



MANIPULATING DATAFRAMES WITH PANDAS

Manipulating DataFrames with pandas



What you will learn

- Extracting, filtering, and transforming data from DataFrames
- Advanced indexing with multiple levels
- Tidying, rearranging and restructuring your data
- Pivoting, melting, and stacking DataFrames
- Identifying and splitting DataFrames by groups



MANIPULATING DATAFRAMES WITH PANDAS

**See you in
the course!**



MANIPULATING DATAFRAMES WITH PANDAS

Indexing DataFrames



A simple DataFrame

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

```
In [2]: df = pd.read_csv('sales.csv', index_col='month')
```

```
In [3]: df
```

```
Out[3]:
```

	eggs	salt	spam
month			
Jan	47	12.0	17
Feb	110	50.0	31
Mar	221	89.0	72
Apr	77	87.0	20
May	132	NaN	52
Jun	205	60.0	55



Indexing using square brackets

```
In [4]: df
```

```
Out[4]:
```

	eggs	salt	spam
month			
Jan	47	12.0	17
Feb	110	50.0	31
Mar	221	89.0	72
Apr	77	87.0	20
May	132	NaN	52
Jun	205	60.0	55

```
In [5]: df['salt']['Jan']
```

```
Out[5]: 12.0
```



Using column attribute and row label

```
In [6]: df
```

```
Out[6]:
```

	eggs	salt	spam
month			
Jan	47	12.0	17
Feb	110	50.0	31
Mar	221	89.0	72
Apr	77	87.0	20
May	132	NaN	52
Jun	205	60.0	55

```
In [7]: df.eggs['Mar']
```

```
Out[7]: 221
```



Using the .loc accessor

```
In [8]: df
```

```
Out[8]:
```

	eggs	salt	spam
month			
Jan	47	12.0	17
Feb	110	50.0	31
Mar	221	89.0	72
Apr	77	87.0	20
May	132	NaN	52
Jun	205	60.0	55

```
In [9]: df.loc['May', 'spam']
```

```
Out[9]: 52.0
```



Using the .iloc accessor

```
In [10]: df
```

```
Out[10]:
```

	eggs	salt	spam
month			
Jan	47	12.0	17
Feb	110	50.0	31
Mar	221	89.0	72
Apr	77	87.0	20
May	132	NaN	52
Jun	205	60.0	55

```
In [11]: df.iloc[4, 2]
```

```
Out[11]: 52.0
```



Selecting only some columns

```
In [12]: df_new = df[['salt', 'eggs']]
```

```
In [13]: df_new
```

```
Out[13]:
```

	salt	eggs
month		
Jan	12.0	47
Feb	50.0	110
Mar	89.0	221
Apr	87.0	77
May	NaN	132
Jun	60.0	205



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Let's practice!



MANIPULATING DATAFRAMES WITH PANDAS

Slicing DataFrames



sales DataFrame

```
In [1]: df
```

```
Out[1]:
```

	eggs	salt	spam
month			
Jan	47	12.0	17
Feb	110	50.0	31
Mar	221	89.0	72
Apr	77	87.0	20
May	132	NaN	52
Jun	205	60.0	55



Selecting a column (i.e., Series)

```
In [2]: df['eggs']
```

```
Out[2]:
```

```
month
```

```
Jan      47
```

```
Feb     110
```

```
Mar     221
```

```
Apr      77
```

```
May     132
```

```
Jun     205
```

```
Name: eggs, dtype: int64
```

```
In [3]: type(df['eggs'])
```

```
Out[3]: pandas.core.series.Series
```



Slicing and indexing a Series

```
In [4]: df['eggs'][1:4] # Part of the eggs column
```

```
Out[4]:
```

```
month
```

```
Feb      110
```

```
Mar      221
```

```
Apr       77
```

```
Name: eggs, dtype: int64
```

```
In [5]: df['eggs'][4] # The value associated with May
```

```
Out[5]: 132
```



Using .loc[] (1)

```
In [6]: df.loc[:, 'eggs':'salt'] # All rows, some columns  
Out[6]:
```

	eggs	salt
month		
Jan	47	12.0
Feb	110	50.0
Mar	221	89.0
Apr	77	87.0
May	132	NaN
Jun	205	60.0



Using .loc[] (2)

```
In [7]: df.loc['Jan':'Apr',:] # Some rows, all columns
```

```
Out[7]:
```

	eggs	salt	spam
month			
Jan	47	12.0	17
Feb	110	50.0	31
Mar	221	89.0	72
Apr	77	87.0	20



Using .loc[] (3)

```
In [8]: df.loc['Mar': 'May', 'salt': 'spam']
```

```
Out[8]:
```

	salt	spam
month		
Mar	89.0	72
Apr	87.0	20
May	NaN	52



Using .iloc[]

```
In [9]: df.iloc[2:5, 1:] # A block from middle of the DataFrame
Out[9]:
```

	salt	spam
month		
Mar	89.0	72
Apr	87.0	20
May	NaN	52



Using lists rather than slices (1)

```
In [10]: df.loc['Jan': 'May', ['eggs', 'spam']]
```

```
Out[10]:
```

	eggs	spam
month		
Jan	47	17
Feb	110	31
Mar	221	72
Apr	77	20
May	132	52



Using lists rather than slices (2)

```
In [11]: df.iloc[[0,4,5], 0:2]
```

```
Out[11]:
```

	eggs	salt
month		
Jan	47	12.0
May	132	NaN
Jun	205	60.0



Series versus 1-column DataFrame

```
# A Series by column name
```

```
In [13]: df['eggs']
```

```
Out[13]:
```

```
month
```

```
Jan      47
```

```
Feb     110
```

```
Mar     221
```

```
Apr      77
```

```
May     132
```

```
Jun     205
```

```
Name: eggs, dtype: int64
```

```
In [14]: type(df['eggs'])
```

```
Out[14]:
```

```
pandas.core.series.Series
```

```
# A DataFrame w/ single column
```

```
In [15]: df[['eggs']]
```

```
Out[15]:
```

```
eggs
```

```
month
```

```
Jan      47
```

```
Feb     110
```

```
Mar     221
```

```
Apr      77
```

```
May     132
```

```
Jun     205
```

```
In [16]: type(df[['eggs']])
```

```
Out[16]:
```

```
pandas.core.frame.DataFrame
```



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Let's practice!



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Filtering DataFrames



Creating a Boolean Series

```
In [1]: df.salt > 60
Out[1]:
month
Jan    False
Feb    False
Mar     True
Apr     True
May    False
Jun    False
Name: salt, dtype: bool
```



Filtering with a Boolean Series

```
In [2]: df[df.salt > 60]
```

```
Out[2]:
```

	eggs	salt	spam
month			
Mar	221	89.0	72
Apr	77	87.0	20

```
In [3]: enough_salt_sold = df.salt > 60
```

```
In [4]: df[enough_salt_sold]
```

```
Out[4]:
```

	eggs	salt	spam
month			
Mar	221	89.0	72
Apr	77	87.0	20



Combining filters

```
In [5]: df[(df.salt >= 50) & (df.eggs < 200)] # Both conditions
Out[5]:
```

	eggs	salt	spam
month			
Feb	110	50.0	31
Apr	77	87.0	20

```
In [6]: df[(df.salt >= 50) | (df.eggs < 200)] # Either condition
Out[6]:
```

	eggs	salt	spam
month			
Jan	47	12.0	17
Feb	110	50.0	31
Mar	221	89.0	72
Apr	77	87.0	20
May	132	NaN	52
Jun	205	60.0	55



DataFrames with zeros and NaNs

```
In [7]: df2 = df.copy()
```

```
In [8]: df2['bacon'] = [0, 0, 50, 60, 70, 80]
```

```
In [9]: df2
```

```
Out[9]:
```

	eggs	salt	spam	bacon
month				
Jan	47	12.0	17	0
Feb	110	50.0	31	0
Mar	221	89.0	72	50
Apr	77	87.0	20	60
May	132	NaN	52	70
Jun	205	60.0	55	80



Select columns with all nonzeros

```
In [10]: df2.loc[:, df2.all()]
```

```
Out[10]:
```

	eggs	salt	spam
month			
Jan	47	12.0	17
Feb	110	50.0	31
Mar	221	89.0	72
Apr	77	87.0	20
May	132	NaN	52
Jun	205	60.0	55



Select columns with any nonzeros

```
In [11]: df2.loc[:, df2.any()]
```

```
Out[11]:
```

	eggs	salt	spam	bacon
month				
Jan	47	12.0	17	0
Feb	110	50.0	31	0
Mar	221	89.0	72	50
Apr	77	87.0	20	60
May	132	NaN	52	70
Jun	205	60.0	55	80



Select columns with any NaNs

```
In [12]: df.loc[:, df.isnull().any()]
```

```
Out[12]:
```

	salt
month	
Jan	12.0
Feb	50.0
Mar	89.0
Apr	87.0
May	NaN
Jun	60.0



Select columns without NaNs

```
In [13]: df.loc[:, df.notnull().all()]
```

```
Out[13]:
```

	eggs	spam
month		
Jan	47	17
Feb	110	31
Mar	221	72
Apr	77	20
May	132	52
Jun	205	55



Drop rows with any NaNs

```
In [14]: df.dropna(how='any')
```

```
Out[14]:
```

	eggs	salt	spam
month			
Jan	47	12.0	17
Feb	110	50.0	31
Mar	221	89.0	72
Apr	77	87.0	20
Jun	205	60.0	55



Filtering a column based on another

```
In [15]: df.eggs[df.salt > 55]
Out[15]:
month
Mar      221
Apr       77
Jun     205
Name: eggs, dtype: int64
```



Modifying a column based on another

```
In [16]: df.eggs[df.salt > 55] += 5
```

```
In [17]: df
```

```
Out[17]:
```

	eggs	salt	spam
month			
Jan	47	12.0	17
Feb	110	50.0	31
Mar	226	89.0	72
Apr	82	87.0	20
May	132	NaN	52
Jun	210	60.0	55



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Transforming DataFrames



DataFrame vectorized methods

```
In [1]: df.floordiv(12) # Convert to dozens unit
```

```
Out[1]:
```

	eggs	salt	spam
month			
Jan	3	1.0	1
Feb	9	4.0	2
Mar	18	7.0	6
Apr	6	7.0	1
May	11	NaN	4
Jun	17	5.0	4



NumPy vectorized functions

```
In [2]: import numpy as np
```

```
In [3]: np.floor_divide(df, 12) # Convert to dozens unit
```

```
Out[3]:
```

	eggs	salt	spam
month			
Jan	3.0	1.0	1.0
Feb	9.0	4.0	2.0
Mar	18.0	7.0	6.0
Apr	6.0	7.0	1.0
May	11.0	NaN	4.0
Jun	17.0	5.0	4.0



Plain Python functions (1)

```
In [4]: def dozens(n):  
.....:     return n//12
```

```
In [5]: df.apply(dozens) # Convert to dozens unit
```

```
Out[5]:
```

	eggs	salt	spam
month			
Jan	3	1.0	1
Feb	9	4.0	2
Mar	18	7.0	6
Apr	6	7.0	1
May	11	NaN	4
Jun	17	5.0	4



Plain Python functions (2)

```
In [6]: df.apply(lambda n: n//12)
```

```
Out[6]:
```

	eggs	salt	spam
month			
Jan	3	1.0	1
Feb	9	4.0	2
Mar	18	7.0	6
Apr	6	7.0	1
May	11	NaN	4
Jun	17	5.0	4



Storing a transformation

```
In [7]: df['dozens_of_eggs'] = df.eggs.floordiv(12)
```

```
In [8]: df
```

```
Out[8]:
```

	eggs	salt	spam	dozens_of_eggs
month				
Jan	47	12.0	17	3
Feb	110	50.0	31	9
Mar	221	89.0	72	18
Apr	77	87.0	20	6
May	132	NaN	52	11
Jun	205	60.0	55	17



The DataFrame index

```
In [9]: df
```

```
Out[9]:
```

	eggs	salt	spam	dozens_of_eggs
month				
Jan	47	12.0	17	3
Feb	110	50.0	31	9
Mar	221	89.0	72	18
Apr	77	87.0	20	6
May	132	NaN	52	11
Jun	205	60.0	55	17

```
In [10]: df.index
```

```
Out[10]: Index(['Jan', 'Feb', 'Mar', 'Apr', 'May', 'Jun'],  
dtype='object', name='month')
```



Working with string values (1)

```
In [11]: df.index = df.index.str.upper()
```

```
In [12]: df
```

```
Out[12]:
```

	eggs	salt	spam	dozens_of_eggs
month				
JAN	47	12.0	17	3
FEB	110	50.0	31	9
MAR	221	89.0	72	18
APR	77	87.0	20	6
MAY	132	NaN	52	11
JUN	205	60.0	55	17



Working with string values (2)

```
In [13]: df.index = df.index.map(str.lower)
```

```
In [14]: df
```

```
Out[14]:
```

	eggs	salt	spam	dozens_of_eggs
jan	47	12.0	17	3
feb	110	50.0	31	9
mar	221	89.0	72	18
apr	77	87.0	20	6
may	132	NaN	52	11
jun	205	60.0	55	17



Defining columns using other columns

```
In [15]: df['salty_eggs'] = df.salt + df.dozens_of_eggs
```

```
In [16]: df
```

```
Out[16]:
```

	eggs	salt	spam	dozens_of_eggs	salty_eggs
jan	47	12.0	17	3	15.0
feb	110	50.0	31	9	59.0
mar	221	89.0	72	18	107.0
apr	77	87.0	20	6	93.0
may	132	NaN	52	11	NaN
jun	205	60.0	55	17	77.0



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Let's practice!