



MERGING DATAFRAMES WITH PANDAS

Merging DataFrames



Population DataFrame

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

```
In [2]: population = pd.read_csv('pa_zipcode_population.csv')
```

```
In [3]: print(population)
```

	Zipcode	2010 Census Population
0	16855	282
1	15681	5241
2	18657	11985
3	17307	5899
4	15635	220



Cities DataFrame

```
In [4]: cities = pd.read_csv('pa_zipcode_city.csv')
```

```
In [5]: print(cities)
```

	Zipcode	City	State
0	17545	MANHEIM	PA
1	18455	PRESTON PARK	PA
2	17307	BIGLERVILLE	PA
3	15705	INDIANA	PA
4	16833	CURWENSVILLE	PA
5	16220	CROWN	PA
6	18618	HARVEYS LAKE	PA
7	16855	MINERAL SPRINGS	PA
8	16623	CASSVILLE	PA
9	15635	HANNASTOWN	PA
10	15681	SALTSBURG	PA
11	18657	TUNKHANNOCK	PA
12	15279	PITTSBURGH	PA
13	17231	LEMASTERS	PA
14	18821	GREAT BEND	PA



Merging

```
In [6]: pd.merge(population, cities)
```

```
Out[6]:
```

	Zipcode	2010 Census Population	City	State
0	16855	282	MINERAL SPRINGS	PA
1	15681	5241	SALTSBURG	PA
2	18657	11985	TUNKHANNOCK	PA
3	17307	5899	BIGLERVILLE	PA
4	15635	220	HANNASTOWN	PA



Medal DataFrames

```
In [7]: bronze = pd.read_csv('bronze_sorted.csv')
```

```
In [8]: gold = pd.read_csv('gold_sorted.csv')
```

```
In [9]: print(bronze)
```

	NOC	Country	Total
0	USA	United States	1052.0
1	URS	Soviet Union	584.0
2	GBR	United Kingdom	505.0
3	FRA	France	475.0
4	GER	Germany	454.0

```
In [10]: print(gold)
```

	NOC	Country	Total
0	USA	United States	2088.0
1	URS	Soviet Union	838.0
2	GBR	United Kingdom	498.0
3	ITA	Italy	460.0
4	GER	Germany	407.0



Merging all columns

```
In [11]: pd.merge(bronze, gold)
Out[11]:
Empty DataFrame
Columns: [NOC, Country, Total]
Index: []
```



Merging on

```
In [12]: pd.merge(bronze, gold, on='NOC')
```

```
Out[12]:
```

	NOC	Country_x	Total_x	Country_y	Total_y
0	USA	United States	1052.0	United States	2088.0
1	URS	Soviet Union	584.0	Soviet Union	838.0
2	GBR	United Kingdom	505.0	United Kingdom	498.0
3	GER	Germany	454.0	Germany	407.0



Merging on multiple columns

```
In [13]: pd.merge(bronze, gold, on=['NOC', 'Country'])
```

```
Out[13]:
```

	NOC	Country	Total_x	Total_y
0	USA	United States	1052.0	2088.0
1	URS	Soviet Union	584.0	838.0
2	GBR	United Kingdom	505.0	498.0
3	GER	Germany	454.0	407.0



Using suffixes

```
In [14]: pd.merge(bronze, gold, on=['NOC', 'Country'], suffixes=['_bronze', '_gold'])
```

```
Out[14]:
```

	NOC	Country	Total_bronze	Total_gold
0	USA	United States	1052.0	2088.0
1	URS	Soviet Union	584.0	838.0
2	GBR	United Kingdom	505.0	498.0
3	GER	Germany	454.0	407.0



Counties DataFrame

```
In [15]: counties = pd.read_csv('pa_counties.csv')
```

```
In [16]: print(counties)
```

	CITY NAME	COUNTY NAME
0	SALTSBURG	INDIANA
1	MINERAL SPRINGS	CLEARFIELD
2	BIGLERVILLE	ADAMS
3	HANNASTOWN	WESTMORELAND
4	TUNKHANNOCK	WYOMING

```
In [17]: print(cities.tail())
```

	Zipcode	City	State
10	15681	SALTSBURG	PA
11	18657	TUNKHANNOCK	PA
12	15279	PITTSBURGH	PA
13	17231	LEMASTERS	PA
14	18821	GREAT BEND	PA



Specifying columns to merge

```
In [18]: pd.merge(counties, cities, left_on='CITY NAME', right_on='City')  
Out[18]:
```

	CITY NAME	COUNTY NAME	Zipcode	City	State
0	SALTSBURG	INDIANA	15681	SALTSBURG	PA
1	MINERAL SPRINGS	CLEARFIELD	16855	MINERAL SPRINGS	PA
2	BIGLERVILLE	ADAMS	17307	BIGLERVILLE	PA
3	HANNASTOWN	WESTMORELAND	15635	HANNASTOWN	PA
4	TUNKHANNOCK	WYOMING	18657	TUNKHANNOCK	PA



Switching left/right DataFrames

```
In [19]: pd.merge(cities, counties, left_on='City', right_on='CITY NAME')  
Out[19]:
```

	Zipcode	City	State	CITY NAME	COUNTY NAME
0	17307	BIGLERVILLE	PA	BIGLERVILLE	ADAMS
1	16855	MINERAL SPRINGS	PA	MINERAL SPRINGS	CLEARFIELD
2	15635	HANNASTOWN	PA	HANNASTOWN	WESTMORELAND
3	15681	SALTSBURG	PA	SALTSBURG	INDIANA
4	18657	TUNKHANNOCK	PA	TUNKHANNOCK	WYOMING



MERGING DATAFRAMES WITH PANDAS

Let's practice!



MERGING DATAFRAMES WITH PANDAS

Joining DataFrames



Medal DataFrames

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

```
In [2]: bronze = pd.read_csv('bronze_sorted.csv')
```

```
In [3]: gold = pd.read_csv('gold_sorted.csv')
```

```
In [4]: print(bronze)
```

	NOC	Country	Total
0	USA	United States	1052.0
1	URS	Soviet Union	584.0
2	GBR	United Kingdom	505.0
3	FRA	France	475.0
4	GER	Germany	454.0

```
In [5]: print(gold)
```

	NOC	Country	Total
0	USA	United States	2088.0
1	URS	Soviet Union	838.0
2	GBR	United Kingdom	498.0
3	ITA	Italy	460.0
4	GER	Germany	407.0



Merging with inner join

```
In [6]: pd.merge(bronze, gold, on=['NOC', 'Country'],  
....:           suffixes=['_bronze', '_gold'], how='inner')
```

Out[6]:

	NOC	Country	Total_bronze	Total_gold
0	USA	United States	1052.0	2088.0
1	URS	Soviet Union	584.0	838.0
2	GBR	United Kingdom	505.0	498.0
3	GER	Germany	454.0	407.0



Merging with left join

- Keeps all rows of the left DF in the merged DF
- For rows in the left DF with matches in the right DF:
 - Non-joining columns of right DF are appended to left DF
- For rows in the left DF with no matches in the right DF:
 - Non-joining columns are filled with nulls



Merging with left join

```
In [7]: pd.merge(bronze, gold, on=['NOC', 'Country'],  
....:           suffixes=['_bronze', '_gold'], how='left')
```

```
Out[7]:
```

	NOC	Country	Total_bronze	Total_gold
0	USA	United States	1052.0	2088.0
1	URS	Soviet Union	584.0	838.0
2	GBR	United Kingdom	505.0	498.0
3	FRA	France	475.0	NaN
4	GER	Germany	454.0	407.0



Merging with right join

```
In [8]: pd.merge(bronze, gold, on=['NOC', 'Country'],  
....:           suffixes=['_bronze', '_gold'], how='right')
```

```
Out[8]:
```

	NOC	Country	Total_bronze	Total_gold
0	USA	United States	1052.0	2088.0
1	URS	Soviet Union	584.0	838.0
2	GBR	United Kingdom	505.0	498.0
3	GER	Germany	454.0	407.0
4	ITA	Italy	NaN	460.0



Merging with outer join

```
In [9]: pd.merge(bronze, gold, on=['NOC', 'Country'],  
....:           suffixes=['_bronze', '_gold'], how='outer')
```

```
Out[9]:
```

	NOC	Country	Total_bronze	Total_gold
0	USA	United States	1052.0	2088.0
1	URS	Soviet Union	584.0	838.0
2	GBR	United Kingdom	505.0	498.0
3	FRA	France	475.0	NaN
4	GER	Germany	454.0	407.0
5	ITA	Italy	NaN	460.0



Population & unemployment data

```
In [10]: population = pd.read_csv('population_00.csv', index_col=0)
```

```
In [11]: unemployment = pd.read_csv('unemployment_00.csv', index_col=0)
```

```
In [12]: print(population)
```

```
                2010 Census Population
Zip Code ZCTA
57538                322
59916                130
37660            40038
2860            45199
```

```
In [13]: print(unemployment)
```

```
      unemployment  participants
Zip
2860            0.11        34447
46167           0.02         4800
1097            0.33           42
80808           0.07        4310
```



Using `.join(how='left')`

```
In [16]: population.join(unemployment)
```

```
Out[16]:
```

	2010 Census Population	unemployment	participants
Zip Code ZCTA			
57538	322	NaN	NaN
59916	130	NaN	NaN
37660	40038	NaN	NaN
2860	45199	0.11	34447.0



Using `.join(how='right')`

```
In [17]: population.join(unemployment, how= 'right')
```

```
Out[17]:
```

	2010 Census Population	unemployment	participants
Zip			
2860	45199.0	0.11	34447
46167	NaN	0.02	4800
1097	NaN	0.33	42
80808	NaN	0.07	4310



Using `.join(how='inner')`

```
In [18]: population.join(unemployment, how='inner')
```

```
Out[18]:
```

	2010 Census Population	unemployment	participants
2860	45199	0.11	34447



Using `.join(how='outer')`

```
In [19]: population.join(unemployment, how= 'outer')
```

```
Out[19]:
```

	2010 Census Population	unemployment	participants
1097	NaN	0.33	42.0
2860	45199.0	0.11	34447.0
37660	40038.0	NaN	NaN
46167	NaN	0.02	4800.0
57538	322.0	NaN	NaN
59916	130.0	NaN	NaN
80808	NaN	0.07	4310.0



Which should you use?

- `df1.append(df2)`: stacking vertically
- `pd.concat([df1, df2])`:
 - stacking many horizontally or vertically
 - simple inner/outer joins on Indexes
- `df1.join(df2)`: inner/outer/left/right joins on Indexes
- `pd.merge(df1, df2)`: many joins on multiple columns



MERGING DATAFRAMES WITH PANDAS

Let's practice!



MERGING DATAFRAMES WITH PANDAS

Ordered merges



Software & hardware sales

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

In [2]: software = pd.read_csv('feb-sales-Software.csv', parse_dates=['Date'])
      ....:         .sort_values('Date')

In [3]: hardware = pd.read_csv('feb-sales-Hardware.csv', parse_dates=['Date'])
      ....:         .sort_values('Date')
```



Software & hardware sales

```
In [4]: print(software)
```

	Date	Company	Product	Units
2	2015-02-02 08:33:01	Hooli	Software	3
1	2015-02-03 14:14:18	Initech	Software	13
7	2015-02-04 15:36:29	Streeplex	Software	13
3	2015-02-05 01:53:06	Acme Coporation	Software	19
5	2015-02-09 13:09:55	Mediacore	Software	7
4	2015-02-11 20:03:08	Initech	Software	7
6	2015-02-11 22:50:44	Hooli	Software	4
0	2015-02-16 12:09:19	Hooli	Software	10
8	2015-02-21 05:01:26	Mediacore	Software	3

```
In [5]: print(hardware)
```

	Date	Company	Product	Units
3	2015-02-02 20:54:49	Mediacore	Hardware	9
0	2015-02-04 21:52:45	Acme Coporation	Hardware	14
1	2015-02-07 22:58:10	Acme Coporation	Hardware	1
2	2015-02-19 10:59:33	Mediacore	Hardware	16
4	2015-02-21 20:41:47	Hooli	Hardware	3



Using merge()

```
In [6]: pd.merge(hardware, software)
Out[6]:
Empty DataFrame
Columns: [Date, Company, Product, Units]
Index: []
```



Using merge(how='outer')

```
In [7]: pd.merge(hardware, software, how='outer')
```

```
Out[7]:
```

	Date	Company	Product	Units
0	2015-02-02 20:54:49	Mediacore	Hardware	9
1	2015-02-04 21:52:45	Acme Coporation	Hardware	14
2	2015-02-07 22:58:10	Acme Coporation	Hardware	1
3	2015-02-19 10:59:33	Mediacore	Hardware	16
4	2015-02-21 20:41:47	Hooli	Hardware	3
5	2015-02-02 08:33:01	Hooli	Software	3
6	2015-02-03 14:14:18	Initech	Software	13
7	2015-02-04 15:36:29	Streeplex	Software	13
8	2015-02-05 01:53:06	Acme Coporation	Software	19
9	2015-02-09 13:09:55	Mediacore	Software	7
10	2015-02-11 20:03:08	Initech	Software	7
11	2015-02-11 22:50:44	Hooli	Software	4
12	2015-02-16 12:09:19	Hooli	Software	10
13	2015-02-21 05:01:26	Mediacore	Software	3



Sorting merge(how='outer')

```
In [8]: pd.merge(hardware, software, how='outer').sorted_values('Date')
```

```
Out[8]:
```

	Date		Company	Product	Units
0	2015-02-02 20:54:49		Mediacore	Hardware	9
1	2015-02-04 21:52:45	Acme	Coporation	Hardware	14
2	2015-02-07 22:58:10	Acme	Coporation	Hardware	1
3	2015-02-19 10:59:33		Mediacore	Hardware	16
4	2015-02-21 20:41:47		Hooli	Hardware	3
5	2015-02-02 08:33:01		Hooli	Software	3
6	2015-02-03 14:14:18		Initech	Software	13
7	2015-02-04 15:36:29		Streeplex	Software	13
8	2015-02-05 01:53:06	Acme	Coporation	Software	19
9	2015-02-09 13:09:55		Mediacore	Software	7
10	2015-02-11 20:03:08		Initech	Software	7
11	2015-02-11 22:50:44		Hooli	Software	4
12	2015-02-16 12:09:19		Hooli	Software	10
13	2015-02-21 05:01:26		Mediacore	Software	3



Using merge_ordered()

```
In [9]: pd.merge_ordered(hardware, software)
```

```
Out[9]:
```

	Date	Company	Product	Units
0	2015-02-02 08:33:01	Hooli	Software	3.0
1	2015-02-02 20:54:49	Mediacore	Hardware	9.0
2	2015-02-03 14:14:18	Initech	Software	13.0
3	2015-02-04 15:36:29	Streeplex	Software	13.0
4	2015-02-04 21:52:45	Acme Coporation	Hardware	14.0
5	2015-02-05 01:53:06	Acme Coporation	Software	19.0
6	2015-02-07 22:58:10	Acme Coporation	Hardware	1.0
7	2015-02-09 13:09:55	Mediacore	Software	7.0
8	2015-02-11 20:03:08	Initech	Software	7.0
9	2015-02-11 22:50:44	Hooli	Software	4.0
10	2015-02-16 12:09:19	Hooli	Software	10.0
11	2015-02-19 10:59:33	Mediacore	Hardware	16.0
12	2015-02-21 05:01:26	Mediacore	Software	3.0
13	2015-02-21 20:41:47	Hooli	Hardware	3.0



Using on & suffixes

```
In [10]: pd.merge_ordered(hardware, software, on=['Date', 'Company'],  
      ....:                suffixes=['_hardware', '_software']).head()
```

```
Out[10]:
```

	Date	Company	Product_hardware \
0	2015-02-02 08:33:01	Hooli	NaN
1	2015-02-02 20:54:49	Mediacore	Hardware
2	2015-02-03 14:14:18	Initech	NaN
3	2015-02-04 15:36:29	Streeplex	NaN
4	2015-02-04 21:52:45	Acme Coporation	Hardware

	Units_hardware	Product_software	Units_software
0	NaN	Software	3.0
1	9.0	NaN	NaN
2	NaN	Software	13.0
3	NaN	Software	13.0
4	14.0	NaN	NaN



Stocks data

```
In [11]: stocks = pd.read_csv('stocks-2013.csv')
```

```
In [12]: print(stocks)
```

	Date	AAPL	IBM	CSCO	MSFT
0	2013-01-31	497.822381	197.271905	20.699524	27.236667
1	2013-02-28	456.808953	200.735788	20.988947	27.704211
2	2013-03-31	441.840998	210.978001	21.335000	28.141000
3	2013-04-30	419.764998	204.733636	20.914545	29.870909
4	2013-05-31	446.452730	205.263639	22.386364	33.950909
5	2013-06-30	425.537999	200.850000	24.375500	34.632500
6	2013-07-31	429.157272	194.354546	25.378636	33.650454
7	2013-08-31	484.843635	187.125000	24.948636	32.485000
8	2013-09-30	480.184499	188.767000	24.080000	32.523500
9	2013-10-31	504.744783	180.710002	22.847391	34.382174
10	2013-11-30	524.616499	181.333502	22.204000	37.362500
11	2013-12-31	559.657613	179.114763	21.257619	37.455715



GDP data

```
In [13]: gdp = pd.read_csv('gdp-2013.csv')
```

```
In [14]: print(gdp)
```

	Date	GDP
0	2012-03-31	15973.9
1	2012-06-30	16121.9
2	2012-09-30	16227.9
3	2012-12-31	16297.3
4	2013-03-31	16475.4
5	2013-06-30	16541.4
6	2013-09-30	16749.3
7	2013-12-31	16999.9



Ordered merge

```
In [15]: pd.merge_ordered(stocks, gdp, on='Date')
```

```
Out[15]:
```

	Date	AAPL	IBM	CSCO	MSFT	GDP
0	2012-03-31	NaN	NaN	NaN	NaN	15973.9
1	2012-06-30	NaN	NaN	NaN	NaN	16121.9
2	2012-09-30	NaN	NaN	NaN	NaN	16227.9
3	2012-12-31	NaN	NaN	NaN	NaN	16297.3
4	2013-01-31	497.822381	197.271905	20.699524	27.236667	NaN
5	2013-02-28	456.808953	200.735788	20.988947	27.704211	NaN
6	2013-03-31	441.840998	210.978001	21.335000	28.141000	16475.4
7	2013-04-30	419.764998	204.733636	20.914545	29.870909	NaN
8	2013-05-31	446.452730	205.263639	22.386364	33.950909	NaN
9	2013-06-30	425.537999	200.850000	24.375500	34.632500	16541.4
10	2013-07-31	429.157272	194.354546	25.378636	33.650454	NaN
11	2013-08-31	484.843635	187.125000	24.948636	32.485000	NaN
12	2013-09-30	480.184499	188.767000	24.080000	32.523500	16749.3
13	2013-10-31	504.744783	180.710002	22.847391	34.382174	NaN
14	2013-11-30	524.616499	181.333502	22.204000	37.362500	NaN
15	2013-12-31	559.657613	179.114763	21.257619	37.455715	16999.9



Ordered merge with ffill

```
In [16]: pd.merge_ordered(stocks, gdp, on='Date', fill_method='ffill')
```

```
Out[16]:
```

	Date	AAPL	IBM	CSCO	MSFT	GDP
0	2012-03-31	NaN	NaN	NaN	NaN	15973.9
1	2012-06-30	NaN	NaN	NaN	NaN	16121.9
2	2012-09-30	NaN	NaN	NaN	NaN	16227.9
3	2012-12-31	NaN	NaN	NaN	NaN	16297.3
4	2013-01-31	497.822381	197.271905	20.699524	27.236667	16297.3
5	2013-02-28	456.808953	200.735788	20.988947	27.704211	16297.3
6	2013-03-31	441.840998	210.978001	21.335000	28.141000	16475.4
7	2013-04-30	419.764998	204.733636	20.914545	29.870909	16475.4
8	2013-05-31	446.452730	205.263639	22.386364	33.950909	16475.4
9	2013-06-30	425.537999	200.850000	24.375500	34.632500	16541.4
10	2013-07-31	429.157272	194.354546	25.378636	33.650454	16541.4
11	2013-08-31	484.843635	187.125000	24.948636	32.485000	16541.4
12	2013-09-30	480.184499	188.767000	24.080000	32.523500	16749.3
13	2013-10-31	504.744783	180.710002	22.847391	34.382174	16749.3
14	2013-11-30	524.616499	181.333502	22.204000	37.362500	16749.3
15	2013-12-31	559.657613	179.114763	21.257619	37.455715	16999.9



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