Part-01

Using merge_ordered()

JOINING DATA WITH PANDAS

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datacamp

merge_ordered()

Left Table

A	B	C
A3	B3	C3
A2	B2	C2
A1	B1	C1

Right Table

C	D
C4	D4
C2	D2
C1	D1

Result Table

A	B	C	D
A1	B1	C1	D1
A2	B2	C2	D2
A3	B3	C3	
		C4	D4

Method comparison

`.merge()` method:

- Column(s) to join on
  - `on`, `left_on`, and `right_on`
- Type of join
  - `how` *(left, right, inner, outer)* {{@}}
  - **default** inner
- Overlapping column names
  - `suffixes`
- Calling the method
  - `df1.merge(df2)`

`merge_ordered()` method:

- Column(s) to join on
  - `on`, `left_on`, and `right_on`
- Type of join
  - `how` *(left, right, inner, outer)*
  - **default** outer
- Overlapping column names
  - `suffixes`
- Calling the function
  - `pd.merge_ordered(df1, df2)`

Financial dataset

[1] Photo by Markus Spiske on Unsplash

Stock data

Table Name: `aapl`

```
  date        close
0 2007-02-01  12.087143
1 2007-03-01  13.272857
2 2007-04-01  14.257143
3 2007-05-01  17.312857
4 2007-06-01  17.434286
```

Table Name: `mcd`

```
  date        close
0 2007-01-01  44.349998
1 2007-02-01  43.689999
2 2007-03-01  45.049999
3 2007-04-01  48.279999
4 2007-05-01  50.549999
```

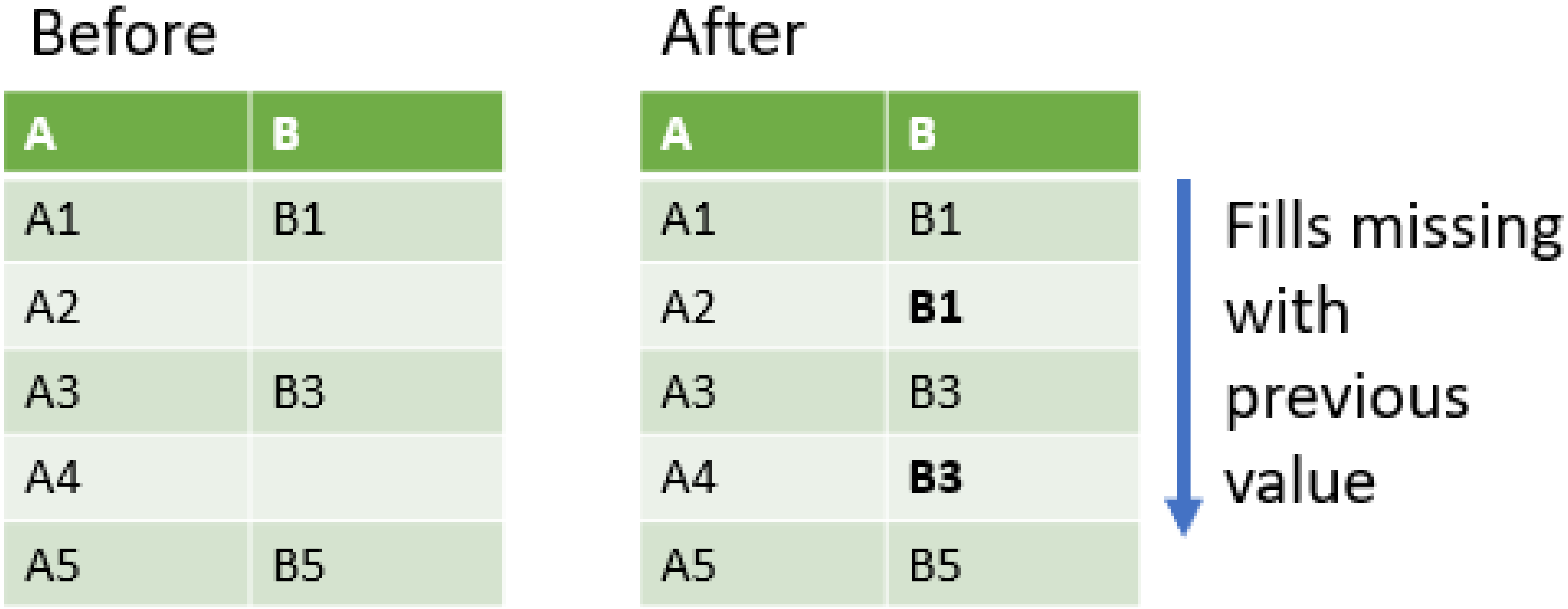
Merging stock data

ordered on "date' here/ join key

```python
import pandas as pd
pd.merge_ordered(aapl, mcd, on='date', suffixes=('_aapl','_mcd'))
```

```
  date        close_aapl  close_mcd
0 2007-01-01  NaN         44.349998
1 2007-02-01  12.087143   43.689999
2 2007-03-01  13.272857   45.049999
3 2007-04-01  14.257143   48.279999
4 2007-05-01  17.312857   50.549999
5 2007-06-01  17.434286   NaN
```

Forward fill



Before

A	B
A1	B1
A2	
A3	B3
A4	
A5	B5

After

A	B
A1	B1
A2	**B1**
A3	B3
A4	**B3**
A5	B5

Fills missing with previous value

Forward fill example

```
pd.merge_ordered(aapl, mcd, on='date',
                 suffixes=('_aapl','_mcd'),
                 fill_method='ffill')
```

```
  date        close_aapl  close_mcd
0 2007-01-01  NaN         44.349998
1 2007-02-01  12.087143   43.689999
2 2007-03-01  13.272857   45.049999
3 2007-04-01  14.257143   48.279999
4 2007-05-01  17.312857   50.549999
5 2007-06-01  17.434286   50.549999
```

```
pd.merge_ordered(aapl, mcd, on='date',
                 suffixes=('_aapl','_mcd'))
```

```
  date        close_aapl  close_mcd
0 2007-01-01  NaN         44.349998
1 2007-02-01  12.087143   43.689999
2 2007-03-01  13.272857   45.049999
3 2007-04-01  14.257143   48.279999
4 2007-05-01  17.312857   50.549999
5 2007-06-01  17.434286   NaN
```

When to use merge_ordered()?

- Ordered data / time series
- Filling in missing values

Part-02

Let's practice!

JOINING DATA WITH PANDAS

Using merge_asof()

JOINING DATA WITH PANDAS

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Using merge_asof()

Left Table

B	C
B2	1
B3	5
B4	10

↔

Right Table

C	D
1	D1
2	D2
3	D3
6	D6
7	D7

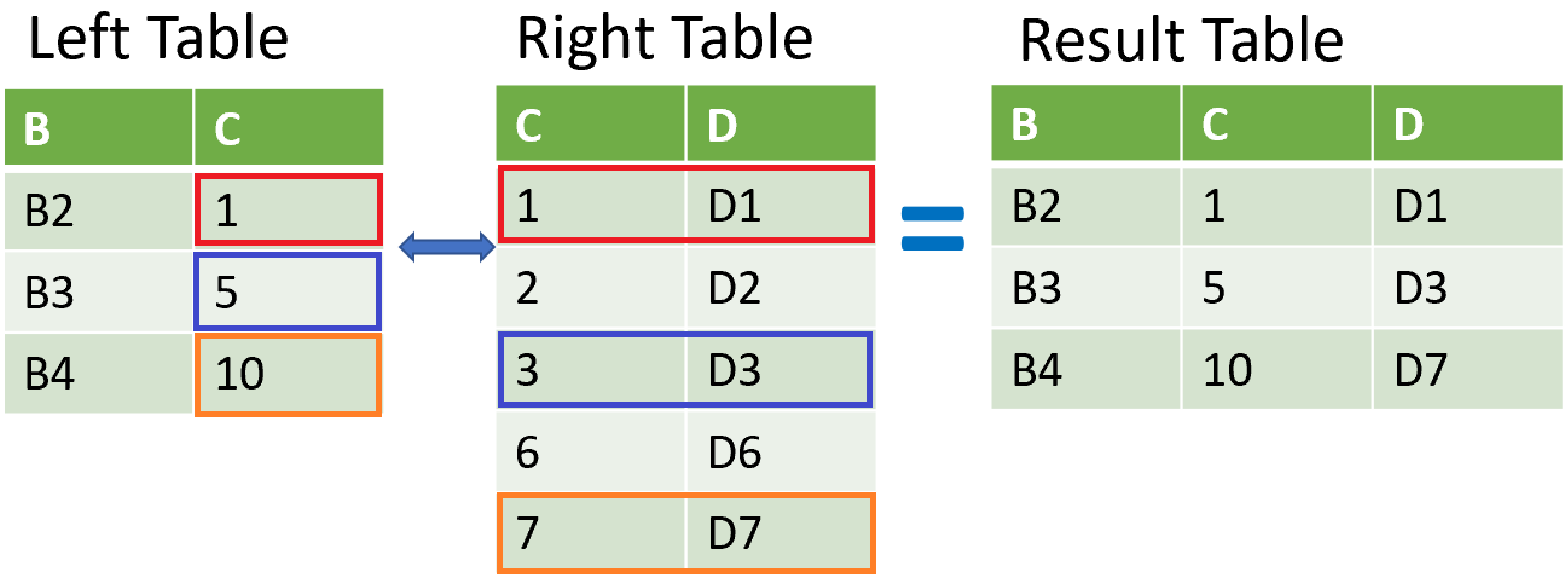
=

Result Table

B	C	D
B2	1	D1
B3	5	D3
B4	10	D7

- Similar to a `merge_ordered()` left join
  - Similar features as `merge_ordered()`
- Match on the nearest key column and not exact matches.
  - Merged "on" columns must be sorted.

Using merge_asof()



Left Table

B	C
B2	1
B3	5
B4	10

Right Table

C	D
1	D1
2	D2
3	D3
6	D6
7	D7

Result Table

B	C	D
B2	1	D1
B3	5	D3
B4	10	D7

- Similar to a `merge_ordered()` left join
  - Similar features as `merge_ordered()`
- Match on the nearest key column and not exact matches.
  - Merged "on" columns must be sorted.

Datasets

Table Name: `visa`

```
  date_time            close
0 2017-11-17 16:00:00  110.32
1 2017-11-17 17:00:00  110.24
2 2017-11-17 18:00:00  110.065
3 2017-11-17 19:00:00  110.04
4 2017-11-17 20:00:00  110.0
5 2017-11-17 21:00:00  109.9966
6 2017-11-17 22:00:00  109.82
```

Table Name: `ibm`

```
   date_time            close
0  2017-11-17 15:35:12  149.3
1  2017-11-17 15:40:34  149.13
2  2017-11-17 15:45:50  148.98
3  2017-11-17 15:50:20  148.99
4  2017-11-17 15:55:10  149.11
5  2017-11-17 16:00:03  149.25
6  2017-11-17 16:05:06  149.5175
7  2017-11-17 16:10:12  149.57
8  2017-11-17 16:15:30  149.59
9  2017-11-17 16:20:32  149.82
10 2017-11-17 16:25:47  149.96
```

merge_asof() example

```
pd.merge_asof(visa, ibm, on='date_time',
              suffixes=('_visa','_ibm'))
```

```
  date_time           close_visa  close_ibm
0 2017-11-17 16:00:00 110.32      149.11
1 2017-11-17 17:00:00 110.24      149.83
2 2017-11-17 18:00:00 110.065     149.59
3 2017-11-17 19:00:00 110.04      149.505
4 2017-11-17 20:00:00 110.0       149.42
5 2017-11-17 21:00:00 109.9966    149.26
6 2017-11-17 22:00:00 109.82      148.97
```

Table Name: `ibm`

```
   date_time            close
0  2017-11-17 15:35:12  149.3
1  2017-11-17 15:40:34  149.13
2  2017-11-17 15:45:50  148.98
3  2017-11-17 15:50:20  148.99
4  2017-11-17 15:55:10  149.11
5  2017-11-17 16:00:03  149.25
6  2017-11-17 16:05:06  149.5175
7  2017-11-17 16:10:12  149.57
8  2017-11-17 16:15:30  149.59
9  2017-11-17 16:20:32  149.82
10 2017-11-17 16:25:47  149.96
```

merge_asof() example with direction

```
pd.merge_asof(visa, ibm, on=['date_time'],
              suffixes=('_visa','_ibm'),
              direction='forward')
```

```
  date_time            close_visa  close_ibm
0 2017-11-17 16:00:00  110.32      149.25
1 2017-11-17 17:00:00  110.24      149.6184
2 2017-11-17 18:00:00  110.065     149.59
3 2017-11-17 19:00:00  110.04      149.505
4 2017-11-17 20:00:00  110.0       149.42
5 2017-11-17 21:00:00  109.9966    149.26
6 2017-11-17 22:00:00  109.82      148.97
```

Table Name: `ibm`

```
   date_time            close
0  2017-11-17 15:35:12  149.3
1  2017-11-17 15:40:34  149.13
2  2017-11-17 15:45:50  148.98
3  2017-11-17 15:50:20  148.99
4  2017-11-17 15:55:10  149.11
5  2017-11-17 16:00:03  149.25
6  2017-11-17 16:05:06  149.5175
7  2017-11-17 16:10:12  149.57
8  2017-11-17 16:15:30  149.59
9  2017-11-17 16:20:32  149.82
10 2017-11-17 16:25:47  149.96
```

When to use merge_asof()

- Data sampled from a process
- Developing a training set (no data leakage)

on='time_column': Match on a datetime column (must be sorted).

direction='forward': Match to the next row in time.

direction='backward': Match to the previous row in time.

direction='nearest': Match to whichever is closest.

Let's practice!

JOINING DATA WITH PANDAS

Part - 03

Selecting data with .query()

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The .query() method

```
.query('SOME SELECTION STATEMENT')
```

- Accepts an input string
  - Input string used to determine what rows are returned
  - Input string similar to statement after **WHERE** clause in **SQL** statement
    - **Prior knowledge of SQL is not necessary**

Querying on a single condition

This table is `stocks`

table

```
stocks.query('nike >= 90')
```

```
  date        disney      nike
0 2019-07-01  143.009995  86.029999
1 2019-08-01  137.259995  84.5
2 2019-09-01  130.320007  93.919998
3 2019-10-01  129.919998  89.550003
4 2019-11-01  151.580002  93.489998
5 2019-12-01  144.630005  101.309998
6 2020-01-01  138.309998  96.300003
7 2020-02-01  117.650002  89.379997
8 2020-03-01  96.599998   82.739998
9 2020-04-01  99.580002   84.629997
```

```
  date        disney      nike
2 2019-09-01  130.320007  93.919998
4 2019-11-01  151.580002  93.489998
5 2019-12-01  144.630005  101.309998
6 2020-01-01  138.309998  96.300003
```

Querying on a multiple conditions, "and", "or"

This table is `stocks`

```
  date        disney      nike
0 2019-07-01  143.009995  86.029999
1 2019-08-01  137.259995  84.5
2 2019-09-01  130.320007  93.919998
3 2019-10-01  129.919998  89.550003
4 2019-11-01  151.580002  93.489998
5 2019-12-01  144.630005  101.309998
6 2020-01-01  138.309998  96.300003
7 2020-02-01  117.650002  89.379997
8 2020-03-01  96.599998   82.739998
9 2020-04-01  99.580002   84.629997
```

```
stocks.query('nike > 90 and disney < 140')
```

```
  date        disney      nike
2 2019-09-01  130.320007  93.919998
6 2020-01-01  138.309998  96.300003
```

```
stocks.query('nike > 96 or disney < 98')
```

```
   date        disney      nike
5  2019-12-01  144.630005  101.309998
6  2020-01-01  138.309998  96.300003
28 020-03-01  96.599998   82.739998
```

Updated dataset

This table is `stocks_long`

```
  date        stock   close
0 2019-07-01  disney  143.009995
1 2019-08-01  disney  137.259995
2 2019-09-01  disney  130.320007
3 2019-10-01  disney  129.919998
4 2019-11-01  disney  151.580002
5 2019-07-01  nike    86.029999
6 2019-08-01  nike    84.5
7 2019-09-01  nike    93.919998
8 2019-10-01  nike    89.550003
9 2019-11-01  nike    93.489998
```

Using .query() to select text

```
stocks_long.query('stock=="disney" or (stock=="nike" and close < 90)')
```

```
  date        stock   close
0 2019-07-01  disney  143.009995
1 2019-08-01  disney  137.259995
2 2019-09-01  disney  130.320007
3 2019-10-01  disney  129.919998
4 2019-11-01  disney  151.580002
5 2019-07-01  nike    86.029999
6 2019-08-01  nike    84.5
8 2019-10-01  nike    89.550003
```

Let's practice!

JOINING DATA WITH PANDAS

Reshaping data with .melt()

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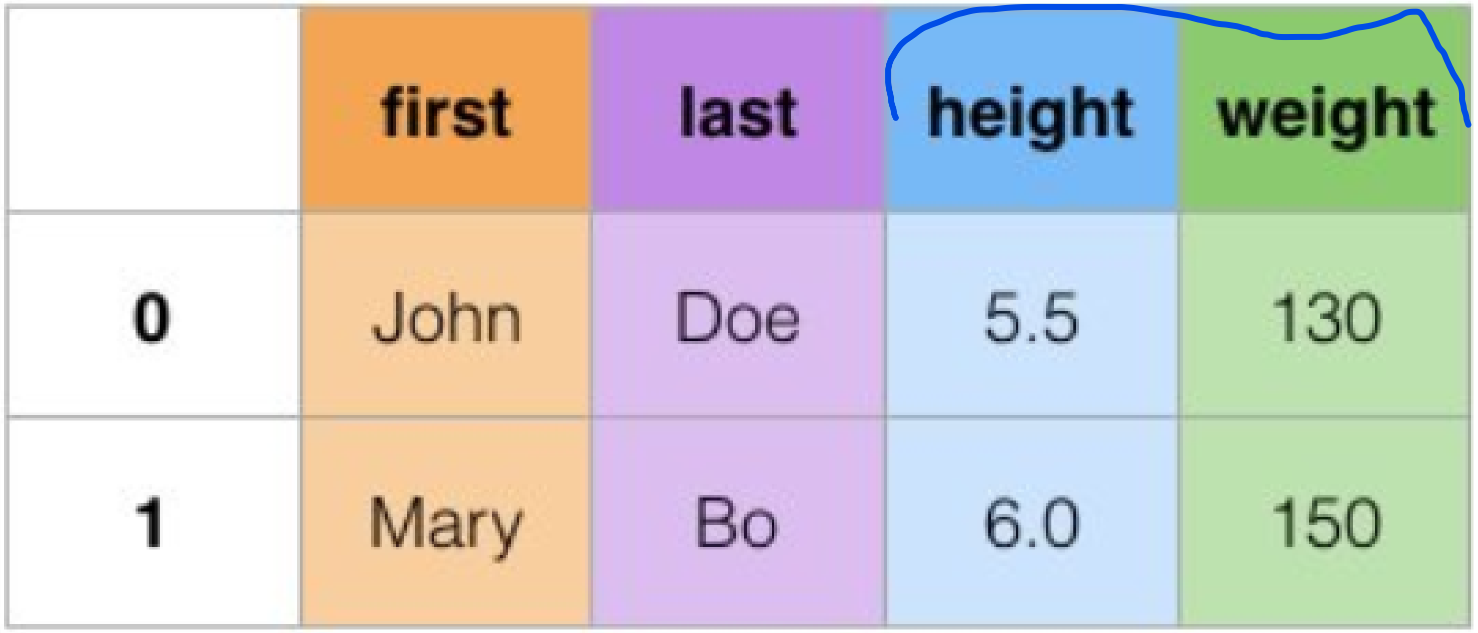
Wide versus long data

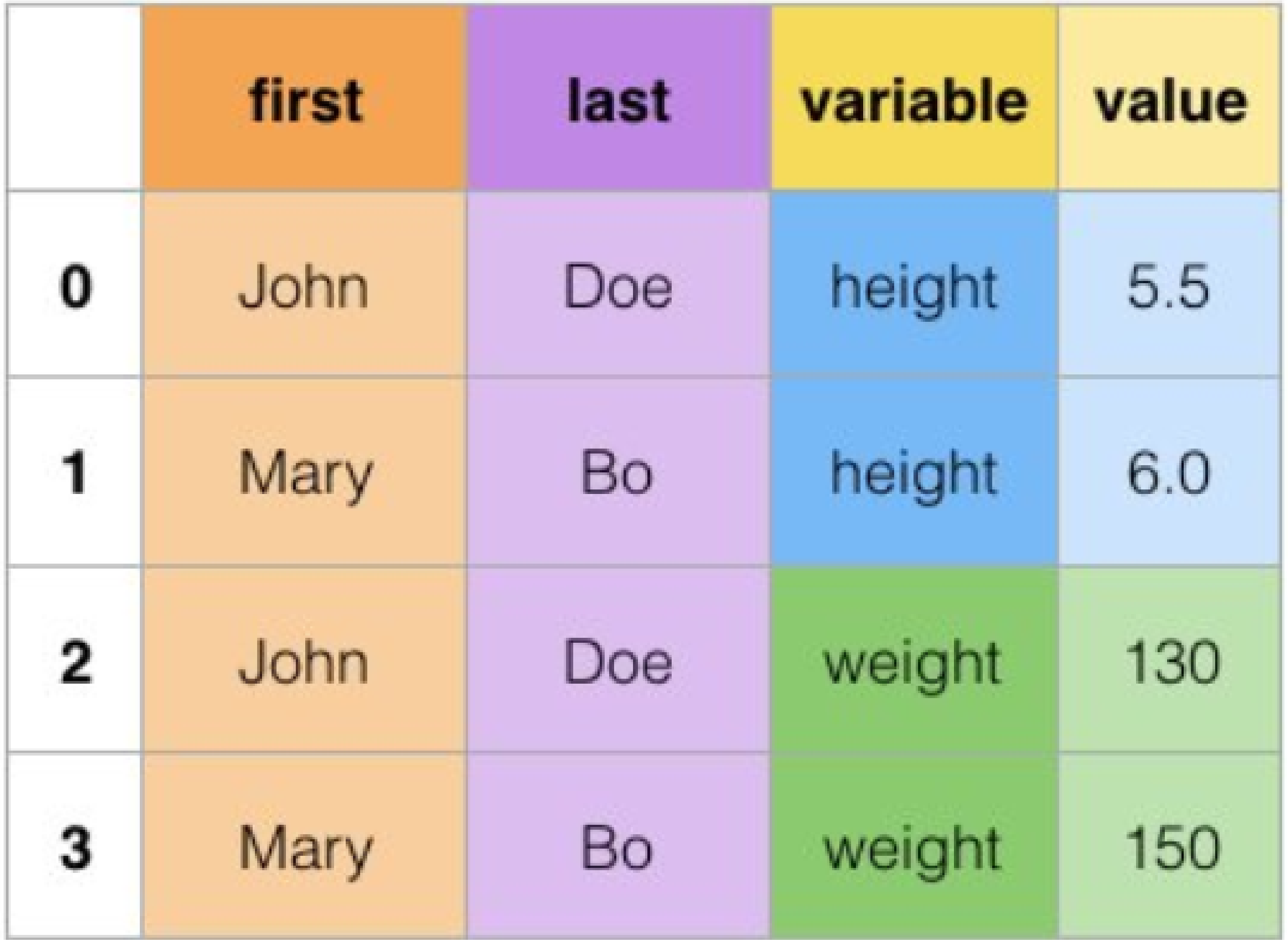
Wide Format

variable



	first	last	height	weight
0	John	Doe	5.5	130
1	Mary	Bo	6.0	150

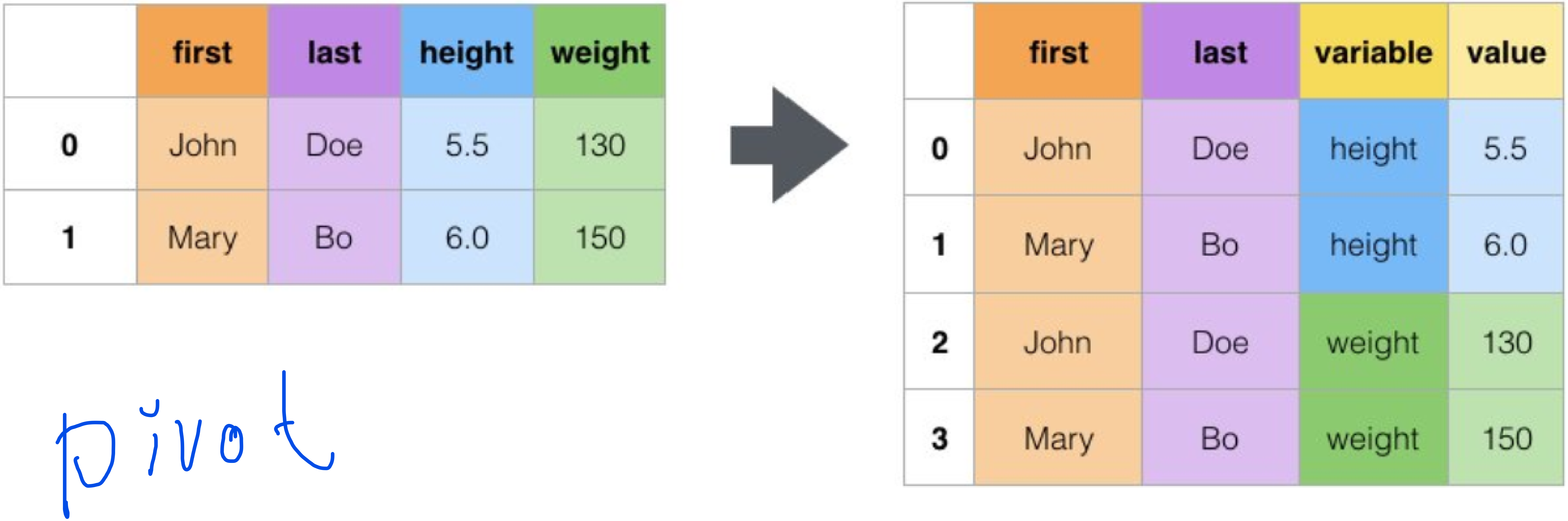
Long Format



	first	last	variable	value
0	John	Doe	height	5.5
1	Mary	Bo	height	6.0
2	John	Doe	weight	130
3	Mary	Bo	weight	150

What does the .melt() method do?

- The melt method will allow us to unpivot our dataset



	first	last	height	weight
0	John	Doe	5.5	130
1	Mary	Bo	6.0	150

	first	last	variable	value
0	John	Doe	height	5.5
1	Mary	Bo	height	6.0
2	John	Doe	weight	130
3	Mary	Bo	weight	150

pivot

unpivot

Dataset in wide format

This table is called `social_fin`

variable

```
  financial      company   2019      2018      2017      2016
0 total_revenue  twitter   3459329   3042359   2443299   2529619
1 gross_profit   twitter   2322288   2077362   1582057   1597379
2 net_income     twitter   1465659   1205596   -108063   -456873
3 total_revenue  facebook  70697000  55838000  40653000  27638000
4 gross_profit   facebook  57927000  46483000  35199000  23849000
5 net_income     facebook  18485000  22112000  15934000  10217000
```

Example of .melt()

it reduces the number of cols here...making the table more compact
but it can increase number of rows

```
social_fin_tall = social_fin.melt(id_vars=['financial','company'])
print(social_fin_tall.head(10))
```

```
  financial      company   variable  value
0 total_revenue  twitter   2019      3459329
1 gross_profit   twitter   2019      2322288
2 net_income     twitter   2019      1465659
3 total_revenue  facebook  2019      70697000
4 gross_profit   facebook  2019      57927000
5 net_income     facebook  2019      18485000
6 total_revenue  twitter   2018      3042359
7 gross_profit   twitter   2018      2077362
8 net_income     twitter   2018      1205596
9 total_revenue  facebook  2018      55838000
```

Melting with value_vars

```
social_fin_tall = social_fin.melt(id_vars=['financial','company'],
                                  value_vars=['2018','2017'])
print(social_fin_tall.head(9))
```

cols to unpivot

```
  financial       company   variable  value
0 total_revenue  twitter   2018      3042359
1 gross_profit   twitter   2018      2077362
2 net_income     twitter   2018      1205596
3 total_revenue  facebook  2018      55838000
4 gross_profit   facebook  2018      46483000
5 net_income     facebook  2018      22112000
6 total_revenue  twitter   2017      2443299
7 gross_profit   twitter   2017      1582057
8 net_income     twitter   2017      -108063
```

col range select

ur_tall = ur_wide.melt(id_vars="year",value_vars = ur_wide.loc["jan":"dec"].columns)

Melting with column names

```
social_fin_tall = social_fin.melt(id_vars=['financial','company'],
                                  value_vars=['2018','2017'],
                                  var_name='year', value_name='dollars')
print(social_fin_tall.head(8))
```

```
  financial      company   year  dollars
0 total_revenue  twitter   2018  3042359
1 gross_profit   twitter   2018  2077362
2 net_income     twitter   2018  1205596
3 total_revenue  facebook  2018  55838000
4 gross_profit   facebook  2018  46483000
5 net_income     facebook  2018  22112000
6 total_revenue  twitter   2017  2443299
7 gross_profit   twitter   2017  1582057
```

Let's practice!

JOINING DATA WITH PANDAS

Course wrap-up

JOINING DATA WITH PANDAS

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Instructor

You're this high performance race car now

[1] Photo by jae park from Pexels

Data merging basics

- Inner join using `.merge()`
- One-to-one and one-to-many relationships
- Merging multiple tables

Merging tables with different join types

- Inner join using `.merge()`
- One-to-one and one-to-one relationships
- Merging multiple tables
- **Left, right, and outer joins**
- **Merging a table to itself and merging on indexes**

Advanced merging and concatenating

- Inner join using `.merge()`
- One-to-one and one-to-one relationships
- Merging multiple tables
- Left, right, and outer joins
- Merging a table to itself and merging on indexes
- **Filtering joins**
  - **semi and anti joins**
- **Combining data vertically with `.concat()`**
- **Verify data integrity**

Merging ordered and time-series data

- Inner join using `.merge()`
- One-to-one and one-to-one relationships
- Merging multiple tables
- Left, right, and outer joins
- Merging a table to itself and merging on indexes
- Filtering joins
  - semi and anti joins
- Combining data vertically with `.concat()`
- Verify data integrity
- **Ordered data**
  - **`merge_ordered()` and `merge_asof()`**
- **Manipulating data with `.melt()`**

Thank you!

JOINING DATA WITH PANDAS