.752709
	Choctaw County	-5.291205
	Clarke County	-5.411736
	Clay County	3.986270
	Cleburne County	-3.123961
	Coffee County	5.350738
	Colbert County	0.588052
	Conecuh County	2.684140
	Coosa County	-5.387581
	Covington County	-0.264121
	Crenshaw County	5.087600
	Cullman County	8.417777
	Dale County	-1.998668
	Dallas County	-14.711389
	DeKalb County	0.956790
	Elmore County	2.757093
	Escambia County	1.243830
	Etowah County	-1.588308
	Fayette County	-2.857058
	Franklin County	0.442422
...		...
Wisconsin	Washburn County	-4.995197
	Washington County	0.059931
	Waukesha County	0.593567
	Waupaca County	-0.173022
	Waushara County	-4.024395
	Winnebago County	-3.685304
	Wood County	-3.414223
Wyoming	Albany County	-5.166460
	Big Horn County	5.513554
	Campbell County	10.978525
	Carbon County	-22.600668
	Converse County	1.126443
	Crook County	19.309219
	Fremont County	-13.352750
	Goshen County	-10.635133
	Hot Springs County	-5.663940
	Johnson County	0.933652

Laramie County	1.673640
Lincoln County	1.662823
Natrona County	0.793743
Niobrara County	7.492114
Park County	0.856839
Platte County	4.207414
Sheridan County	-2.198937
Sublette County	-20.664059
Sweetwater County	-14.070195
Teton County	1.520747
Uinta County	-12.606351
Washakie County	1.441961
Weston County	6.935294

[3142 rows x 98 columns]

```
In [19]: import numpy as np
def min_max(row):
    data = row[['POPESTIMATE2010',
                'POPESTIMATE2011',
                'POPESTIMATE2012',
                'POPESTIMATE2013',
                'POPESTIMATE2014',
                'POPESTIMATE2015']]
    return pd.Series({'min': np.min(data), 'max': np.max(data)})
```

```
In [18]: df.apply(min_max, axis=1)
```

```
Out[18]:
```

STNAME	CTYNAME	max	min
Alabama	Autauga County	55347.0	54660.0
	Baldwin County	203709.0	183193.0
	Barbour County	27341.0	26489.0
	Bibb County	22861.0	22512.0
	Blount County	57776.0	57373.0
	Bullock County	10887.0	10606.0
	Butler County	20944.0	20154.0
	Calhoun County	118437.0	115620.0
	Chambers County	34153.0	33993.0
	Cherokee County	26084.0	25859.0
	Chilton County	43943.0	43665.0
	Choctaw County	13841.0	13170.0
	Clarke County	25767.0	24675.0
	Clay County	13880.0	13456.0
	Cleburne County	15072.0	14921.0
	Coffee County	51211.0	50177.0
	Colbert County	54514.0	54354.0
	Conecuh County	13208.0	12662.0

	Coosa County	11758.0	10724.0
	Covington County	38060.0	37796.0
	Crenshaw County	13963.0	13853.0
	Cullman County	82005.0	80374.0
	Dale County	50358.0	49501.0
	Dallas County	43803.0	41131.0
	DeKalb County	71387.0	70869.0
	Elmore County	81468.0	79465.0
	Escambia County	38309.0	37784.0
	Etowah County	104442.0	103057.0
	Fayette County	17231.0	16759.0
	Franklin County	31734.0	31507.0
...	
Wisconsin	Washburn County	15930.0	15552.0
	Washington County	133674.0	131967.0
	Waukesha County	396488.0	390076.0
	Waupaca County	52422.0	51945.0
	Waushara County	24581.0	24033.0
	Winnebago County	169639.0	167059.0
	Wood County	74807.0	73435.0
Wyoming	Albany County	37956.0	36428.0
	Big Horn County	12022.0	11672.0
	Campbell County	49220.0	46244.0
	Carbon County	15856.0	15559.0
	Converse County	14343.0	13728.0
	Crook County	7444.0	7114.0
	Fremont County	41129.0	40222.0
	Goshen County	13666.0	13383.0
	Hot Springs County	4846.0	4741.0
	Johnson County	8636.0	8552.0
	Laramie County	97121.0	92271.0
	Lincoln County	18722.0	17943.0
	Natrona County	82178.0	75472.0
	Niobrara County	2548.0	2475.0
	Park County	29237.0	28259.0
	Platte County	8812.0	8678.0
	Sheridan County	30020.0	29146.0
	Sublette County	10418.0	9899.0
	Sweetwater County	45162.0	43593.0
	Teton County	23125.0	21297.0
	Uinta County	21102.0	20822.0
	Washakie County	8545.0	8316.0
	Weston County	7234.0	7065.0

[3142 rows x 2 columns]

```
In [20]: import numpy as np
def min_max(row):
```

```

data = row[['POPESTIMATE2010',
            'POPESTIMATE2011',
            'POPESTIMATE2012',
            'POPESTIMATE2013',
            'POPESTIMATE2014',
            'POPESTIMATE2015']]
row['max'] = np.max(data)
row['min'] = np.min(data)
return row
df.apply(min_max, axis=1)

```

```

Out[20]:

```

	STNAME	CTYNAME	SUMLEV	REGION	DIVISION	STATE	COUNTY \
	Alabama	Autauga County	50.0	3.0	6.0	1.0	1.0
		Baldwin County	50.0	3.0	6.0	1.0	3.0
		Barbour County	50.0	3.0	6.0	1.0	5.0
		Bibb County	50.0	3.0	6.0	1.0	7.0
		Blount County	50.0	3.0	6.0	1.0	9.0
		Bullock County	50.0	3.0	6.0	1.0	11.0
		Butler County	50.0	3.0	6.0	1.0	13.0
		Calhoun County	50.0	3.0	6.0	1.0	15.0
		Chambers County	50.0	3.0	6.0	1.0	17.0
		Cherokee County	50.0	3.0	6.0	1.0	19.0
		Chilton County	50.0	3.0	6.0	1.0	21.0
		Choctaw County	50.0	3.0	6.0	1.0	23.0
		Clarke County	50.0	3.0	6.0	1.0	25.0
		Clay County	50.0	3.0	6.0	1.0	27.0
		Cleburne County	50.0	3.0	6.0	1.0	29.0
		Coffee County	50.0	3.0	6.0	1.0	31.0
		Colbert County	50.0	3.0	6.0	1.0	33.0
		Conecuh County	50.0	3.0	6.0	1.0	35.0
		Coosa County	50.0	3.0	6.0	1.0	37.0
		Covington County	50.0	3.0	6.0	1.0	39.0
		Crenshaw County	50.0	3.0	6.0	1.0	41.0
		Cullman County	50.0	3.0	6.0	1.0	43.0
		Dale County	50.0	3.0	6.0	1.0	45.0
		Dallas County	50.0	3.0	6.0	1.0	47.0
		DeKalb County	50.0	3.0	6.0	1.0	49.0
		Elmore County	50.0	3.0	6.0	1.0	51.0
		Escambia County	50.0	3.0	6.0	1.0	53.0
		Etowah County	50.0	3.0	6.0	1.0	55.0
		Fayette County	50.0	3.0	6.0	1.0	57.0
		Franklin County	50.0	3.0	6.0	1.0	59.0

	Wisconsin	Washburn County	50.0	2.0	3.0	55.0	129.0
		Washington County	50.0	2.0	3.0	55.0	131.0
		Waukesha County	50.0	2.0	3.0	55.0	133.0
		Waupaca County	50.0	2.0	3.0	55.0	135.0

	Waushara County	50.0	2.0	3.0	55.0	137.0
	Winnebago County	50.0	2.0	3.0	55.0	139.0
	Wood County	50.0	2.0	3.0	55.0	141.0
Wyoming	Albany County	50.0	4.0	8.0	56.0	1.0
	Big Horn County	50.0	4.0	8.0	56.0	3.0
	Campbell County	50.0	4.0	8.0	56.0	5.0
	Carbon County	50.0	4.0	8.0	56.0	7.0
	Converse County	50.0	4.0	8.0	56.0	9.0
	Crook County	50.0	4.0	8.0	56.0	11.0
	Fremont County	50.0	4.0	8.0	56.0	13.0
	Goshen County	50.0	4.0	8.0	56.0	15.0
	Hot Springs County	50.0	4.0	8.0	56.0	17.0
	Johnson County	50.0	4.0	8.0	56.0	19.0
	Laramie County	50.0	4.0	8.0	56.0	21.0
	Lincoln County	50.0	4.0	8.0	56.0	23.0
	Natrona County	50.0	4.0	8.0	56.0	25.0
	Niobrara County	50.0	4.0	8.0	56.0	27.0
	Park County	50.0	4.0	8.0	56.0	29.0
	Platte County	50.0	4.0	8.0	56.0	31.0
	Sheridan County	50.0	4.0	8.0	56.0	33.0
	Sublette County	50.0	4.0	8.0	56.0	35.0
	Sweetwater County	50.0	4.0	8.0	56.0	37.0
	Teton County	50.0	4.0	8.0	56.0	39.0
	Uinta County	50.0	4.0	8.0	56.0	41.0
	Washakie County	50.0	4.0	8.0	56.0	43.0
	Weston County	50.0	4.0	8.0	56.0	45.0

STNAME	CTYNAME	CENSUS2010POP	ESTIMATESBASE2010 \
Alabama	Autauga County	54571.0	54571.0
	Baldwin County	182265.0	182265.0
	Barbour County	27457.0	27457.0
	Bibb County	22915.0	22919.0
	Blount County	57322.0	57322.0
	Bullock County	10914.0	10915.0
	Butler County	20947.0	20946.0
	Calhoun County	118572.0	118586.0
	Chambers County	34215.0	34170.0
	Cherokee County	25989.0	25986.0
	Chilton County	43643.0	43631.0
	Choctaw County	13859.0	13858.0
	Clarke County	25833.0	25840.0
	Clay County	13932.0	13932.0
	Cleburne County	14972.0	14972.0
	Coffee County	49948.0	49948.0
	Colbert County	54428.0	54428.0
	Conecuh County	13228.0	13228.0
	Coosa County	11539.0	11758.0

	Covington County	37765.0	37765.0
	Crenshaw County	13906.0	13906.0
	Cullman County	80406.0	80410.0
	Dale County	50251.0	50251.0
	Dallas County	43820.0	43820.0
	DeKalb County	71109.0	71115.0
	Elmore County	79303.0	79296.0
	Escambia County	38319.0	38319.0
	Etowah County	104430.0	104427.0
	Fayette County	17241.0	17241.0
	Franklin County	31704.0	31709.0
...	
Wisconsin	Washburn County	15911.0	15911.0
	Washington County	131887.0	131885.0
	Waukesha County	389891.0	389938.0
	Waupaca County	52410.0	52410.0
	Waushara County	24496.0	24496.0
	Winnebago County	166994.0	166994.0
	Wood County	74749.0	74749.0
Wyoming	Albany County	36299.0	36299.0
	Big Horn County	11668.0	11668.0
	Campbell County	46133.0	46133.0
	Carbon County	15885.0	15885.0
	Converse County	13833.0	13833.0
	Crook County	7083.0	7083.0
	Fremont County	40123.0	40123.0
	Goshen County	13249.0	13247.0
	Hot Springs County	4812.0	4812.0
	Johnson County	8569.0	8569.0
	Laramie County	91738.0	91881.0
	Lincoln County	18106.0	18106.0
	Natrona County	75450.0	75450.0
	Niobrara County	2484.0	2484.0
	Park County	28205.0	28205.0
	Platte County	8667.0	8667.0
	Sheridan County	29116.0	29116.0
	Sublette County	10247.0	10247.0
	Sweetwater County	43806.0	43806.0
	Teton County	21294.0	21294.0
	Uinta County	21118.0	21118.0
	Washakie County	8533.0	8533.0
	Weston County	7208.0	7208.0

STNAME	CTYNAME	POPESTIMATE2010	POPESTIMATE2011 \
Alabama	Autauga County	54660.0	55253.0
	Baldwin County	183193.0	186659.0
	Barbour County	27341.0	27226.0

	Bibb County	22861.0	22733.0
	Blount County	57373.0	57711.0
	Bullock County	10887.0	10629.0
	Butler County	20944.0	20673.0
	Calhoun County	118437.0	117768.0
	Chambers County	34098.0	33993.0
	Cherokee County	25976.0	26080.0
	Chilton County	43665.0	43739.0
	Choctaw County	13841.0	13593.0
	Clarke County	25767.0	25570.0
	Clay County	13880.0	13670.0
	Cleburne County	14973.0	14971.0
	Coffee County	50177.0	50448.0
	Colbert County	54514.0	54443.0
	Conecuh County	13208.0	13121.0
	Coosa County	11758.0	11348.0
	Covington County	37796.0	38060.0
	Crenshaw County	13853.0	13896.0
	Cullman County	80473.0	80469.0
	Dale County	50358.0	50109.0
	Dallas County	43803.0	43178.0
	DeKalb County	71142.0	71387.0
	Elmore County	79465.0	80012.0
	Escambia County	38309.0	38213.0
	Etowah County	104442.0	104236.0
	Fayette County	17231.0	17062.0
	Franklin County	31734.0	31729.0
...
Wisconsin	Washburn County	15930.0	15784.0
	Washington County	131967.0	132225.0
	Waukesha County	390076.0	390808.0
	Waupaca County	52422.0	52342.0
	Waushara County	24506.0	24581.0
	Winnebago County	167059.0	167630.0
	Wood County	74807.0	74647.0
Wyoming	Albany County	36428.0	36908.0
	Big Horn County	11672.0	11745.0
	Campbell County	46244.0	46600.0
	Carbon County	15837.0	15817.0
	Converse County	13826.0	13728.0
	Crook County	7114.0	7129.0
	Fremont County	40222.0	40591.0
	Goshen County	13408.0	13597.0
	Hot Springs County	4813.0	4818.0
	Johnson County	8581.0	8636.0
	Laramie County	92271.0	92663.0
	Lincoln County	18091.0	18022.0
	Natrona County	75472.0	76420.0

Niobrara County	2492.0	2485.0
Park County	28259.0	28473.0
Platte County	8678.0	8701.0
Sheridan County	29146.0	29275.0
Sublette County	10244.0	10142.0
Sweetwater County	43593.0	44041.0
Teton County	21297.0	21482.0
Uinta County	21102.0	20912.0
Washakie County	8545.0	8469.0
Weston County	7181.0	7114.0

STNAME	CTYNAME	POPESTIMATE2012	...	RDOMESTICMIG2013 \
Alabama	Autauga County	55175.0	...	-3.012349
	Baldwin County	190396.0	...	21.845705
	Barbour County	27159.0	...	-7.056824
	Bibb County	22642.0	...	-6.201001
	Blount County	57776.0	...	-1.748766
	Bullock County	10606.0	...	-1.130263
	Butler County	20408.0	...	-5.655413
	Calhoun County	117286.0	...	-5.524649
	Chambers County	34075.0	...	2.872721
	Cherokee County	26023.0	...	5.488706
	Chilton County	43697.0	...	0.480044
	Choctaw County	13543.0	...	-8.766391
	Clarke County	25144.0	...	-0.318345
	Clay County	13456.0	...	4.902871
	Cleburne County	14921.0	...	7.345821
	Coffee County	51173.0	...	-13.146535
	Colbert County	54472.0	...	1.762390
	Conecuh County	12996.0	...	-6.107224
	Coosa County	11195.0	...	-4.313831
	Covington County	37818.0	...	0.740271
	Crenshaw County	13951.0	...	-1.864936
	Cullman County	80374.0	...	4.071247
	Dale County	50324.0	...	-15.236079
	Dallas County	42777.0	...	-16.745678
	DeKalb County	70942.0	...	-1.748807
	Elmore County	80432.0	...	1.760531
	Escambia County	38034.0	...	-4.822706
	Etowah County	104235.0	...	-1.931884
	Fayette County	16960.0	...	-3.725937
	Franklin County	31648.0	...	-8.043702
...
Wisconsin	Washburn County	15831.0	...	-6.732724
	Washington County	132649.0	...	-2.215465
	Waukesha County	392710.0	...	0.038132
	Waupaca County	52035.0	...	6.292687

	Waushara County	24484.0	...	-4.097017
	Winnebago County	168717.0	...	0.833819
	Wood County	74384.0	...	-6.901200
Wyoming	Albany County	37396.0	...	-3.544634
	Big Horn County	11785.0	...	16.815908
	Campbell County	47881.0	...	-5.895711
	Carbon County	15678.0	...	3.178134
	Converse County	14025.0	...	19.035533
	Crook County	7148.0	...	1.397819
	Fremont County	41129.0	...	-4.990688
	Goshen County	13666.0	...	-8.079028
	Hot Springs County	4846.0	...	3.095336
	Johnson County	8610.0	...	-0.812583
	Laramie County	94894.0	...	4.787847
	Lincoln County	17943.0	...	13.564556
	Natrona County	78699.0	...	24.322042
	Niobrara County	2475.0	...	29.066295
	Park County	28863.0	...	7.641997
	Platte County	8732.0	...	2.634593
	Sheridan County	29594.0	...	4.546373
	Sublette County	10418.0	...	-40.870074
	Sweetwater County	45104.0	...	-5.339774
	Teton County	21697.0	...	19.525929
	Uinta County	20989.0	...	-6.902954
	Washakie County	8443.0	...	-2.013502
	Weston County	7065.0	...	12.372583

STNAME	CTYNAME	RDOMESTICMIG2014	RDOMESTICMIG2015	RNETMIG2011 \
Alabama	Autauga County	2.265971	-2.530799	7.606016
	Baldwin County	19.243287	17.197872	15.844176
	Barbour County	-3.904217	-10.543299	-4.874741
	Bibb County	-0.177537	0.177258	-5.088389
	Blount County	-2.062535	-1.369970	1.859511
	Bullock County	14.354290	-16.167247	-29.001673
	Butler County	1.085428	-6.529805	-13.936612
	Calhoun County	-4.463211	-3.376322	-5.791579
	Chambers County	-2.287222	1.349468	-1.821092
	Cherokee County	-0.076806	-3.239866	6.416167
	Chilton County	0.456017	-2.253483	-0.823761
	Choctaw County	-1.274984	-5.291205	-15.528177
	Clarke County	-8.686428	-5.613667	-6.077488
	Clay County	5.702648	3.912450	-10.816697
	Cleburne County	3.654485	-3.123961	-3.673524
	Coffee County	-3.602859	2.214774	2.166460
	Colbert County	1.835688	-0.110260	0.513964
	Conecuh County	-14.645416	2.684140	-4.861559
	Coosa County	-22.958017	-5.387581	-34.017138

	Covington County	3.697932	-0.316945	6.881460
	Crenshaw County	3.084648	3.439504	2.666763
	Cullman County	5.087142	7.915406	-1.031427
	Dale County	-11.979785	-5.107706	-9.575283
	Dallas County	-9.344789	-14.687232	-15.727573
	DeKalb County	0.267830	0.028141	1.375159
	Elmore County	-1.507057	2.067820	3.674511
	Escambia County	-1.189831	1.190902	-3.397716
	Etowah County	-1.726932	-2.082234	-0.632554
	Fayette County	0.296745	-2.797536	-5.132243
	Franklin County	-1.267849	-2.401719	0.063029
...
Wisconsin	Washburn County	3.510452	-5.123279	-6.747809
	Washington County	1.601149	-0.434498	-0.431504
	Waukesha County	0.760109	-0.719858	0.102448
	Waupaca County	-0.441031	-0.480617	3.359933
	Waushara County	-4.906711	-4.397793	5.174486
	Winnebago County	-2.406192	-4.557985	0.842573
	Wood County	-5.596471	-3.958322	-3.733590
Wyoming	Albany County	-3.334877	-9.911169	6.736119
	Big Horn County	-8.026420	5.095861	4.868258
	Campbell County	-8.550911	10.916963	-2.649606
	Carbon County	-2.970641	-23.300971	-7.392431
	Converse County	-20.550587	-0.070403	-12.774915
	Crook County	6.378258	18.629317	-0.982939
	Fremont County	-12.331633	-13.673610	3.093562
	Goshen County	-7.017803	-11.899450	14.886132
	Hot Springs County	-6.017222	-5.454164	5.191569
	Johnson County	-10.715742	0.933652	5.227392
	Laramie County	-1.226133	0.278940	-0.973320
	Lincoln County	6.125989	1.555544	-9.691801
	Natrona County	-0.958472	-0.061057	7.689674
	Niobrara County	-12.603387	7.492114	-0.401849
	Park County	-9.252437	-2.878980	6.486639
	Platte County	6.055759	4.662270	4.373094
	Sheridan County	3.678069	-3.298406	2.122524
	Sublette County	-16.596273	-22.870900	-21.092907
	Sweetwater County	-14.252889	-14.248864	1.255221
	Teton County	14.143021	-0.564849	0.654527
	Uinta County	-14.215862	-12.127022	-18.136812
	Washakie County	-17.781491	1.682288	-11.990126
	Weston County	1.533635	6.935294	-12.032179
		RNETMIG2012	RNETMIG2013	RNETMIG2014 \
STNAME	CTYNAME			
Alabama	Autauga County	-2.626146	-2.722002	2.592270
	Baldwin County	18.559627	22.727626	20.317142
	Barbour County	-2.758113	-7.167664	-3.978583

	Bibb County	-4.363636	-5.403729	0.754533
	Blount County	-0.848580	-1.402476	-1.577232
	Bullock County	-2.825524	1.507017	17.243790
	Butler County	-11.586865	-5.557058	1.184103
	Calhoun County	-4.092677	-5.062836	-3.912834
	Chambers County	4.701181	3.781439	-1.290228
	Cherokee County	1.420264	5.757384	0.230419
	Chilton County	-2.447504	0.868651	0.957636
	Choctaw County	-0.737028	-8.766391	-1.274984
	Clarke County	-17.509958	-0.159172	-8.486280
	Clay County	-13.345130	4.977157	5.776708
	Cleburne County	-5.151880	7.345821	3.654485
	Coffee County	11.513368	-10.438741	-0.767822
	Colbert County	1.469035	2.276420	2.533249
	Conecuh County	-7.504690	-6.107224	-14.645416
	Coosa County	-10.380162	-4.403703	-23.049483
	Covington County	-4.559952	0.793147	3.750759
	Crenshaw County	5.099293	-0.502098	4.734577
	Cullman County	-0.634159	4.542916	5.593387
	Dale County	-0.776637	-12.640155	-9.503292
	Dallas County	-11.378047	-16.792849	-9.368689
	DeKalb County	-8.656001	-1.029539	1.198187
	Elmore County	1.558176	2.306047	-0.951175
	Escambia County	-3.803428	-4.769999	-1.136950
	Etowah County	2.446383	-1.518596	-1.234901
	Fayette County	-0.705426	-3.785079	0.237396
	Franklin County	-3.471291	-5.700261	1.553115
...	
Wisconsin	Washburn County	7.464811	-6.605691	3.638104
	Washington County	1.162817	-1.763330	2.104796
	Waukesha County	3.180527	1.189727	2.077633
	Waupaca County	-2.011937	6.561277	-0.134227
	Waushara County	-2.160399	-3.810226	-4.535615
	Winnebago County	3.502335	1.531624	-1.545153
	Wood County	-4.562809	-6.442917	-5.040889
Wyoming	Albany County	6.433032	0.719587	1.429233
	Big Horn County	3.144921	17.236306	-7.608378
	Campbell County	15.558684	-5.916543	-8.509402
	Carbon County	-12.636926	3.623073	-2.338590
	Converse County	16.502720	20.093063	-19.358233
	Crook County	-3.642222	2.096729	7.071547
	Fremont County	8.027411	-4.747240	-12.013555
	Goshen County	4.841727	-6.903896	-5.761986
	Hot Springs County	6.001656	2.888981	-6.224712
	Johnson County	-4.058912	-0.812583	-10.715742
	Laramie County	17.914554	6.003143	-0.207819
	Lincoln County	-11.566801	13.619696	6.234414
	Natrona County	23.749508	25.085233	-0.110593

Niobrara County	0.806452	29.066295	-12.603387
Park County	11.127389	10.877797	-5.585731
Platte County	4.933173	2.176403	5.598720
Sheridan County	9.342778	5.523001	4.781489
Sublette County	16.828794	-39.211861	-14.409938
Sweetwater County	16.243199	-5.295460	-14.075283
Teton County	2.408578	21.160658	16.308671
Uinta County	-5.536861	-7.521840	-14.740608
Washakie County	-1.182592	-2.250385	-18.020168
Weston County	-8.040059	12.372583	1.533635

STNAME	CTYNAME	RNETMIG2015	max	min
Alabama	Autauga County	-2.187333	55347.0	54660.0
	Baldwin County	18.293499	203709.0	183193.0
	Barbour County	-10.543299	27341.0	26489.0
	Bibb County	1.107861	22861.0	22512.0
	Blount County	-0.884411	57776.0	57373.0
	Bullock County	-13.193961	10887.0	10606.0
	Butler County	-6.430868	20944.0	20154.0
	Calhoun County	-2.806406	118437.0	115620.0
	Chambers County	2.346901	34153.0	33993.0
	Cherokee County	-2.931307	26084.0	25859.0
	Chilton County	-1.752709	43943.0	43665.0
	Choctaw County	-5.291205	13841.0	13170.0
	Clarke County	-5.411736	25767.0	24675.0
	Clay County	3.986270	13880.0	13456.0
	Cleburne County	-3.123961	15072.0	14921.0
	Coffee County	5.350738	51211.0	50177.0
	Colbert County	0.588052	54514.0	54354.0
	Conecuh County	2.684140	13208.0	12662.0
	Coosa County	-5.387581	11758.0	10724.0
	Covington County	-0.264121	38060.0	37796.0
	Crenshaw County	5.087600	13963.0	13853.0
	Cullman County	8.417777	82005.0	80374.0
	Dale County	-1.998668	50358.0	49501.0
	Dallas County	-14.711389	43803.0	41131.0
	DeKalb County	0.956790	71387.0	70869.0
	Elmore County	2.757093	81468.0	79465.0
	Escambia County	1.243830	38309.0	37784.0
	Etowah County	-1.588308	104442.0	103057.0
	Fayette County	-2.857058	17231.0	16759.0
	Franklin County	0.442422	31734.0	31507.0
...
Wisconsin	Washburn County	-4.995197	15930.0	15552.0
	Washington County	0.059931	133674.0	131967.0
	Waukesha County	0.593567	396488.0	390076.0
	Waupaca County	-0.173022	52422.0	51945.0

	Waushara County	-4.024395	24581.0	24033.0
	Winnebago County	-3.685304	169639.0	167059.0
	Wood County	-3.414223	74807.0	73435.0
Wyoming	Albany County	-5.166460	37956.0	36428.0
	Big Horn County	5.513554	12022.0	11672.0
	Campbell County	10.978525	49220.0	46244.0
	Carbon County	-22.600668	15856.0	15559.0
	Converse County	1.126443	14343.0	13728.0
	Crook County	19.309219	7444.0	7114.0
	Fremont County	-13.352750	41129.0	40222.0
	Goshen County	-10.635133	13666.0	13383.0
	Hot Springs County	-5.663940	4846.0	4741.0
	Johnson County	0.933652	8636.0	8552.0
	Laramie County	1.673640	97121.0	92271.0
	Lincoln County	1.662823	18722.0	17943.0
	Natrona County	0.793743	82178.0	75472.0
	Niobrara County	7.492114	2548.0	2475.0
	Park County	0.856839	29237.0	28259.0
	Platte County	4.207414	8812.0	8678.0
	Sheridan County	-2.198937	30020.0	29146.0
	Sublette County	-20.664059	10418.0	9899.0
	Sweetwater County	-14.070195	45162.0	43593.0
	Teton County	1.520747	23125.0	21297.0
	Uinta County	-12.606351	21102.0	20822.0
	Washakie County	1.441961	8545.0	8316.0
	Weston County	6.935294	7234.0	7065.0

[3142 rows x 100 columns]

```
In [21]: rows = ['POPESTIMATE2010',
                 'POPESTIMATE2011',
                 'POPESTIMATE2012',
                 'POPESTIMATE2013',
                 'POPESTIMATE2014',
                 'POPESTIMATE2015']

df.apply(lambda x: np.max(x[rows]), axis=1)
```

```
Out[21]: STNAME      CTYNAME      55347.0
Alabama  Autauga County
          Baldwin County  203709.0
          Barbour County  27341.0
          Bibb County    22861.0
          Blount County  57776.0
          Bullock County  10887.0
          Butler County  20944.0
          Calhoun County  118437.0
          Chambers County  34153.0
          Cherokee County  26084.0
```

	Chilton County	43943.0
	Choctaw County	13841.0
	Clarke County	25767.0
	Clay County	13880.0
	Cleburne County	15072.0
	Coffee County	51211.0
	Colbert County	54514.0
	Conecuh County	13208.0
	Coosa County	11758.0
	Covington County	38060.0
	Crenshaw County	13963.0
	Cullman County	82005.0
	Dale County	50358.0
	Dallas County	43803.0
	DeKalb County	71387.0
	Elmore County	81468.0
	Escambia County	38309.0
	Etowah County	104442.0
	Fayette County	17231.0
	Franklin County	31734.0
	...	
Wisconsin	Washburn County	15930.0
	Washington County	133674.0
	Waukesha County	396488.0
	Waupaca County	52422.0
	Waushara County	24581.0
	Winnebago County	169639.0
	Wood County	74807.0
Wyoming	Albany County	37956.0
	Big Horn County	12022.0
	Campbell County	49220.0
	Carbon County	15856.0
	Converse County	14343.0
	Crook County	7444.0
	Fremont County	41129.0
	Goshen County	13666.0
	Hot Springs County	4846.0
	Johnson County	8636.0
	Laramie County	97121.0
	Lincoln County	18722.0
	Natrona County	82178.0
	Niobrara County	2548.0
	Park County	29237.0
	Platte County	8812.0
	Sheridan County	30020.0
	Sublette County	10418.0
	Sweetwater County	45162.0
	Teton County	23125.0

```

        Uinta County      21102.0
        Washakie County   8545.0
        Weston County     7234.0
dtype: float64

```

3 Group by

```

In [22]: import pandas as pd
import numpy as np
df = pd.read_csv('census.csv')
df = df[df['SUMLEV']==50]
df

```

```

Out[22]:
   SUMLEV  REGION  DIVISION  STATE  COUNTY  STNAME  CTYNAME \
1       50      3         6      1      1  Alabama  Autauga County
2       50      3         6      1      3  Alabama  Baldwin County
3       50      3         6      1      5  Alabama  Barbour County
4       50      3         6      1      7  Alabama  Bibb County
5       50      3         6      1      9  Alabama  Blount County
6       50      3         6      1     11  Alabama  Bullock County
7       50      3         6      1     13  Alabama  Butler County
8       50      3         6      1     15  Alabama  Calhoun County
9       50      3         6      1     17  Alabama  Chambers County
10      50      3         6      1     19  Alabama  Cherokee County
11      50      3         6      1     21  Alabama  Chilton County
12      50      3         6      1     23  Alabama  Choctaw County
13      50      3         6      1     25  Alabama  Clarke County
14      50      3         6      1     27  Alabama  Clay County
15      50      3         6      1     29  Alabama  Cleburne County
16      50      3         6      1     31  Alabama  Coffee County
17      50      3         6      1     33  Alabama  Colbert County
18      50      3         6      1     35  Alabama  Conecuh County
19      50      3         6      1     37  Alabama  Coosa County
20      50      3         6      1     39  Alabama  Covington County
21      50      3         6      1     41  Alabama  Crenshaw County
22      50      3         6      1     43  Alabama  Cullman County
23      50      3         6      1     45  Alabama  Dale County
24      50      3         6      1     47  Alabama  Dallas County
25      50      3         6      1     49  Alabama  DeKalb County
26      50      3         6      1     51  Alabama  Elmore County
27      50      3         6      1     53  Alabama  Escambia County
28      50      3         6      1     55  Alabama  Etowah County
29      50      3         6      1     57  Alabama  Fayette County
30      50      3         6      1     59  Alabama  Franklin County
...      ...      ...      ...      ...      ...      ...      ...
3162     50      2         3     55     129  Wisconsin  Washburn County
3163     50      2         3     55     131  Wisconsin  Washington County

```

3164	50	2	3	55	133	Wisconsin	Waukesha County
3165	50	2	3	55	135	Wisconsin	Waupaca County
3166	50	2	3	55	137	Wisconsin	Waushara County
3167	50	2	3	55	139	Wisconsin	Winnebago County
3168	50	2	3	55	141	Wisconsin	Wood County
3170	50	4	8	56	1	Wyoming	Albany County
3171	50	4	8	56	3	Wyoming	Big Horn County
3172	50	4	8	56	5	Wyoming	Campbell County
3173	50	4	8	56	7	Wyoming	Carbon County
3174	50	4	8	56	9	Wyoming	Converse County
3175	50	4	8	56	11	Wyoming	Crook County
3176	50	4	8	56	13	Wyoming	Fremont County
3177	50	4	8	56	15	Wyoming	Goshen County
3178	50	4	8	56	17	Wyoming	Hot Springs County
3179	50	4	8	56	19	Wyoming	Johnson County
3180	50	4	8	56	21	Wyoming	Laramie County
3181	50	4	8	56	23	Wyoming	Lincoln County
3182	50	4	8	56	25	Wyoming	Natrona County
3183	50	4	8	56	27	Wyoming	Niobrara County
3184	50	4	8	56	29	Wyoming	Park County
3185	50	4	8	56	31	Wyoming	Platte County
3186	50	4	8	56	33	Wyoming	Sheridan County
3187	50	4	8	56	35	Wyoming	Sublette County
3188	50	4	8	56	37	Wyoming	Sweetwater County
3189	50	4	8	56	39	Wyoming	Teton County
3190	50	4	8	56	41	Wyoming	Uinta County
3191	50	4	8	56	43	Wyoming	Washakie County
3192	50	4	8	56	45	Wyoming	Weston County

	CENSUS2010POP	ESTIMATESBASE2010	POPESTIMATE2010	...	\
1	54571	54571	54660	...	
2	182265	182265	183193	...	
3	27457	27457	27341	...	
4	22915	22919	22861	...	
5	57322	57322	57373	...	
6	10914	10915	10887	...	
7	20947	20946	20944	...	
8	118572	118586	118437	...	
9	34215	34170	34098	...	
10	25989	25986	25976	...	
11	43643	43631	43665	...	
12	13859	13858	13841	...	
13	25833	25840	25767	...	
14	13932	13932	13880	...	
15	14972	14972	14973	...	
16	49948	49948	50177	...	
17	54428	54428	54514	...	
18	13228	13228	13208	...	

19	11539	11758	11758	...
20	37765	37765	37796	...
21	13906	13906	13853	...
22	80406	80410	80473	...
23	50251	50251	50358	...
24	43820	43820	43803	...
25	71109	71115	71142	...
26	79303	79296	79465	...
27	38319	38319	38309	...
28	104430	104427	104442	...
29	17241	17241	17231	...
30	31704	31709	31734	...
...
3162	15911	15911	15930	...
3163	131887	131885	131967	...
3164	389891	389938	390076	...
3165	52410	52410	52422	...
3166	24496	24496	24506	...
3167	166994	166994	167059	...
3168	74749	74749	74807	...
3170	36299	36299	36428	...
3171	11668	11668	11672	...
3172	46133	46133	46244	...
3173	15885	15885	15837	...
3174	13833	13833	13826	...
3175	7083	7083	7114	...
3176	40123	40123	40222	...
3177	13249	13247	13408	...
3178	4812	4812	4813	...
3179	8569	8569	8581	...
3180	91738	91881	92271	...
3181	18106	18106	18091	...
3182	75450	75450	75472	...
3183	2484	2484	2492	...
3184	28205	28205	28259	...
3185	8667	8667	8678	...
3186	29116	29116	29146	...
3187	10247	10247	10244	...
3188	43806	43806	43593	...
3189	21294	21294	21297	...
3190	21118	21118	21102	...
3191	8533	8533	8545	...
3192	7208	7208	7181	...

	RDOMESTICMIG2011	RDOMESTICMIG2012	RDOMESTICMIG2013	RDOMESTICMIG2014 \
1	7.242091	-2.915927	-3.012349	2.265971
2	14.832960	17.647293	21.845705	19.243287
3	-4.728132	-2.500690	-7.056824	-3.904217

4	-5.527043	-5.068871	-6.201001	-0.177537
5	1.807375	-1.177622	-1.748766	-2.062535
6	-30.953709	-5.180127	-1.130263	14.354290
7	-14.032727	-11.684234	-5.655413	1.085428
8	-6.155670	-4.611706	-5.524649	-4.463211
9	-2.731639	3.849092	2.872721	-2.287222
10	6.339327	1.113180	5.488706	-0.076806
11	-1.372935	-2.653369	0.480044	0.456017
12	-15.455274	-0.737028	-8.766391	-1.274984
13	-6.194363	-17.667705	-0.318345	-8.686428
14	-10.744102	-13.345130	4.902871	5.702648
15	-3.673524	-5.151880	7.345821	3.654485
16	0.377640	7.675579	-13.146535	-3.602859
17	-0.073423	1.065051	1.762390	1.835688
18	-4.861559	-7.504690	-6.107224	-14.645416
19	-33.930581	-10.291443	-4.313831	-22.958017
20	6.696899	-4.612668	0.740271	3.697932
21	1.729792	3.950156	-1.864936	3.084648
22	-1.404233	-1.019628	4.071247	5.087142
23	-10.749798	-5.277150	-15.236079	-11.979785
24	-15.635599	-11.308243	-16.745678	-9.344789
25	0.294677	-9.302391	-1.748807	0.267830
26	3.235576	0.822717	1.760531	-1.507057
27	-3.449988	-3.855889	-4.822706	-1.189831
28	-1.015919	2.062637	-1.931884	-1.726932
29	-5.015601	-0.646640	-3.725937	0.296745
30	-1.638750	-5.459394	-8.043702	-1.267849
...
3162	-6.873936	7.338289	-6.732724	3.510452
3163	-0.794876	0.785279	-2.215465	1.601149
3164	-0.765799	2.128860	0.038132	0.760109
3165	3.111756	-2.241873	6.292687	-0.441031
3166	4.930022	-2.404973	-4.097017	-4.906711
3167	0.316712	2.889873	0.833819	-2.406192
3168	-4.081523	-5.019090	-6.901200	-5.596471
3170	3.708956	2.637812	-3.544634	-3.334877
3171	4.868258	2.804930	16.815908	-8.026420
3172	-2.843479	15.601020	-5.895711	-8.550911
3173	-7.581980	-13.081441	3.178134	-2.970641
3174	-12.847499	15.493820	19.035533	-20.550587
3175	-1.544618	-4.202564	1.397819	6.378258
3176	2.747083	7.782673	-4.990688	-12.331633
3177	14.293649	3.961413	-8.079028	-7.017803
3178	3.322604	6.208609	3.095336	-6.017222
3179	4.995063	-4.058912	-0.812583	-10.715742
3180	-1.200428	15.547274	4.787847	-1.226133
3181	-9.802564	-11.566801	13.564556	6.125989
3182	7.189319	23.066162	24.322042	-0.958472

3183	-0.401849	0.806452	29.066295	-12.603387
3184	4.582951	8.057765	7.641997	-9.252437
3185	4.373094	5.392073	2.634593	6.055759
3186	0.958559	8.425487	4.546373	3.678069
3187	-23.741784	15.272374	-40.870074	-16.596273
3188	1.072643	16.243199	-5.339774	-14.252889
3189	-1.589565	0.972695	19.525929	14.143021
3190	-17.755986	-4.916350	-6.902954	-14.215862
3191	-11.637475	-0.827815	-2.013502	-17.781491
3192	-11.752361	-8.040059	12.372583	1.533635

	RDOMESTICMIG2015	RNETMIG2011	RNETMIG2012	RNETMIG2013	RNETMIG2014 \
1	-2.530799	7.606016	-2.626146	-2.722002	2.592270
2	17.197872	15.844176	18.559627	22.727626	20.317142
3	-10.543299	-4.874741	-2.758113	-7.167664	-3.978583
4	0.177258	-5.088389	-4.363636	-5.403729	0.754533
5	-1.369970	1.859511	-0.848580	-1.402476	-1.577232
6	-16.167247	-29.001673	-2.825524	1.507017	17.243790
7	-6.529805	-13.936612	-11.586865	-5.557058	1.184103
8	-3.376322	-5.791579	-4.092677	-5.062836	-3.912834
9	1.349468	-1.821092	4.701181	3.781439	-1.290228
10	-3.239866	6.416167	1.420264	5.757384	0.230419
11	-2.253483	-0.823761	-2.447504	0.868651	0.957636
12	-5.291205	-15.528177	-0.737028	-8.766391	-1.274984
13	-5.613667	-6.077488	-17.509958	-0.159172	-8.486280
14	3.912450	-10.816697	-13.345130	4.977157	5.776708
15	-3.123961	-3.673524	-5.151880	7.345821	3.654485
16	2.214774	2.166460	11.513368	-10.438741	-0.767822
17	-0.110260	0.513964	1.469035	2.276420	2.533249
18	2.684140	-4.861559	-7.504690	-6.107224	-14.645416
19	-5.387581	-34.017138	-10.380162	-4.403703	-23.049483
20	-0.316945	6.881460	-4.559952	0.793147	3.750759
21	3.439504	2.666763	5.099293	-0.502098	4.734577
22	7.915406	-1.031427	-0.634159	4.542916	5.593387
23	-5.107706	-9.575283	-0.776637	-12.640155	-9.503292
24	-14.687232	-15.727573	-11.378047	-16.792849	-9.368689
25	0.028141	1.375159	-8.656001	-1.029539	1.198187
26	2.067820	3.674511	1.558176	2.306047	-0.951175
27	1.190902	-3.397716	-3.803428	-4.769999	-1.136950
28	-2.082234	-0.632554	2.446383	-1.518596	-1.234901
29	-2.797536	-5.132243	-0.705426	-3.785079	0.237396
30	-2.401719	0.063029	-3.471291	-5.700261	1.553115
...
3162	-5.123279	-6.747809	7.464811	-6.605691	3.638104
3163	-0.434498	-0.431504	1.162817	-1.763330	2.104796
3164	-0.719858	0.102448	3.180527	1.189727	2.077633
3165	-0.480617	3.359933	-2.011937	6.561277	-0.134227
3166	-4.397793	5.174486	-2.160399	-3.810226	-4.535615

3167	-4.557985	0.842573	3.502335	1.531624	-1.545153
3168	-3.958322	-3.733590	-4.562809	-6.442917	-5.040889
3170	-9.911169	6.736119	6.433032	0.719587	1.429233
3171	5.095861	4.868258	3.144921	17.236306	-7.608378
3172	10.916963	-2.649606	15.558684	-5.916543	-8.509402
3173	-23.300971	-7.392431	-12.636926	3.623073	-2.338590
3174	-0.070403	-12.774915	16.502720	20.093063	-19.358233
3175	18.629317	-0.982939	-3.642222	2.096729	7.071547
3176	-13.673610	3.093562	8.027411	-4.747240	-12.013555
3177	-11.899450	14.886132	4.841727	-6.903896	-5.761986
3178	-5.454164	5.191569	6.001656	2.888981	-6.224712
3179	0.933652	5.227392	-4.058912	-0.812583	-10.715742
3180	0.278940	-0.973320	17.914554	6.003143	-0.207819
3181	1.555544	-9.691801	-11.566801	13.619696	6.234414
3182	-0.061057	7.689674	23.749508	25.085233	-0.110593
3183	7.492114	-0.401849	0.806452	29.066295	-12.603387
3184	-2.878980	6.486639	11.127389	10.877797	-5.585731
3185	4.662270	4.373094	4.933173	2.176403	5.598720
3186	-3.298406	2.122524	9.342778	5.523001	4.781489
3187	-22.870900	-21.092907	16.828794	-39.211861	-14.409938
3188	-14.248864	1.255221	16.243199	-5.295460	-14.075283
3189	-0.564849	0.654527	2.408578	21.160658	16.308671
3190	-12.127022	-18.136812	-5.536861	-7.521840	-14.740608
3191	1.682288	-11.990126	-1.182592	-2.250385	-18.020168
3192	6.935294	-12.032179	-8.040059	12.372583	1.533635

RNETMIG2015

1	-2.187333
2	18.293499
3	-10.543299
4	1.107861
5	-0.884411
6	-13.193961
7	-6.430868
8	-2.806406
9	2.346901
10	-2.931307
11	-1.752709
12	-5.291205
13	-5.411736
14	3.986270
15	-3.123961
16	5.350738
17	0.588052
18	2.684140
19	-5.387581
20	-0.264121
21	5.087600

```

22      8.417777
23     -1.998668
24    -14.711389
25      0.956790
26      2.757093
27      1.243830
28     -1.588308
29     -2.857058
30      0.442422
...
3162    -4.995197
3163      0.059931
3164      0.593567
3165    -0.173022
3166    -4.024395
3167    -3.685304
3168    -3.414223
3170    -5.166460
3171      5.513554
3172    10.978525
3173   -22.600668
3174      1.126443
3175    19.309219
3176   -13.352750
3177   -10.635133
3178    -5.663940
3179      0.933652
3180      1.673640
3181      1.662823
3182      0.793743
3183      7.492114
3184      0.856839
3185      4.207414
3186    -2.198937
3187   -20.664059
3188   -14.070195
3189      1.520747
3190   -12.606351
3191      1.441961
3192      6.935294

```

```
[3142 rows x 100 columns]
```

```

In [ ]: %%timeit -n 10
        for state in df['STNAME'].unique():
            avg = np.average(df.where(df['STNAME']==state).dropna()['CENSUS2010POP'])
            print('Counties in state ' + state + ' have an average population of ' + str(avg))

Counties in state Alabama have an average population of 71339.3432836

```

Counties in state Alaska have an average population of 24490.7241379
Counties in state Arizona have an average population of 426134.466667
Counties in state Arkansas have an average population of 38878.9066667
Counties in state California have an average population of 642309.586207
Counties in state Colorado have an average population of 78581.1875
Counties in state Connecticut have an average population of 446762.125
Counties in state Delaware have an average population of 299311.333333
Counties in state District of Columbia have an average population of 601723.0
Counties in state Florida have an average population of 280616.567164
Counties in state Georgia have an average population of 60928.6352201
Counties in state Hawaii have an average population of 272060.2
Counties in state Idaho have an average population of 35626.8636364
Counties in state Illinois have an average population of 125790.509804
Counties in state Indiana have an average population of 70476.1086957
Counties in state Iowa have an average population of 30771.2626263
Counties in state Kansas have an average population of 27172.552381
Counties in state Kentucky have an average population of 36161.3916667
Counties in state Louisiana have an average population of 70833.9375
Counties in state Maine have an average population of 83022.5625
Counties in state Maryland have an average population of 240564.666667
Counties in state Massachusetts have an average population of 467687.785714
Counties in state Michigan have an average population of 119080.0
Counties in state Minnesota have an average population of 60964.6551724
Counties in state Mississippi have an average population of 36186.5487805
Counties in state Missouri have an average population of 52077.626087
Counties in state Montana have an average population of 17668.125
Counties in state Nebraska have an average population of 19638.0752688
Counties in state Nevada have an average population of 158855.941176
Counties in state New Hampshire have an average population of 131647.0
Counties in state New Jersey have an average population of 418661.619048
Counties in state New Mexico have an average population of 62399.3636364
Counties in state New York have an average population of 312550.032258
Counties in state North Carolina have an average population of 95354.83
Counties in state North Dakota have an average population of 12690.3962264
Counties in state Ohio have an average population of 131096.636364
Counties in state Oklahoma have an average population of 48718.8441558
Counties in state Oregon have an average population of 106418.722222
Counties in state Pennsylvania have an average population of 189587.746269
Counties in state Rhode Island have an average population of 210513.4
Counties in state South Carolina have an average population of 100551.391304
Counties in state South Dakota have an average population of 12336.0606061
Counties in state Tennessee have an average population of 66801.1052632
Counties in state Texas have an average population of 98998.2716535
Counties in state Utah have an average population of 95306.3793103
Counties in state Vermont have an average population of 44695.7857143
Counties in state Virginia have an average population of 60111.2932331
Counties in state Washington have an average population of 172424.102564
Counties in state West Virginia have an average population of 33690.8

Counties in state Wisconsin have an average population of 78985.9166667
Counties in state Wyoming have an average population of 24505.4782609
Counties in state Alabama have an average population of 71339.3432836
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Counties in state Utah have an average population of 95306.3793103
Counties in state Vermont have an average population of 44695.7857143

Counties in state Virginia have an average population of 60111.2932331
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Counties in state Mississippi have an average population of 36186.5487805
Counties in state Missouri have an average population of 52077.626087
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Counties in state Connecticut have an average population of 446762.125

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Counties in state New York have an average population of 312550.032258
Counties in state North Carolina have an average population of 95354.83

```
In [ ]: %timeit -n 10
        for group, frame in df.groupby('STNAME'):
            avg = np.average(frame['CENSUS2010POP'])
            print('Counties in state ' + group + ' have an average population of ' + str(avg))
```

```
In [26]: df.head()
```

```
Out[26]:
```

	SUMLEV	REGION	DIVISION	STATE	COUNTY	STNAME	CTYNAME	\
1	50	3	6	1	1	Alabama	Autauga County	
2	50	3	6	1	3	Alabama	Baldwin County	
3	50	3	6	1	5	Alabama	Barbour County	
4	50	3	6	1	7	Alabama	Bibb County	
5	50	3	6	1	9	Alabama	Blount County	

	CENSUS2010POP	ESTIMATESBASE2010	POPESTIMATE2010	...	\
1	54571	54571	54660	...	
2	182265	182265	183193	...	
3	27457	27457	27341	...	
4	22915	22919	22861	...	
5	57322	57322	57373	...	

	RDOMESTICMIG2011	RDOMESTICMIG2012	RDOMESTICMIG2013	RDOMESTICMIG2014	\
1	7.242091	-2.915927	-3.012349	2.265971	
2	14.832960	17.647293	21.845705	19.243287	
3	-4.728132	-2.500690	-7.056824	-3.904217	
4	-5.527043	-5.068871	-6.201001	-0.177537	
5	1.807375	-1.177622	-1.748766	-2.062535	

	RDOMESTICMIG2015	RNETMIG2011	RNETMIG2012	RNETMIG2013	RNETMIG2014	\
1	-2.530799	7.606016	-2.626146	-2.722002	2.592270	
2	17.197872	15.844176	18.559627	22.727626	20.317142	
3	-10.543299	-4.874741	-2.758113	-7.167664	-3.978583	
4	0.177258	-5.088389	-4.363636	-5.403729	0.754533	
5	-1.369970	1.859511	-0.848580	-1.402476	-1.577232	

	RNETMIG2015
1	-2.187333
2	18.293499
3	-10.543299
4	1.107861
5	-0.884411

```
[5 rows x 100 columns]
```

```
In [27]: df = df.set_index('STNAME')
```

```
def fun(item):
    if item[0]<'M':
        return 0
    if item[0]<'Q':
        return 1
    return 2
```

```

for group, frame in df.groupby(fun):
    print('There are ' + str(len(frame)) + ' records in group ' + str(group) + ' for pr

```

There are 1177 records in group 0 for processing.

There are 1134 records in group 1 for processing.

There are 831 records in group 2 for processing.

```

In [28]: df = pd.read_csv('census.csv')
        df = df[df['SUMLEV']==50]

```

```

In [29]: df.groupby('STNAME').agg({'CENSUS2010POP': np.average})

```

```

Out[29]:
          CENSUS2010POP
STNAME
Alabama              71339.343284
Alaska               24490.724138
Arizona             426134.466667
Arkansas             38878.906667
California           642309.586207
Colorado             78581.187500
Connecticut          446762.125000
Delaware             299311.333333
District of Columbia 601723.000000
Florida              280616.567164
Georgia              60928.635220
Hawaii               272060.200000
Idaho                35626.863636
Illinois             125790.509804
Indiana              70476.108696
Iowa                 30771.262626
Kansas               27172.552381
Kentucky             36161.391667
Louisiana            70833.937500
Maine                83022.562500
Maryland             240564.666667
Massachusetts        467687.785714
Michigan             119080.000000
Minnesota            60964.655172
Mississippi          36186.548780
Missouri             52077.626087
Montana              17668.125000
Nebraska             19638.075269
Nevada               158855.941176
New Hampshire        131647.000000
New Jersey           418661.619048
New Mexico           62399.363636
New York             312550.032258
North Carolina       95354.830000

```

North Dakota	12690.396226
Ohio	131096.636364
Oklahoma	48718.844156
Oregon	106418.722222
Pennsylvania	189587.746269
Rhode Island	210513.400000
South Carolina	100551.391304
South Dakota	12336.060606
Tennessee	66801.105263
Texas	98998.271654
Utah	95306.379310
Vermont	44695.785714
Virginia	60111.293233
Washington	172424.102564
West Virginia	33690.800000
Wisconsin	78985.916667
Wyoming	24505.478261

```
In [30]: print(type(df.groupby(level=0)['POPESTIMATE2010', 'POPESTIMATE2011']))
         print(type(df.groupby(level=0)['POPESTIMATE2010']))
```

```
<class 'pandas.core.groupby.DataFrameGroupBy'>
<class 'pandas.core.groupby.SeriesGroupBy'>
```

```
In [31]: (df.set_index('STNAME').groupby(level=0)['CENSUS2010POP']
         .agg({'avg': np.average, 'sum': np.sum}))
```

```
Out[31]:
```

	avg	sum
STNAME		
Alabama	71339.343284	4779736
Alaska	24490.724138	710231
Arizona	426134.466667	6392017
Arkansas	38878.906667	2915918
California	642309.586207	37253956
Colorado	78581.187500	5029196
Connecticut	446762.125000	3574097
Delaware	299311.333333	897934
District of Columbia	601723.000000	601723
Florida	280616.567164	18801310
Georgia	60928.635220	9687653
Hawaii	272060.200000	1360301
Idaho	35626.863636	1567582
Illinois	125790.509804	12830632
Indiana	70476.108696	6483802
Iowa	30771.262626	3046355
Kansas	27172.552381	2853118
Kentucky	36161.391667	4339367
Louisiana	70833.937500	4533372

Maine	83022.562500	1328361
Maryland	240564.666667	5773552
Massachusetts	467687.785714	6547629
Michigan	119080.000000	9883640
Minnesota	60964.655172	5303925
Mississippi	36186.548780	2967297
Missouri	52077.626087	5988927
Montana	17668.125000	989415
Nebraska	19638.075269	1826341
Nevada	158855.941176	2700551
New Hampshire	131647.000000	1316470
New Jersey	418661.619048	8791894
New Mexico	62399.363636	2059179
New York	312550.032258	19378102
North Carolina	95354.830000	9535483
North Dakota	12690.396226	672591
Ohio	131096.636364	11536504
Oklahoma	48718.844156	3751351
Oregon	106418.722222	3831074
Pennsylvania	189587.746269	12702379
Rhode Island	210513.400000	1052567
South Carolina	100551.391304	4625364
South Dakota	12336.060606	814180
Tennessee	66801.105263	6346105
Texas	98998.271654	25145561
Utah	95306.379310	2763885
Vermont	44695.785714	625741
Virginia	60111.293233	7994802
Washington	172424.102564	6724540
West Virginia	33690.800000	1852994
Wisconsin	78985.916667	5686986
Wyoming	24505.478261	563626

```
In [32]: (df.set_index('STNAME').groupby(level=0)['POPESTIMATE2010','POPESTIMATE2011']
          .agg({'avg': np.average, 'sum': np.sum}))
```

```
Out[32]:
```

	avg	sum \
STNAME	POPESTIMATE2010	POPESTIMATE2011 POPESTIMATE2010
Alabama	71420.313433	71658.328358 4785161
Alaska	24621.413793	24921.379310 714021
Arizona	427213.866667	431248.800000 6408208
Arkansas	38965.253333	39180.506667 2922394
California	643691.017241	650000.586207 37334079
Colorado	78878.968750	79991.875000 5048254
Connecticut	447464.625000	448719.875000 3579717
Delaware	299930.333333	302638.666667 899791
District of Columbia	605126.000000	620472.000000 605126

Florida	281341.641791	285157.208955	18849890
Georgia	61090.905660	61712.452830	9713454
Hawaii	272796.000000	275645.400000	1363980
Idaho	35704.227273	36003.045455	1570986
Illinois	125894.598039	126096.882353	12841249
Indiana	70549.891304	70835.271739	6490590
Iowa	30815.090909	30963.525253	3050694
Kansas	27226.895238	27332.542857	2858824
Kentucky	36232.808333	36399.016667	4347937
Louisiana	71014.859375	71490.328125	4544951
Maine	82980.937500	83016.062500	1327695
Maryland	241183.708333	243507.125000	5788409
Massachusetts	468931.142857	472271.214286	6565036
Michigan	119004.445783	118995.048193	9877369
Minnesota	61044.862069	61472.632184	5310903
Mississippi	36223.365854	36317.060976	2970316
Missouri	52139.582609	52265.973913	5996052
Montana	17690.053571	17816.892857	990643
Nebraska	19677.688172	19810.569892	1830025
Nevada	159025.882353	159930.529412	2703440
New Hampshire	131670.800000	131834.400000	1316708
New Jersey	419232.428571	421092.095238	8803881
New Mexico	62567.909091	62976.545455	2064741
New York	312950.322581	314890.354839	19402920
North Carolina	95589.790000	96510.250000	9558979
North Dakota	12726.981132	12930.679245	674530
Ohio	131145.068182	131198.204545	11540766
Oklahoma	48825.922078	49176.961039	3759596
Oregon	106610.333333	107458.583333	3837972
Pennsylvania	189731.552239	190226.895522	12712014
Rhode Island	210643.800000	210371.200000	1053219
South Carolina	100780.304348	101581.152174	4635894
South Dakota	12368.166667	12489.227273	816299
Tennessee	66911.421053	67351.663158	6356585
Texas	99387.255906	101001.826772	25244363
Utah	95704.344828	97118.620690	2775426
Vermont	44713.142857	44763.357143	625984
Virginia	60344.263158	60983.330827	8025787
Washington	172898.974359	174954.589744	6743060
West Virginia	33713.181818	33726.327273	1854225
Wisconsin	79030.611111	79301.666667	5690204
Wyoming	24544.173913	24685.565217	564516

POPESTIMATE2011

STNAME

Alabama	4801108
Alaska	722720

Arizona	6468732
Arkansas	2938538
California	37700034
Colorado	5119480
Connecticut	3589759
Delaware	907916
District of Columbia	620472
Florida	19105533
Georgia	9812280
Hawaii	1378227
Idaho	1584134
Illinois	12861882
Indiana	6516845
Iowa	3065389
Kansas	2869917
Kentucky	4367882
Louisiana	4575381
Maine	1328257
Maryland	5844171
Massachusetts	6611797
Michigan	9876589
Minnesota	5348119
Mississippi	2977999
Missouri	6010587
Montana	997746
Nebraska	1842383
Nevada	2718819
New Hampshire	1318344
New Jersey	8842934
New Mexico	2078226
New York	19523202
North Carolina	9651025
North Dakota	685326
Ohio	11545442
Oklahoma	3786626
Oregon	3868509
Pennsylvania	12745202
Rhode Island	1051856
South Carolina	4672733
South Dakota	824289
Tennessee	6398408
Texas	25654464
Utah	2816440
Vermont	626687
Virginia	8110783
Washington	6823229
West Virginia	1854948
Wisconsin	5709720

Wyoming

567768

```
In [33]: (df.set_index('STNAME').groupby(level=0)['POPESTIMATE2010','POPESTIMATE2011']  
         .agg({'POPESTIMATE2010': np.average, 'POPESTIMATE2011': np.sum}))
```

```
Out[33]:
```

	POPESTIMATE2010	POPESTIMATE2011
STNAME		
Alabama	71420.313433	4801108
Alaska	24621.413793	722720
Arizona	427213.866667	6468732
Arkansas	38965.253333	2938538
California	643691.017241	37700034
Colorado	78878.968750	5119480
Connecticut	447464.625000	3589759
Delaware	299930.333333	907916
District of Columbia	605126.000000	620472
Florida	281341.641791	19105533
Georgia	61090.905660	9812280
Hawaii	272796.000000	1378227
Idaho	35704.227273	1584134
Illinois	125894.598039	12861882
Indiana	70549.891304	6516845
Iowa	30815.090909	3065389
Kansas	27226.895238	2869917
Kentucky	36232.808333	4367882
Louisiana	71014.859375	4575381
Maine	82980.937500	1328257
Maryland	241183.708333	5844171
Massachusetts	468931.142857	6611797
Michigan	119004.445783	9876589
Minnesota	61044.862069	5348119
Mississippi	36223.365854	2977999
Missouri	52139.582609	6010587
Montana	17690.053571	997746
Nebraska	19677.688172	1842383
Nevada	159025.882353	2718819
New Hampshire	131670.800000	1318344
New Jersey	419232.428571	8842934
New Mexico	62567.909091	2078226
New York	312950.322581	19523202
North Carolina	95589.790000	9651025
North Dakota	12726.981132	685326
Ohio	131145.068182	11545442
Oklahoma	48825.922078	3786626
Oregon	106610.333333	3868509
Pennsylvania	189731.552239	12745202
Rhode Island	210643.800000	1051856
South Carolina	100780.304348	4672733

South Dakota	12368.166667	824289
Tennessee	66911.421053	6398408
Texas	99387.255906	25654464
Utah	95704.344828	2816440
Vermont	44713.142857	626687
Virginia	60344.263158	8110783
Washington	172898.974359	6823229
West Virginia	33713.181818	1854948
Wisconsin	79030.611111	5709720
Wyoming	24544.173913	567768

4 Scales

```
In [34]: df = pd.DataFrame(['A+', 'A', 'A-', 'B+', 'B', 'B-', 'C+', 'C', 'C-', 'D+', 'D'],
                           index=['excellent', 'excellent', 'excellent', 'good', 'good', 'good',
                                   'ok', 'ok', 'ok', 'poor', 'poor', 'poor'],
                           df.rename(columns={0: 'Grades'}, inplace=True)
                           df
```

```
Out[34]:
```

	Grades
excellent	A+
excellent	A
excellent	A-
good	B+
good	B
good	B-
ok	C+
ok	C
ok	C-
poor	D+
poor	D

```
In [35]: df['Grades'].astype('category').head()
```

```
Out[35]: excellent    A+
excellent            A
excellent            A-
good                 B+
good                 B
Name: Grades, dtype: category
Categories (11, object): [A, A+, A-, B, ..., C+, C-, D, D+]
```

```
In [36]: grades = df['Grades'].astype('category',
                                       categories=['D', 'D+', 'C-', 'C', 'C+', 'B-', 'B', 'B+', 'A-', 'A', 'A+'],
                                       ordered=True)

grades.head()
```

```
Out[36]: excellent    A+
excellent            A
```

```

excellent    A-
good         B+
good         B
Name: Grades, dtype: category
Categories (11, object): [D < D+ < C- < C ... B+ < A- < A < A+]

```

```
In [37]: grades > 'C'
```

```

Out[37]: excellent    True
excellent    True
excellent    True
good         True
good         True
good         True
ok           True
ok           False
ok           False
poor         False
poor         False
Name: Grades, dtype: bool

```

```

In [38]: df = pd.read_csv('census.csv')
df = df[df['SUMLEV']==50]
df = df.set_index('STNAME').groupby(level=0)['CENSUS2010POP'].agg({'avg': np.average})
pd.cut(df['avg'],10)

```

```

Out[38]: STNAME
Alabama      (11706.0871, 75333.413]
Alaska       (11706.0871, 75333.413]
Arizona      (390320.176, 453317.529]
Arkansas     (11706.0871, 75333.413]
California   (579312.234, 642309.586]
Colorado     (75333.413, 138330.766]
Connecticut  (390320.176, 453317.529]
Delaware     (264325.471, 327322.823]
District of Columbia (579312.234, 642309.586]
Florida      (264325.471, 327322.823]
Georgia      (11706.0871, 75333.413]
Hawaii       (264325.471, 327322.823]
Idaho        (11706.0871, 75333.413]
Illinois     (75333.413, 138330.766]
Indiana      (11706.0871, 75333.413]
Iowa         (11706.0871, 75333.413]
Kansas       (11706.0871, 75333.413]
Kentucky     (11706.0871, 75333.413]
Louisiana    (11706.0871, 75333.413]
Maine        (75333.413, 138330.766]
Maryland     (201328.118, 264325.471]
Massachusetts (453317.529, 516314.881]

```

```

Michigan          (75333.413, 138330.766]
Minnesota         (11706.0871, 75333.413]
Mississippi       (11706.0871, 75333.413]
Missouri          (11706.0871, 75333.413]
Montana           (11706.0871, 75333.413]
Nebraska          (11706.0871, 75333.413]
Nevada            (138330.766, 201328.118]
New Hampshire     (75333.413, 138330.766]
New Jersey        (390320.176, 453317.529]
New Mexico        (11706.0871, 75333.413]
New York          (264325.471, 327322.823]
North Carolina    (75333.413, 138330.766]
North Dakota      (11706.0871, 75333.413]
Ohio              (75333.413, 138330.766]
Oklahoma          (11706.0871, 75333.413]
Oregon            (75333.413, 138330.766]
Pennsylvania      (138330.766, 201328.118]
Rhode Island      (201328.118, 264325.471]
South Carolina    (75333.413, 138330.766]
South Dakota      (11706.0871, 75333.413]
Tennessee         (11706.0871, 75333.413]
Texas             (75333.413, 138330.766]
Utah              (75333.413, 138330.766]
Vermont           (11706.0871, 75333.413]
Virginia          (11706.0871, 75333.413]
Washington        (138330.766, 201328.118]
West Virginia     (11706.0871, 75333.413]
Wisconsin          (75333.413, 138330.766]
Wyoming           (11706.0871, 75333.413]
Name: avg, dtype: category
Categories (10, object): [(11706.0871, 75333.413] < (75333.413, 138330.766] < (138330.7

```

5 Pivot Tables

```
In [39]: #http://open.canada.ca/data/en/dataset/98f1a129-f628-4ce4-b24d-6f16bf24dd64
df = pd.read_csv('cars.csv')
```

```
In [40]: df.head()
```

```
Out[40]:
```

	YEAR	Make	Model	Size	(kW)	Unnamed: 5	TYPE	\
0	2012	MITSUBISHI	i-MiEV	SUBCOMPACT	49	A1	B	
1	2012	NISSAN	LEAF	MID-SIZE	80	A1	B	
2	2013	FORD	FOCUS ELECTRIC	COMPACT	107	A1	B	
3	2013	MITSUBISHI	i-MiEV	SUBCOMPACT	49	A1	B	
4	2013	NISSAN	LEAF	MID-SIZE	80	A1	B	

	CITY (kWh/100 km)	HWY (kWh/100 km)	COMB (kWh/100 km)	CITY (Le/100 km)	\
0	16.9	21.4	18.7	1.9	

1	19.3	23.0	21.1	2.2
2	19.0	21.1	20.0	2.1
3	16.9	21.4	18.7	1.9
4	19.3	23.0	21.1	2.2

	HWY (Le/100 km)	COMB (Le/100 km)	(g/km)	RATING	(km)	TIME (h)
0	2.4	2.1	0	n/a	100	7
1	2.6	2.4	0	n/a	117	7
2	2.4	2.2	0	n/a	122	4
3	2.4	2.1	0	n/a	100	7
4	2.6	2.4	0	n/a	117	7

```
In [41]: df.pivot_table(values='(kW)', index='YEAR', columns='Make', aggfunc=np.mean)
```

```
Out[41]:
```

Make	BMW	CHEVROLET	FORD	KIA	MAZDA	NISSAN	SMART	TESLA
YEAR								
2012	NaN	NaN	NaN	NaN	49.0	80.0	NaN	NaN
2013	NaN	NaN	107.0	NaN	49.0	80.0	35.0	280.000000
2014	NaN	104.0	107.0	NaN	49.0	80.0	35.0	268.333333
2015	125.0	104.0	107.0	81.0	49.0	80.0	35.0	320.666667
2016	125.0	104.0	107.0	81.0	49.0	80.0	35.0	409.700000

```
In [42]: df.pivot_table(values='(kW)', index='YEAR', columns='Make', aggfunc=[np.mean,np.min], m
```

```
Out[42]:
```

		mean							
Make	BMW	CHEVROLET	FORD	KIA	MAZDA	NISSAN	SMART	TESLA	
YEAR									
2012	NaN	NaN	NaN	NaN	49.0	80.0	NaN	NaN	
2013	NaN	NaN	107.0	NaN	49.0	80.0	35.0	280.000000	
2014	NaN	104.0	107.0	NaN	49.0	80.0	35.0	268.333333	
2015	125.0	104.0	107.0	81.0	49.0	80.0	35.0	320.666667	
2016	125.0	104.0	107.0	81.0	49.0	80.0	35.0	409.700000	
All	125.0	104.0	107.0	81.0	49.0	80.0	35.0	345.478261	

		amin							
Make	All	BMW	CHEVROLET	FORD	KIA	MAZDA	NISSAN	SMART	TESLA
YEAR									
2012	64.500000	NaN	NaN	NaN	NaN	49.0	80.0	NaN	NaN
2013	158.444444	NaN	NaN	107.0	NaN	49.0	80.0	35.0	270.0
2014	135.000000	NaN	104.0	107.0	NaN	49.0	80.0	35.0	225.0
2015	181.428571	125.0	104.0	107.0	81.0	49.0	80.0	35.0	280.0
2016	252.263158	125.0	104.0	107.0	81.0	49.0	80.0	35.0	283.0
All	190.622642	125.0	104.0	107.0	81.0	49.0	80.0	35.0	225.0

Make	All
YEAR	
2012	49.0
2013	35.0

```

2014    35.0
2015    35.0
2016    35.0
All     35.0

```

6 Date Functionality in Pandas

```

In [43]: import pandas as pd
         import numpy as np

```

6.0.1 Timestamp

```

In [44]: pd.Timestamp('9/1/2016 10:05AM')
Out[44]: Timestamp('2016-09-01 10:05:00')

```

6.0.2 Period

```

In [45]: pd.Period('1/2016')
Out[45]: Period('2016-01', 'M')
In [46]: pd.Period('3/5/2016')
Out[46]: Period('2016-03-05', 'D')

```

6.0.3 DatetimeIndex

```

In [47]: t1 = pd.Series(list('abc'), [pd.Timestamp('2016-09-01'), pd.Timestamp('2016-09-02'), pd.Timestamp('2016-09-03')],
                        index=t1)
Out[47]: 2016-09-01    a
          2016-09-02    b
          2016-09-03    c
          dtype: object
In [48]: type(t1.index)
Out[48]: pandas.tseries.index.DatetimeIndex

```

6.0.4 PeriodIndex

```

In [49]: t2 = pd.Series(list('def'), [pd.Period('2016-09'), pd.Period('2016-10'), pd.Period('2016-11')],
                        index=t2)
Out[49]: 2016-09    d
          2016-10    e
          2016-11    f
          Freq: M, dtype: object
In [50]: type(t2.index)
Out[50]: pandas.tseries.period.PeriodIndex

```

6.0.5 Converting to Datetime

```
In [51]: d1 = ['2 June 2013', 'Aug 29, 2014', '2015-06-26', '7/12/16']
         ts3 = pd.DataFrame(np.random.randint(10, 100, (4,2)), index=d1, columns=list('ab'))
         ts3
```

```
Out[51]:
```

	a	b
2 June 2013	62	41
Aug 29, 2014	36	74
2015-06-26	43	91
7/12/16	71	96

```
In [52]: ts3.index = pd.to_datetime(ts3.index)
         ts3
```

```
Out[52]:
```

	a	b
2013-06-02	62	41
2014-08-29	36	74
2015-06-26	43	91
2016-07-12	71	96

```
In [53]: pd.to_datetime('4.7.12', dayfirst=True)
```

```
Out[53]: Timestamp('2012-07-04 00:00:00')
```

6.0.6 Timedeltas

```
In [54]: pd.Timestamp('9/3/2016')-pd.Timestamp('9/1/2016')
```

```
Out[54]: Timedelta('2 days 00:00:00')
```

```
In [55]: pd.Timestamp('9/2/2016 8:10AM') + pd.Timedelta('12D 3H')
```

```
Out[55]: Timestamp('2016-09-14 11:10:00')
```

6.0.7 Working with Dates in a Dataframe

```
In [56]: dates = pd.date_range('10-01-2016', periods=9, freq='2W-SUN')
         dates
```

```
Out[56]: DatetimeIndex(['2016-10-02', '2016-10-16', '2016-10-30', '2016-11-13',
                        '2016-11-27', '2016-12-11', '2016-12-25', '2017-01-08',
                        '2017-01-22'],
                        dtype='datetime64[ns]', freq='2W-SUN')
```

```
In [57]: df = pd.DataFrame({'Count 1': 100 + np.random.randint(-5, 10, 9).cumsum(),
                           'Count 2': 120 + np.random.randint(-5, 10, 9)}, index=dates)
         df
```

```
Out [57]:
```

	Count 1	Count 2
2016-10-02	105	128
2016-10-16	108	127
2016-10-30	117	115
2016-11-13	118	115
2016-11-27	122	119
2016-12-11	128	118
2016-12-25	130	125
2017-01-08	128	124
2017-01-22	124	120

```
In [58]: df.index.weekday_name
```

```
Out [58]: array(['Sunday', 'Sunday', 'Sunday', 'Sunday', 'Sunday', 'Sunday',
                  'Sunday', 'Sunday', 'Sunday'], dtype=object)
```

```
In [59]: df.diff()
```

```
Out [59]:
```

	Count 1	Count 2
2016-10-02	NaN	NaN
2016-10-16	3.0	-1.0
2016-10-30	9.0	-12.0
2016-11-13	1.0	0.0
2016-11-27	4.0	4.0
2016-12-11	6.0	-1.0
2016-12-25	2.0	7.0
2017-01-08	-2.0	-1.0
2017-01-22	-4.0	-4.0

```
In [60]: df.resample('M').mean()
```

```
Out [60]:
```

	Count 1	Count 2
2016-10-31	110.0	123.333333
2016-11-30	120.0	117.000000
2016-12-31	129.0	121.500000
2017-01-31	126.0	122.000000

```
In [61]: df['2017']
```

```
Out [61]:
```

	Count 1	Count 2
2017-01-08	128	124
2017-01-22	124	120

```
In [62]: df['2016-12']
```

```
Out [62]:
```

	Count 1	Count 2
2016-12-11	128	118
2016-12-25	130	125

```
In [63]: df['2016-12']:
```

```
Out[63]:
```

	Count 1	Count 2
2016-12-11	128	118
2016-12-25	130	125
2017-01-08	128	124
2017-01-22	124	120

```
In [64]: df.asfreq('W', method='ffill')
```

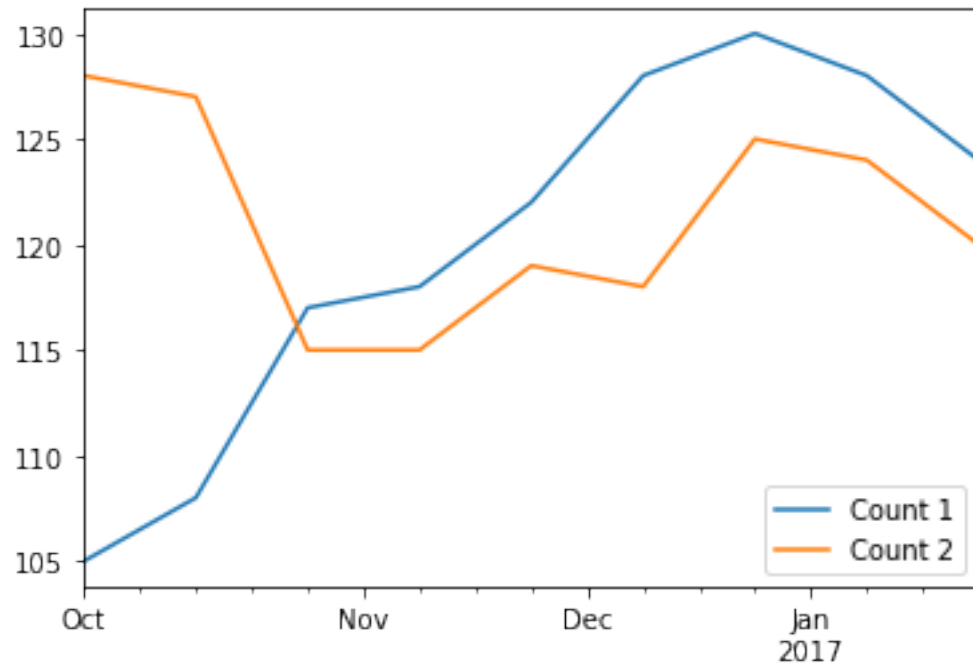
```
Out[64]:
```

	Count 1	Count 2
2016-10-02	105	128
2016-10-09	105	128
2016-10-16	108	127
2016-10-23	108	127
2016-10-30	117	115
2016-11-06	117	115
2016-11-13	118	115
2016-11-20	118	115
2016-11-27	122	119
2016-12-04	122	119
2016-12-11	128	118
2016-12-18	128	118
2016-12-25	130	125
2017-01-01	130	125
2017-01-08	128	124
2017-01-15	128	124
2017-01-22	124	120

```
In [65]: import matplotlib.pyplot as plt
          %matplotlib inline

          df.plot()
```

```
Out[65]: <matplotlib.axes._subplots.AxesSubplot at 0x7ff7068dce10>
```

In []: