Introduction to Data Science

Data Science Essentials

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Goals for today

- Review last session coding tasks
- Learn about some common data wrangling approaches
- Learn ways to find help (module API, Stack Overflow, etc)
- Intro to markdown

Review: Week 1 Coding Tasks

week1_review notebook

Resources for help when you get stuck

- Google
- Stack Overflow
- Doc Strings

Google

- Be as specific as you can: search for python + package + what you are trying to do.
- Copy the error from Jupyter and paste it right in the search box
- Pay attention to the dates of results - sometimes blog posts, etc. are outdated
- If you're not sure what text to use try asking your question exactly like you would ask another person!

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stack overflow

- Many times your google search will lead you here
- The question is at the top. Remember this is someone’s question and not the answer! Skim the question to ascertain that the issue is similar to yours.
- Scroll through the answers looking for:
  - A green check – this means the original poster accepted this as the best solution.
  - The largest number – this means the most people agreed this is the best solution. Sometimes the largest number is next to the question. This just means a lot of people had the same question!

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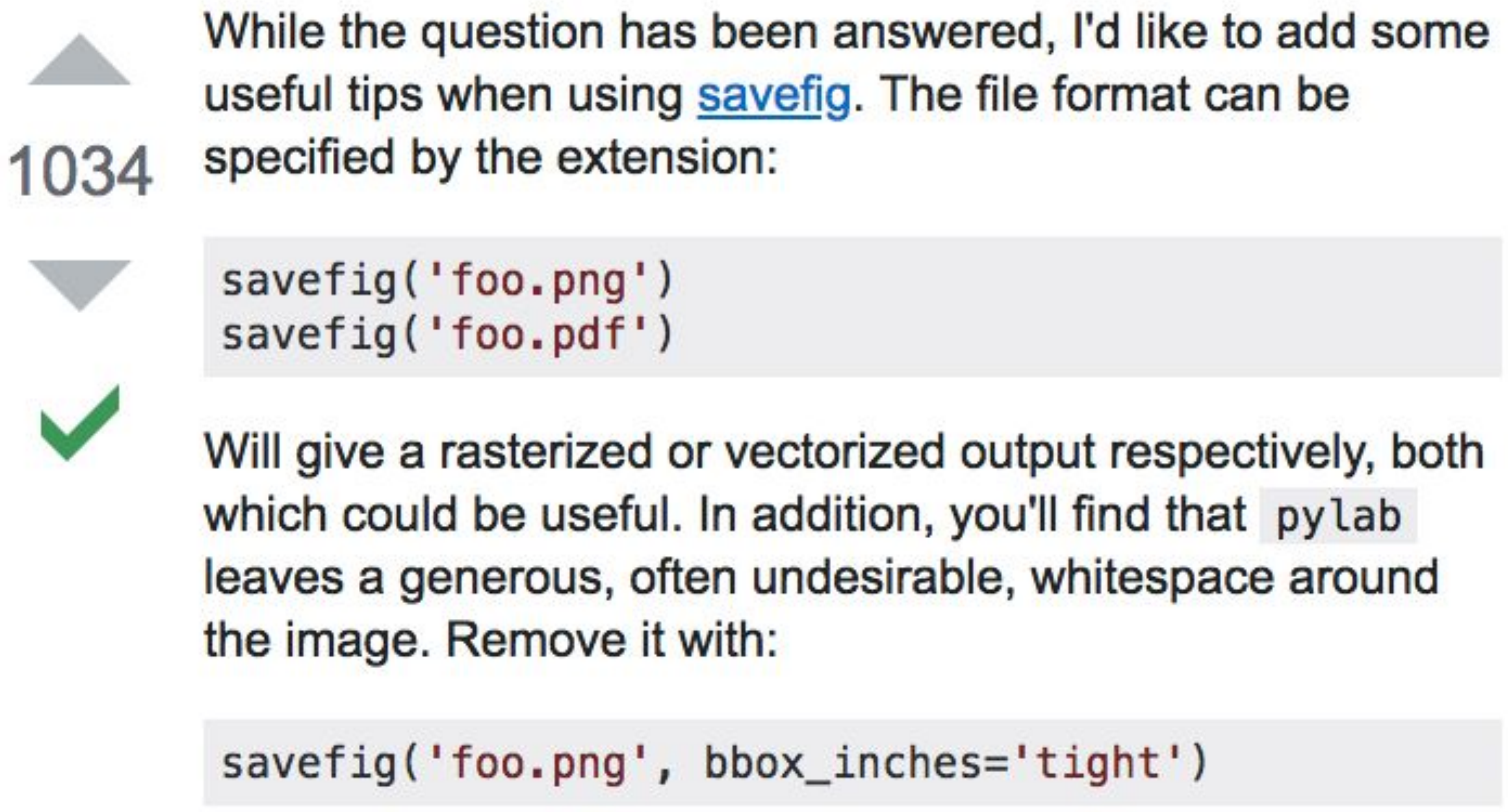


While the question has been answered, I'd like to add some useful tips when using savefig. The file format can be specified by the extension:

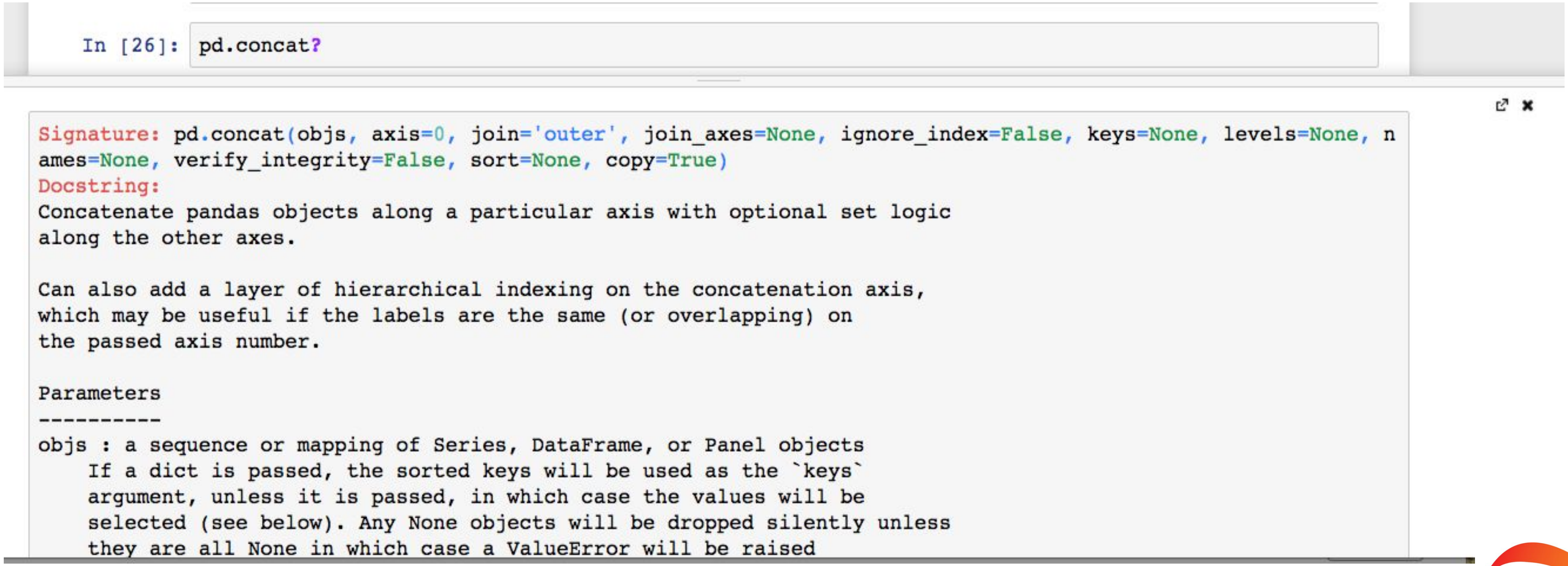
```
savefig('foo.png')
savefig('foo.pdf')
```

Will give a rasterized or vectorized output respectively, both which could be useful. In addition, you'll find that `pylab` leaves a generous, often undesirable, whitespace around the image. Remove it with:

```
savefig('foo.png', bbox_inches='tight')
```

Help within Jupyter

- shift + tab after keyword in a Jupyter cell
- ? + keyword in a Jupyter cell



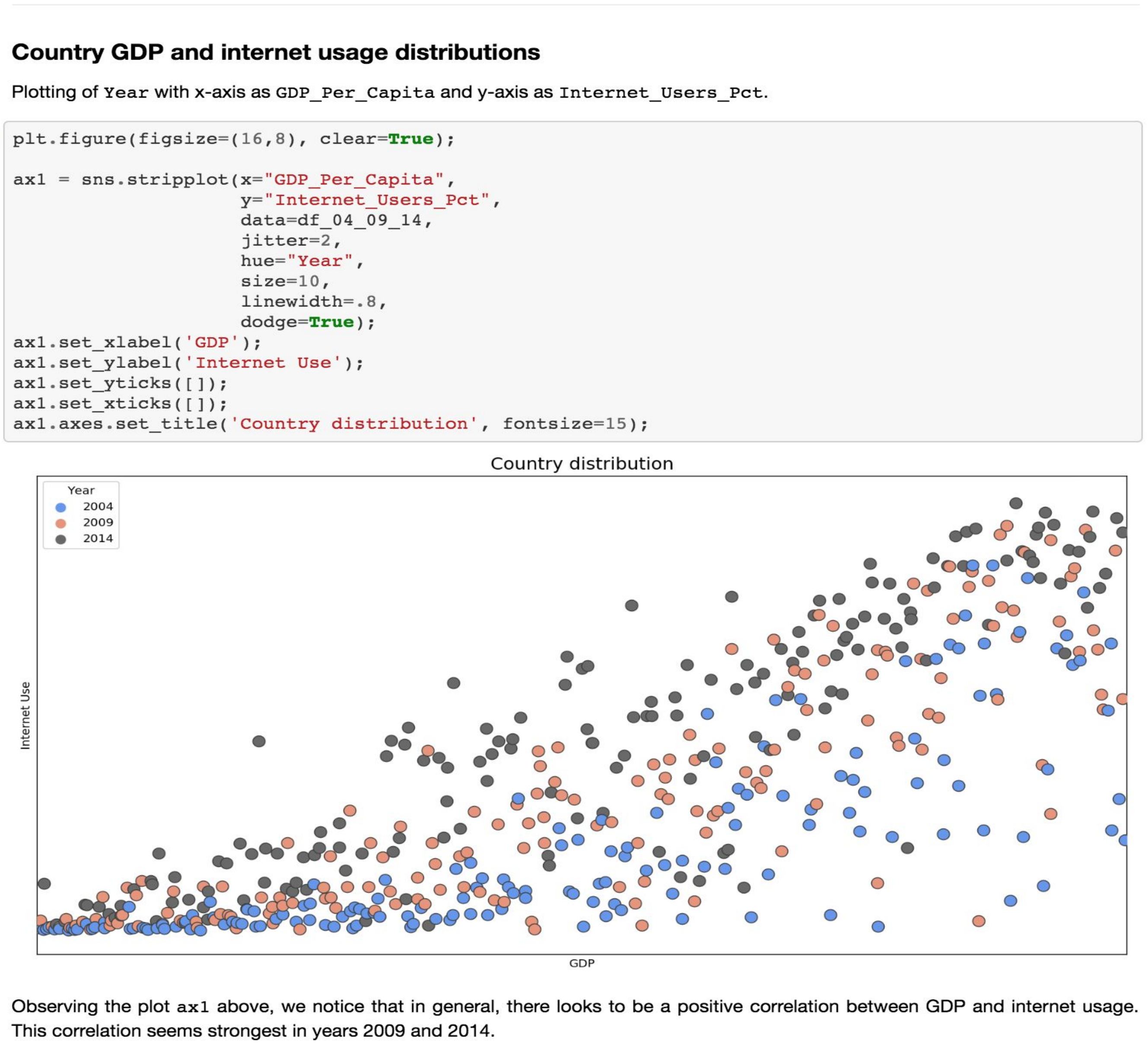
```
In [26]: pd.concat?
```

```
Signature: pd.concat(objs, axis=0, join='outer', join_axes=None, ignore_index=False, keys=None, levels=None, n
ames=None, verify_integrity=False, sort=None, copy=True)
Docstring:
Concatenate pandas objects along a particular axis with optional set logic
along the other axes.

Can also add a layer of hierarchical indexing on the concatenation axis,
which may be useful if the labels are the same (or overlapping) on
the passed axis number.

Parameters
----------
objs : a sequence or mapping of Series, DataFrame, or Panel objects
    If a dict is passed, the sorted keys will be used as the `keys`
    argument, unless it is passed, in which case the values will be
    selected (see below). Any None objects will be dropped silently unless
    they are all None in which case a ValueError will be raised
```

Markdown cells are a useful way to annotate your work:

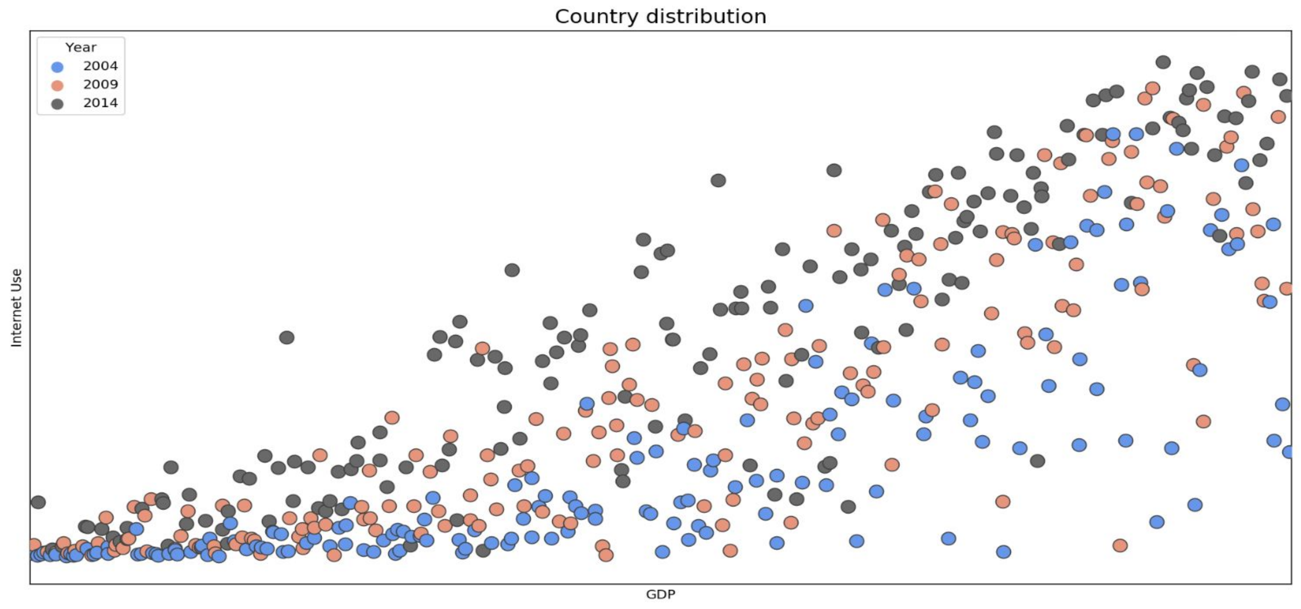


Country GDP and internet usage distributions

Plotting of `Year` with x-axis as `GDP_Per_Capita` and y-axis as `Internet_Users_Pct`.

```
In [8]: plt.figure(figsize=(16,8), clear=True);

        ax1 = sns.stripplot(x="GDP_Per_Capita",
                            y="Internet_Users_Pct",
                            data=df_04_09_14,
                            jitter=2,
                            hue="Year",
                            size=10,
                            linewidth=.8,
                            dodge=True);
        ax1.set_xlabel('GDP');
        ax1.set_ylabel('Internet Use');
        ax1.set_yticks([]);
        ax1.set_xticks([]);
        ax1.axes.set_title('Country distribution', fontsize=15);
```



Observing the plot `ax1` above, we notice that in general, there looks to be a positive correlation between GDP and internet usage. This correlation seems strongest in years 2009 and 2014.

- Comment on choices made
- Comment on trends observed
- Note anomalies/surprises

https://www.markdownguide.org/cheat-sheet/

pandas – https://pandas.pydata.org/pandas-docs/stable/api.html

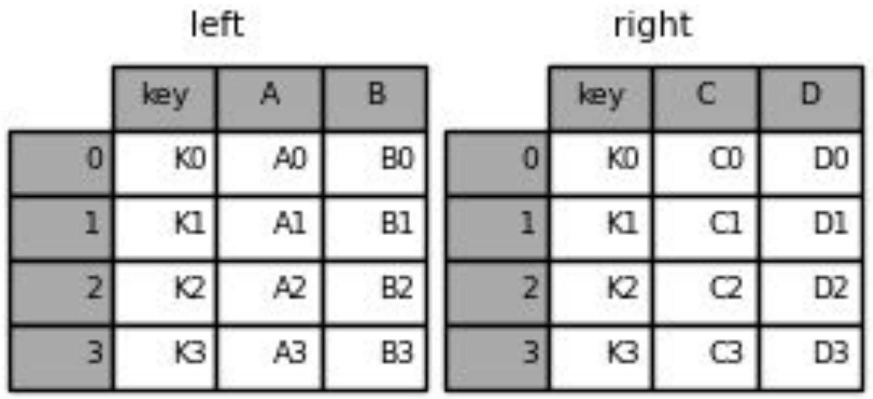
- **String Methods:**
  - **.str.lower()** - convert a column to lowercase
  - **.str.upper()** - convert a column to uppercase
  - **.str.split()** - divide a string column into a list by specifying a delimiter character
  - **.str.replace()** - replace each instance of a string with a different string

- **df.describe() and series.describe()** – returns statistical info (count, mean, sd, quartiles)

- **pd.merge()** - Combines two DataFrames by joining along one or more columns

Merging two DataFrames:

pd.merge(<df1>, <df2>, on = <col or list of cols to join on>, how = <join_type>*)*



left

	key	A	B
0	K0	A0	B0
1	K1	A1	B1
2	K2	A2	B2
3	K3	A3	B3

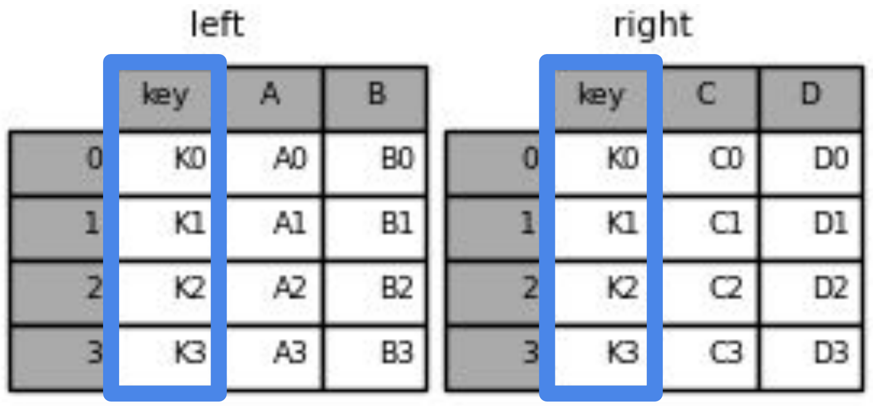
right

	key	C	D
0	K0	C0	D0
1	K1	C1	D1
2	K2	C2	D2
3	K3	C3	D3

- Need one or more “key” columns to join on
- Pastes matching rows together along the key column(s)

Merging two DataFrames:

pd.merge(<df1>, <df2>, on = <col or list of cols to join on>, how = <join_type>*)*



left

	key	A	B
0	K0	A0	B0
1	K1	A1	B1
2	K2	A2	B2
3	K3	A3	B3

right

	key	C	D
0	K0	C0	D0
1	K1	C1	D1
2	K2	C2	D2
3	K3	C3	D3

- Need one or more “key” columns to join on
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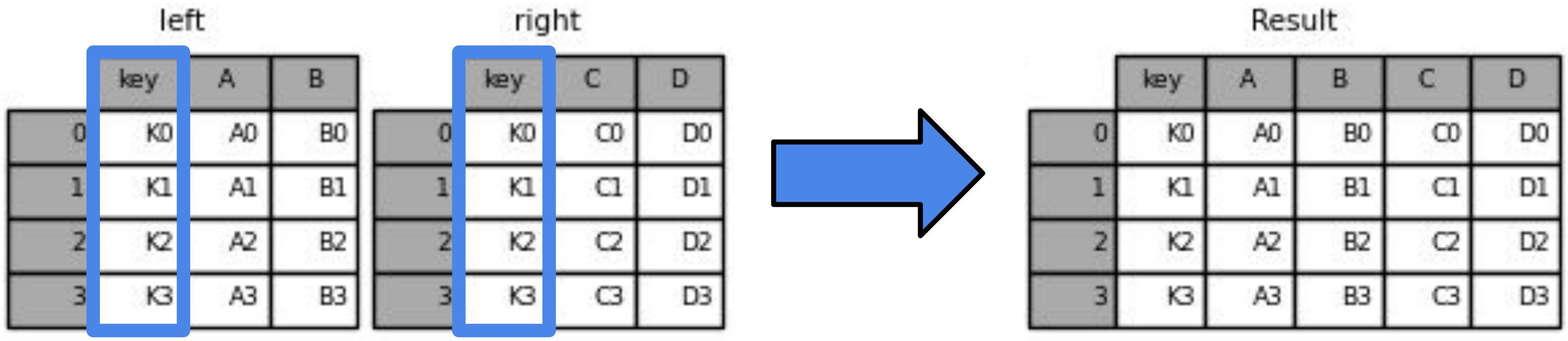
Merging two DataFrames:

pd.merge(<df1>, <df2>, on = <col or list of cols to join on>, how = <join_type>)



left

	key	A	B
0	K0	A0	B0
1	K1	A1	B1
2	K2	A2	B2
3	K3	A3	B3

right

	key	C	D
0	K0	C0	D0
1	K1	C1	D1
2	K2	C2	D2
3	K3	C3	D3

Result

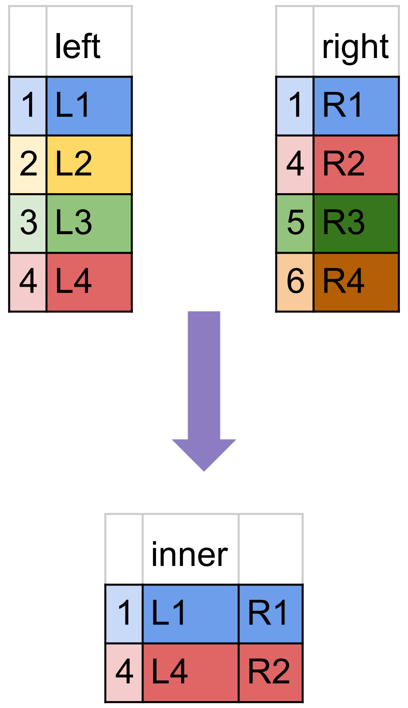
	key	A	B	C	D
0	K0	A0	B0	C0	D0
1	K1	A1	B1	C1	D1
2	K2	A2	B2	C2	D2
3	K3	A3	B3	C3	D3

- **Need one or more “key” columns to join on**
- **Pastes matching rows together along the key column(s)**

INNER JOIN

An **INNER JOIN** keeps **only the rows that have matching values in both tables**.

This is the default type of join when using *pd.merge()*.



	left
1	L1
2	L2
3	L3
4	L4

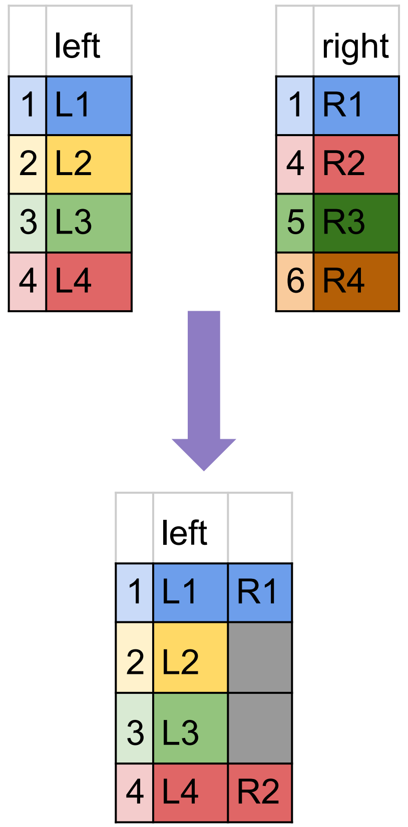
	right
1	R1
4	R2
5	R3
6	R4

	inner	
1	L1	R1
4	L4	R2

LEFT JOIN and RIGHT JOIN

A **LEFT JOIN** keeps all rows from the left table and all matching rows from the right table. A **RIGHT JOIN** works similarly, except all rows from the right table are kept.

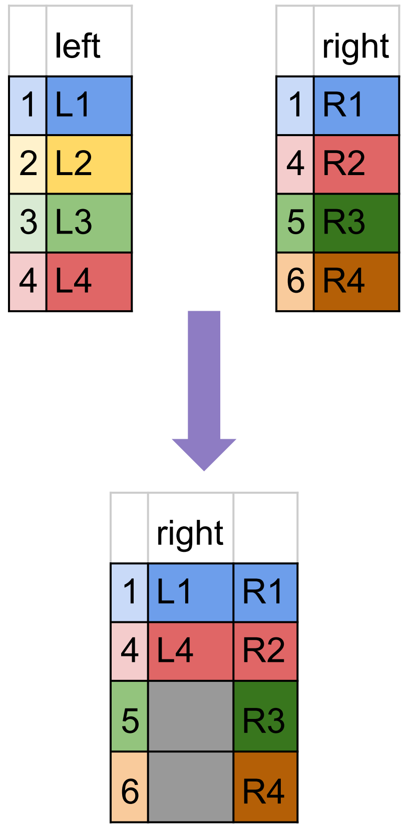
how = “left” or *how = “right”*



	left
1	L1
2	L2
3	L3
4	L4

	right
1	R1
4	R2
5	R3
6	R4

	left	
1	L1	R1
2	L2	
3	L3	
4	L4	R2



	left
1	L1
2	L2
3	L3
4	L4

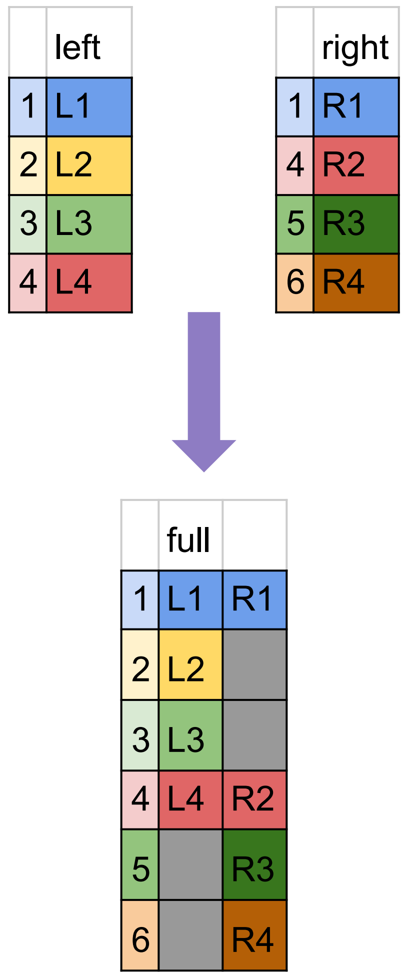
	right
1	R1
4	R2
5	R3
6	R4

	right	
1	L1	R1
4	L4	R2
5		R3
6		R4

OUTER/FULL JOIN

AN **OUTER JOIN** keeps all rows from both tables.

how = “outer”



	left
1	L1
2	L2
3	L3
4	L4

	right
1	R1
4	R2
5	R3
6	R4

	full	
1	L1	R1
2	L2	
3	L3	
4	L4	R2
5		R3
6		R4

Questions?

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