Creating a DataFrame

INTERMEDIATE PYTHON FOR FINANCE

Kennedy Behrman
Data Engineer, Author, Founder

Pandas

```
import pandas as pd
```

```
print(pd)
```

```
<module 'pandas' from '.../pandas/__init__.py'>
```

Pandas DataFrame

```
pd.DataFrame()
```

Pandas DataFrame

	Col 1	Col 2	Col 3
0	v1	a	00
1	v2	b	01
2	v3	c	13.02

From dict

```
data = {'Bank Code': ['BA', 'AAD', 'BA'],
        'Account#': ['ajfdk2', '1234nmk', 'mm3d90'],
        'Balance':[1222.00, 390789.11, 13.02]}
```

```
df = pd.DataFrame(data=data)
```

From dict

```
data = {'Bank Code': ['BA', 'AAD', 'BA'],
        'Account#': ['ajfdk2', '1234nmk', 'mm3d90'],
        'Balance':[1222.00, 390789.11, 13.02]}
```

```
df = pd.DataFrame(data=data)
```

	Bank Code	Account#	Balance
0	BA	ajfdk2	1222.00
1	AAD	1234nmk	390789.11
1	BA	mm3d90	13.02

From list of dicts

```
data = [{'Bank Code': 'BA', 'Account#': 'ajfdk2',  'Balance': 1222.00},
        {'Bank Code': 'AAD', 'Account#': '1234nmk', 'Balance': 390789.11},
        {'Bank Code': 'BA', 'Account#': 'mm3d90', 'Balance': 13.02}]
df = pd.DataFrame(data=data)
```

From list of dicts

```
data = [{'Bank Code': 'BA', 'Account#': 'ajfdk2',  'Balance': 1222.00},
        {'Bank Code': 'AAD', 'Account#': '1234nmk', 'Balance': 390789.11},
        {'Bank Code': 'BA', 'Account#': 'mm3d90', 'Balance': 13.02}]
df = pd.DataFrame(data=data)
```

	Bank Code	Account#	Balance
0	BA	ajfdk2	1222.00
1	AAD	1234nmk	390789.11
1	BA	mm3d90	13.02

From list of lists

```
data = [['BA',  'ajfdk2',  1222.00],
        ['AAD', '1234nmk', 390789.11],
        ['BA',  'mm3d90',  13.02]]
df = pd.DataFrame(data=data)
```

From list of lists

```
data = [['BA',  'ajfdk2',  1222.00],
        ['AAD', '1234nmk', 390789.11],
        ['BA',  'mm3d90',  13.02]]
df = pd.DataFrame(data=data)
```

	0	1	2
0	BA	ajfdk2	1222.00
1	AAD	1234nmk	390789.11
1	BA	mm3d90	13.02

From list of lists with column names

```
data = [['BA',  'ajfdk2',  1222.00],
        ['AAD', '1234nmk', 390789.11],
        ['BA',  'mm3d90',  13.02]]
columns = ['Bank Code', 'Account#', 'Balance']
df = pd.DataFrame(data=data, columns=columns)
```

	Bank Code	Account#	Balance
0	BA	ajfdk2	1222.00
1	AAD	1234nmk	390789.11
1	BA	mm3d90	13.02

From list of lists with column names

```
data = [['BA',  'ajfdk2',  1222.00],
        ['AAD', '1234nmk', 390789.11],
        ['BA',  'mm3d90',  13.02]]
columns = ['Bank Code', 'Account#', 'Balance']
df = pd.DataFrame(data=data, columns=columns)
```

	Bank Code	Account#	Balance
0	BA	ajfdk2	1222.00
1	AAD	1234nmk	390789.11
2	BA	mm3d90	13.02

Reading data

- Excel `pd.read_excel`
- JSON `pd.read_json`
- HTML `pd.read_html`
- Pickle `pd.read_pickle`
- Sql `pd.read_sql`
- Csv `pd.read_csv`

CSV

Comma separated values

```
client id,trans type, amount
14343,buy,23.0
0574,sell,2000
7093,dividend,2234
```

Reading a csv file

```
df = pd.read_csv('/data/daily/transactions.csv')
```

Reading a csv file

```
df = pd.read_csv('/data/daily/transactions.csv')
```

client id	trans type	amount
14343	buy	23.0
0574	sell	2000
7093	dividend	2234

Non-comma csv

```
client id|trans type| amount
14343|buy|23.0
0574|sell|2000
7093|dividend|2234
```

Non-comma csv

```
df = pd.read_csv('/data/daily/transactions.csv', sep='|')
```

Non-comma csv

```
df = pd.read_csv('/data/daily/transactions.csv', sep='|')
```

client id	trans type	amount
14343	buy	23.0
0574	sell	2000
7093	dividend	2234

Let's practice!

INTERMEDIATE PYTHON FOR FINANCE

Accessing Data

INTERMEDIATE PYTHON FOR FINANCE

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Account Balance

Introducing lesson data

	Bank Code	Account#	Balance
a	BA	ajfdk2	1222.00
b	AAD	1234nmk	390789.11
c	BA	mm3d90	13.02

```
accounts
```

Access column using brackets

```
accounts['Balance']
```

Access column using brackets

```
accounts['Balance']
```

a	1222.00
b	390789.11
c	13.02

Name: Balance, dtype: float6

Access column using dot-syntax

```
accounts.Balance
```

	Balance
a	1222.00
b	390789.11
c	13.02

Access multiple columns

```
accounts[['Bank Code', 'Account#']]
```

Access multiple columns

```
accounts[['Bank Code', 'Account#']]
```

	Bank Code	Account#
a	BA	ajfdk2
b	AAD	1234nmk
c	BA	mm3d90

Access rows using brackets

```
accounts[0:2]
```

Access rows using brackets

```
accounts[0:2]
```

	Bank Code	Account#	Balance
a	BA	ajfdk2	1222.00
b	AAD	1234nmk	390789.11

Access rows using brackets

```
accounts[[True, False, True]]
```

Access rows using brackets

```
accounts[[True, False, True]]
```

	Bank Code	Account#	Balance
a	BA	ajfdk2	1222.00
c	BA	mm3d90	13.02

loc and iloc

- `loc` access by name
- `iloc` access by position

loc

```
accounts.loc['b']
```

Bank Code	AAD
Account#	1234nmk
Balance	390789

Name: b, dtype: object

loc

```
accounts.loc[['a','c']]
```

	Bank Code	Account#	Balance
a	BA	ajfdk2	1222.00
c	BA	mm3d90	13.02

```
df.loc[[True, False, True]]
```

	Bank Code	Account#	Balance
a	BA	ajfdk2	1222.00
c	BA	mm3d90	13.02

Columns with loc

```
accounts.loc['a':'c','Balance']
```

```
accounts.loc['a':'c', ['Balance','Account#']]
```

```
accounts.loc['a':'c',[True,False,True]]
```

```
accounts.loc['a':'c','Bank Code':'Balance']
```

Columns with loc

```
accounts.loc['a':'c',['Bank Code', 'Balance']]
```

Columns with loc

```
accounts.loc['a':'c',['Bank Code', 'Balance']]
```

	Bank Code	Balance
a	BA	1222.00
b	AAD	390789.11
c	BA	13.02

iloc

```
accounts.iloc[0:2, [0,2]]
```

iloc

```
accounts.iloc[0:2, [0,2]]
```

iloc

```
accounts.iloc[0:2, [0,2]]
```

	Bank Code	Balance
a	BA	1222.00
b	AAD	390789.11

Setting a single value

	Bank Code	Account#	Balance
a	BA	ajfdk2	1222.00
b	AAD	1234nmk	390789.11
c	BA	mm3d90	13.02

```
accounts.loc['a', 'Balance'] = 0
```

Setting a single value

	Bank Code	Account#	Balance
a	BA	ajfdk2	0.00
b	AAD	1234nmk	390789.11
c	BA	mm3d90	13.02

```
accounts.loc['a', 'Balance'] = 0
```

Setting multiple values

	Bank Code	Account#	Balance
a	BA	ajfdk2	1222.00
b	AAD	1234nmk	390789.11
c	BA	mm3d90	13.02

```
accounts.iloc[:2, 1:] = 'NA'
```

Setting multiple columns

	Bank Code	Account#	Balance
a	BA	NA	NA
b	AAD	NA	NA
c	BA	mm3d90	13.02

```
accounts.iloc[:2, 1:] = 'NA'
```

Let's practice!

INTERMEDIATE PYTHON FOR FINANCE

Aggregating and summarizing

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DataFrame methods

- `.count()`
- `.min()`
- `.max()`
- `.first()`
- `.last()`
- `.sum()`
- `.prod()`
- `.mean()`
- `.median()`
- `.std()`
- `.var()`

Axis

Rows

- default
- `axis=0`
- `axis='rows'`

Columns

- `axis=1`
- `axis='columns'`

Count

	AAD	GDDL	IMA
2020-10-03	300.22	75.32	39.90
2020-10-04	301.49	79.99	44.99
2020-10-05	300.00	80.00	45.33
2020-10-07	302.90	82.92	49.00

```
df.count()
```

```
AAD      4
GDDL     4
IMA      4
dtype: int64
```

Sum

	AAD	GDDL	IMA
2020-10-03	300.22	75.32	39.90
2020-10-04	301.49	79.99	44.99
2020-10-05	300.00	80.00	45.33
2020-10-07	302.90	82.92	49.00

```
df.sum(axis=1)
```

```
2020-10-03    415.44
2020-10-04    426.47
2020-10-05    425.33
2020-10-07    434.82
dtype: float64
```

Product

	AAD	GDDL	IMA
2020-10-03	300.22	75.32	39.90
2020-10-04	301.49	79.99	44.99
2020-10-05	300.00	80.00	45.33
2020-10-07	302.90	82.92	49.00

```
df.prod(axis='columns')
```

```
2020-10-03    9.022416e+05
2020-10-04    1.084987e+06
2020-10-05    1.087920e+06
2020-10-07    1.230707e+06
dtype: float64
```

Mean

	AAD	GDDL	IMA
2020-10-03	300.22	75.32	39.90
2020-10-04	301.49	79.99	44.99
2020-10-05	300.00	80.00	45.33
2020-10-07	302.90	82.92	49.00

```
df.mean()
```

```
AAD      301.1525
GDDL      79.5575
IMA       44.8050
dtype: float64
```

Median

	AAD	GDDL	IMA
2020-10-03	300.22	75.32	39.90
2020-10-04	301.49	79.99	44.99
2020-10-05	300.00	80.00	45.33
2020-10-07	302.90	82.92	49.00

```
df.median()
```

```
AAD      300.855
GDDL      79.995
IMA       45.160
dtype: float64
```

Standard deviation

	AAD	GDDL	IMA
2020-10-03	300.22	75.32	39.90
2020-10-04	301.49	79.99	44.99
2020-10-05	300.00	80.00	45.33
2020-10-07	302.90	82.92	49.00

```
df.std()
```

```
AAD     1.337345
GDDL    3.143548
IMA     3.740183
dtype: float64
```

Variance

	AAD	GDDL	IMA
2020-10-03	300.22	75.32	39.90
2020-10-04	301.49	79.99	44.99
2020-10-05	300.00	80.00	45.33
2020-10-07	302.90	82.92	49.00

```
df.var()
```

```
AAD       1.788492
GDDL      9.881892
IMA      13.988967
dtype: float64
```

Columns and rows

	AAD	GDDL	IMA
2020-10-03	300.22	75.32	39.90
2020-10-04	301.49	79.99	44.99
2020-10-05	300.00	80.00	45.33
2020-10-07	302.90	82.92	49.00

```
df.loc[:,'AAD'].max()
```

```
302.9
```

```
df.iloc[0].min()
```

```
39.9
```

Let's practice!

INTERMEDIATE PYTHON FOR FINANCE

Extending and manipulating data

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PCE

Personal consumption expenditures (PCE)

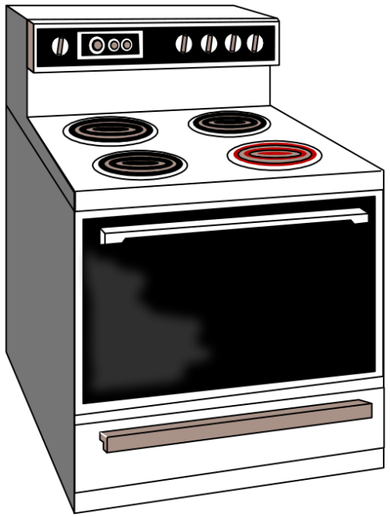
PCE =

PCE

Personal consumption expenditures (PCE)

PCE = PCDG

Durable goods



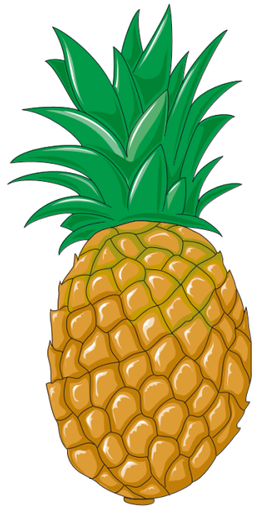
[1] By cactus cowboy [2] Open Clipart, CC0, https://commons.wikimedia.org/w/index.php?curid=64953673

PCE

Personal consumption expenditures (PCE)

PCE = PCDG + PCNDG

Non-durable goods



[1] By Smart Servier [2] https://smart.servier.com/, CC BY 3.0, https://commons.wikimedia.org/w/index.php?curid=74765623

PCE

Personal consumption expenditures (PCE)

PCE = PCDG + PCNDG + PCESV

Services

[1] By Clip Art by Vector Toons [2] Own work, CC BY-SA 4.0, https://commons.wikimedia.org/w/index.php?curid=65937611

PCE - adding and removing columns

DATE	PCDGA
1929-01-01	9.829
1930-01-01	7.661
1931-01-01	5.911
1932-01-01	3.959

PCE - adding and removing columns

```
pce['PCND'] = [[33.941,
                30.503,
                25.798000000000002,
                20.169]
```

PCE - adding and removing columns

```
pce
```

DATE	PCDG	PCND
1929-01-01	9.829	33.941
1930-01-01	7.661	30.503
1931-01-01	5.911	25.798
1932-01-01	3.959	20.169

PCE - adding and removing columns

```
pce
```

DATE	PCDG	PCND
1929-01-01	9.829	33.941
1930-01-01	7.661	30.503
1931-01-01	5.911	25.798
1932-01-01	3.959	20.169

```
pcesv
```

PCESV	
0	33.613
1	31.972
2	28.963
3	24.587

PCE - adding and removing columns

```
pce['PCESV'] = pcesv
```

```
pce
```

PCE - adding and removing columns

```
pce['PCESV'] = pcesv
```

```
pce
```

DATE	PCDG	PCND	PCESV
1929-01-01	9.829	33.941	33.613
1930-01-01	7.661	30.503	31.972
1931-01-01	5.911	25.798	28.963
1932-01-01	3.959	20.169	24.587

PCE - adding and removing columns

```
pce['PCE'] = pce['PCDG'] + pce['PCND'] + pce['PCESV']
```

PCE - adding and removing columns

```
pce['PCE'] = pce['PCDG'] + pce['PCND'] + pce['PCESV']
```

DATE	PCDG	PCND	PCESV	PCE
1929-01-01	9.829	33.941	33.613	77.383
1930-01-01	7.661	30.503	31.972	70.136
1931-01-01	5.911	25.798	28.963	60.672
1932-01-01	3.959	20.169	24.587	48.715

PCE - adding and removing columns

```
pce.drop(columns=['PCDG', 'PCND', 'PCESV'],
         axis=1,
         inplace=True)
```

PCE - adding and removing columns

```
pce.drop(columns=['PCDG', 'PCND', 'PCESV'],
         axis=1,
         inplace=True)
```

DATE	PCE
1929-01-01	77.383
1930-01-01	70.136
1931-01-01	60.672
1932-01-01	48.715

PCE - adding and removing rows

```
new_row
```

PCE - adding and removing rows

```
new_row
```

```
pce.append(new_row)
```

DATE	PCE
1933-01-01	45.945

PCE - adding and removing rows

```
new_row
```

DATE	PCE
1933-01-01	45.945

```
pce.append(new_row)
```

DATE	PCE
1929-01-01	77.383
1930-01-01	70.136
1931-01-01	60.672
1932-01-01	48.715
1933-01-01	45.945

PCE - adding and removing rows

Adding multiple rows

```
new_rows = [ row1, row2, row3
]
for row in new_rows:
    pce = pce.append(row)
```

PCE - adding and removing rows

Adding multiple rows

```
for row in new_rows:
    pce = pce.append(row)
```

DATE	PCE
1929-01-01	77.383
1930-01-01	70.136
1931-01-01	60.672
1932-01-01	48.715
1933-01-01	45.945
1934-01-01	51.461
1935-01-01	55.933

PCE - adding and removing rows

```
pce.drop(['1934-01-01',
          '1935-01-01',
          '1936-01-01',
          '1937-01-01',
          '1938-01-01',
          '1939-01-01'],
          inplace=True)
```

PCE - adding and removing rows

```
pce.drop(['1934-01-01',
          '1935-01-01',
          '1936-01-01',
          '1937-01-01',
          '1938-01-01',
          '1939-01-01'],
          inplace=True)
```

DATE	PCE
1929-01-01	77.383
1930-01-01	70.136
1931-01-01	60.672
1932-01-01	48.715
1933-01-01	45.945

PCE - adding and removing rows

```
all_rows = [row1, row2, row3, pce]
```

```
pd.concat(all_rows)
```

PCE - adding and removing rows

```
all_rows = [row1, row2, row3, pce]
```

```
pd.concat(all_rows)
```

DATE	PCE
1929-01-01	77.383
1930-01-01	70.136
1931-01-01	60.672
1932-01-01	48.715
1933-01-01	45.945
1934-01-01	51.461
1935-01-01	55.933

PCE - operations on DataFrames

```
ec = 0.88
pce * ec
```

PCE - operations on DataFrames

```
ec = 0.88
pce * ec
```

DATE	PCE
1934-01-01	45.28568
1935-01-01	49.22104
1936-01-01	54.72544
1937-01-01	58.81832

PCE - map

```
def convert_to_euro(x):
    return x * 0.88

pce['EURO'] = pce['PCE'].map(convert_to_euro)
```

PCE - map

```
def convert_to_euro(x):
    return x * 0.88

pce['EURO'] = pce['PCE'].map(convert_to_euro)
```

DATE	PCE	EURO
1934-01-01	51.461	45.28568
1935-01-01	55.933	49.22104
1936-01-01	62.188	54.72544

Gross Domestic Product (GDP)

- GDP = PCE + GE + GPDI + NE
- PCE: Personal Consumption Expenditures
- GE: Government Expenditures
- GPDI: Gross Private Domestic Investment
- NE: Net Exports

GDP - apply

map - Elements in a column (series)

apply - Across rows or columns

GDP - apply

	GCE	GPDI	NE	PCE
DATE				
1929-01-01	9.622	17.170	0.383	77.383
1930-01-01	10.273	11.428	0.323	70.136
1931-01-01	10.169	6.549	0.001	60.672
1932-01-01	8.946	1.819	0.043	48.715

GDP - apply

```
gdp.apply(np.sum, axis=1)
```

GDP - apply

```
gdp['GDP'] = gdp.apply(np.sum, axis=1)
```

	GCE	GPDI	NE	PCE	GDP
DATE					
1929-01-01	9.622	17.170	0.383	77.383	104.558
1930-01-01	10.273	11.428	0.323	70.136	92.160
1931-01-01	10.169	6.549	0.001	60.672	77.391
1932-01-01	8.946	1.819	0.043	48.715	59.523

Let's practice!

INTERMEDIATE PYTHON FOR FINANCE