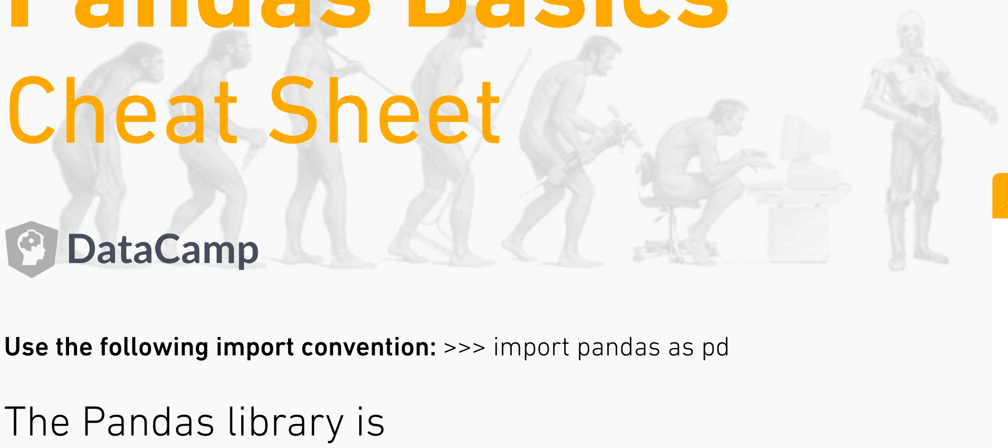
Pandas Basics
Cheat Sheet



DataCamp

Use the following import convention: >>> import pandas as pd

The Pandas library is built on NumPy and provides easy-to-use data structures and data analysis tools for the Python programming language.

Pandas Data Structures

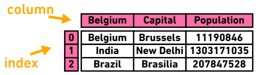
Series

A one-dimensional labeled array a capable of holding any data type

```
>>> s = pd.Series([3, -5, 7, 4], index=['a', 'b', 'c', 'd'])
```

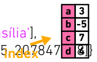
Data Frame

A two-dimensional labeled data structure with columns of potentially different types



	Belgium	Capital	Population
0	Belgium	Brussels	11190846
1	India	New Delhi	1303171035
2	Brazil	Brasilia	207847528

```
>>> data = {'Country': ['Belgium', 'India', 'Brazil'],
            'Capital': ['Brussels', 'New Delhi', 'Brasília'],
            'Population': [11190846, 1303171035, 207847528]}
>>> df = pd.DataFrame(data,
                      columns=['Country', 'Capital', 'Population'])
```



a	3
b	-5
c	7
d	4

Dropping

```
>>> s.drop(['a', 'c'])                  Drop values from rows (axis=0)
>>> df.drop('Country', axis=1)          Drop values from  columns(axis=1)
```

Sort & Rank

```
>>> df.sort_index()                     Sort by labels along an axis
>>> df.sort_values(by='Country')        Sort by the values along an axis
>>> df.rank()                           Assign ranks to entries
```

Retrieving Series/ DataFrame Information

```
>>> df.shape                            (rows,columns)
>>> df.index                            Describe index
>>> df.columns                          Describe DataFrame columns
>>> df.info()                           Info on DataFrame
>>> df.count()                          Number of non-NA values
```

Summary

```
>>> df.sum()                            Sum of values
>>> df.cumsum()                         Cummulative sum of values
>>> df.min()/df.max()                   Minimum/maximum values
>>> df.idxmin()/df.idxmax()             Minimum/Maximum index value
>>> df.describe()                       Summary statistics
>>> df.mean()                           Mean of values
>>> df.median()                         Median of values
```

Selection

Also see NumPy Arrays

Getting

```
>>> s['b']                              Get one element
 -5
>>> df[1:]                              Get subset of a DataFrame
   Country Capital    Population
 1 India   New Delhi  1303171035
 2 Brazil  Brasília   207847528
```

Selecting, Boolean Indexing & Setting

By Position

```
>>> df.iloc[[0],[0]]                    Select single value by row &
 'Belgium'                                                    column
>>> df.iat([0],[0])
 'Belgium'
```

By Label

```
>>> df.loc[[0], ['Country']]            Select single value by row &
 'Belgium'                                             column labels
>>> df.at([0], ['Country']) 'Belgium'
```

By Label/Position

```
>>> df.ix[2]                            Select single row of
  Country       Brazil                  subset of rows
  Capital       Brasília
  Population    207847528
>>> df.ix[:,'Capital']                  Select a single column of
  0 Brussels                            subset of columns
  1 New Delhi
  2 Brasília
>>> df.ix[1,'Capital']                  Select rows and columns
 'New Delhi'
```

Boolean Indexing

```
>>> s[~(s > 1)]                         Series s where value is not >1
>>> s[(s < -1) | (s > 2)]               s where value is <-1 or >2
>>> df[df['Population']>1200000000]     Use filter to adjust DataFrame
```

Setting

```
>>> s['a'] = 6                          Set index a of Series s to 6
```

Asking For Help

```
>>> help(pd.Series.loc)
```

Applying Functions

```
>>> f = lambda x: x*2
>>> df.apply(f)                         Apply function
>>> df.applymap(f)                      Apply function element-wise
```

Data Alignment

Internal Data Alignment

NA values are introduced in the indices that don't overlap:

```
>>> s3 = pd.Series([7, -2, 3], index=['a', 'c', 'd'])
>>> s + s3
  a 10.0
  b NaN
  c 5.0
  d 7.0
```

Arithmetic Operations with Fill Methods

You can also do the internal data alignment yourself with the help of the fill methods:

```
>>> s.add(s3, fill_value=0)
  a 10.0
  b -5.0
  c 5.0
  d 7.0
>>> s.sub(s3, fill_value=2)
>>> s.div(s3, fill_value=4)
```

I/O

Read and Write to CSV

```
>>> pd.read_csv('file.csv', header=None, nrows=5)
>>> df.to_csv('myDataFrame.csv')
```

Read and Write to Excel

```
>>> pd.read_excel('file.xlsx')
>>> pd.to_excel('dir/myDataFrame.xlsx', sheet_name='Sheet1')
```

Read multiple sheets from the same file

```
>>> xlsx = pd.ExcelFile('file.xls')
>>> df = pd.read_excel(xlsx, 'Sheet1')
```

Read and Write to SQL Query or Database Table

```
>>> from sqlalchemy import create_engine
>>> engine = create_engine('sqlite:///:memory:')
>>> pd.read_sql("SELECT * FROM my_table;", engine)
>>> pd.read_sql_table('my_table', engine)
>>> pd.read_sql_query("SELECT * FROM my_table;", engine)
```

read_sql()is **a convenience wrapper around** read_sql_table() and read_sql_query()

```
>>> pd.to_sql('myDf', engine)
```

Pandas
Cheat Sheet

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Pandas Data Structures

Pivot

```
>>> df3= df2.pivot(index='Date',                       Spread rows into columns
                   columns='Type',
                   values='Value')
```

	Date	Type	Value
0	2016-03-01	a	11.432
1	2016-03-02	b	13.031
2	2016-03-01	c	20.784
3	2016-03-03	a	99.906
4	2016-03-02	a	1.303
5	2016-03-03	c	20.784

→

Type	a	b	c
Date			
2016-03-01	11.432	NaN	20.784
2016-03-02	1.303	13.031	NaN
2016-03-03	99.906	NaN	20.784

Pivot Table

```
>>> df4 = pd.pivot_table(df2,                          Spread rows into columns
                         values='Value',
                         index='Date',
                         columns='Type'])
```

		0	1
1	5	0.233482	0.390959
2	4	0.184713	0.237102
3	3	0.433522	0.429401

Unstacked

→

1	5	0	0.233482
		1	0.390959
2	4	0	0.184713
		1	0.237102
3	3	0	0.433522
		1	0.429401

Stacked

Melt

```
>>> pd.melt(df2,                                       Gather columns into rows
            id_vars=["Date"],
            value_vars=["Type", "Value"],
            value_name="Observations")
```

	Date	Type	Value
0	2016-03-01	a	11.432
1	2016-03-02	b	13.031
2	2016-03-01	c	20.784
3	2016-03-03	a	99.906
4	2016-03-02	a	1.303
5	2016-03-03	c	20.784

→

	Date	Variable	Observations
0	2016-03-01	Type	a
1	2016-03-02	Type	b
2	2016-03-01	Type	c
3	2016-03-03	Type	a
4	2016-03-02	Type	a
5	2016-03-03	Type	c
6	2016-03-01	Value	11.432
7	2016-03-02	Value	13.031
8	2016-03-01	Value	20.784
9	2016-03-03	Value	99.906
10	2016-03-02	Value	1.303
11	2016-03-03	Value	20.784

Advanced Indexing

Also see NumPy Arrays

Selecting

```
>>> df3.loc[:,(df3>1).any()]                  Select cols with any vals >1
>>> df3.loc[:,(df3>1).all()]                  Select cols with vals > 1
>>> df3.loc[:,df3.isnull().any()]             Select cols with NaN
>>> df3.loc[:,df3.notnull().all()]            Select cols without NaN
```

Indexing With isin

```
>>> df[(df.Country.isin(df2.Type))]           Find same elements
>>> df3.filter(items="a","b"])                Filter on values
>>> df.select(lambda x: not x%5)              Select specific elements
```

Where

```
>>> s.where(s > 0)                            Subset the data
```

Query

```
>>> df6.query('second > first')               Query DataFrame
```

Setting/Resetting Index

```
>>> df.set_index('Country')                   Set the index
>>> df4 = df.reset_index()                    Reset the index
>>> df = df.rename(index=str,                 Rename DataFrame
                   columns={"Country":"cntry",
                            "Capital":"cptl",
                            "Population":"ppltn"})
```

Reindexing

```
>>> s2 = s.reindex(['a','c','d','e','b'])
```

Forward Filling

```
>>> df.reindex(range(4),
               method='ffill')
```

```
Country Capital Population
 0  Belgium   Brussels     11190846
 1  India     New Delhi    1303171035
 2  Brazil    Brasília     207847528
 3  Brazil    Brasília     207847528
```

Forward Filling

```
>>> s3 = s.reindex(range(5),
                   method='bfill')
```

```
 0   3
 1   3
 2   3
 3   3
 4   3
```

MultiIndexing

```
>>> arrays = [np.array([1,2,3]),
              np.array([5,4,3])]
>>> df5 = pd.DataFrame(np.random.rand(3, 2), index=arrays)
>>> tuples = list(zip(*arrays))
>>> index = pd.MultiIndex.from_tuples(tuples,
                                      names=['first', 'second'])
>>> df6 = pd.DataFrame(np.random.rand(3, 2), index=index)
>>> df2.set_index(["Date", "Type"])
```

Duplicate Data

```
>>> s3.unique()                                        Return unique values
>>> df2.duplicated('Type')                             Check duplicates
>>> df2.drop_duplicates('Type', keep='last')           Drop duplicates
>>> df.index.duplicated()                              Drop duplicates
```

Grouping Data

Aggregation

```
>>> df2.groupby(by=['Date','Type']).mean()
>>> df4.groupby(level=0).sum()
>>> df4.groupby(level=0).agg({'a':lambda x:sum(x)/len(x), 'b': np.sum})
```

Transformation

```
>>> customSum = lambda x: (x+x%2)
>>> df4.groupby(level=0).transform(customSum)
```

Missing Data

```
>>> df.dropna()                         Drop NaN value
>>> df3.fillna(df3.mean())              Fill NaN values with a predetermined value
>>> df2.replace("a", "f")               Replace values with others
```

Combining Data

data1

X1	X2
a	11.432
b	1.303
c	99.906

data2

X1	X3
a	20.784
b	NaN
d	20.784

Pivot

```
>>> pd.merge(data1,
             data2,
             how='left',
             on='X1')
```

X1	X2	X3
a	11.432	20.784
b	1.303	NaN
c	99.906	NaN

```
>>> pd.merge(data1,
             data2,
             how='right',
             on='X1')
```

X1	X2	X3
a	11.432	20.784
b	1.303	NaN
d	NaN	20.784

```
>>> pd.merge(data1,
             data2,
             how='inner',
             on='X1')
```

X1	X2	X3
a	11.432	20.784
b	1.303	NaN

```
>>> pd.merge(data1,
             data2,
             how='outer',
             on='X1')
```

X1	X2	X3
a	11.432	20.784
b	1.303	NaN
c	99.906	NaN
d	NaN	

Join

```
>>> data1.join(data2, how='right')
```

Concatenate

Vertical

```
>>> s.append(s2)
```

Horizontal/Vertical

```
>>> pd.concat([s,s2],axis=1, keys=['One','Two'])
>>> pd.concat([data1, data2], axis=1, join='inner')
```

Dates

```
>>> df2['Date']= pd.to_datetime(df2['Date'])
>>> df2['Date']= pd.date_range('2000-1-1', periods=6,
                               freq='M')
>>> dates = [datetime(2012,5,1), datetime(2012,5,2)]
>>> index = pd.DatetimeIndex(dates)
>>> index = pd.date_range(datetime(2012,2,1), end, freq='BM')
```

Visualization

```
>>> import matplotlib.pyplot as plt
```

```
>>> s.plot()
>>> plt.show()
```

```
>>> df2.plot()
>>> plt.show()
```