

Session6&7-Pandas (Groupby, Useful Operations, Pivot, Stack)

C013_DAwPy-6 & 7_5&7 Dec 22

Training Clarusway

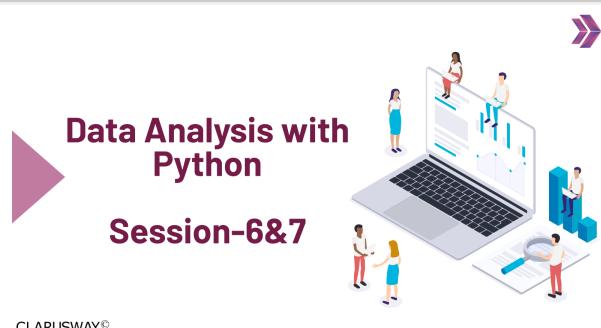
Pear Deck - December 6, 2022 at 2:11PM

Part 1 - Summary

Use this space to summarize your thoughts on the lesson

Part 2 - Responses

Slide 1



Use this space to take notes:

Slide 2



Use this space to take notes:

Slide 3

► Table of Contents

- Basic Aggregation Methods
- Grouping Data (DataFrame.groupby())
- Useful Operations
 - Aggregate
 - Filter
 - Transform
 - Apply
 - Applymap
 - Map
 - Pivot & Pivot Table
 - Stack & Unstack



3

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Slide 4

Your Response

I've completed the pre-class content?

True **False**

Pear Deck

Students choose an option

Pear Deck Interactive Slide
Do not remove this bar

This slide is an interactive poll from Pear Deck. It asks if the user has completed pre-class content. Two large circular buttons are provided: a green one labeled 'True' and a red one labeled 'False'. The slide includes the Pear Deck logo and navigation instructions.

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Slide 5

Your Response

Write down three of the Aggregation Methods in Pandas?

Students, write your response!

Pear Deck Interactive Slide
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This slide is an interactive writing task from Pear Deck. It asks students to list three aggregation methods in Pandas. It features two cartoon characters at desks with laptops. The slide includes the Pear Deck logo and navigation instructions.

Use this space to take notes:

Slide 6

► Basic Aggregation Methods ➤

- ▶ count()
- ▶ min()
- ▶ mean()
- ▶ max()
- ▶ median()
- ▶ std()
- ▶ idxmin()
- ▶ var()
- ▶ idxmax()
- ▶ sum()
- ▶ corr()
- ▶ describe()

8

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Slide 7

► Grouping Data (DataFrame.groupby) ➤

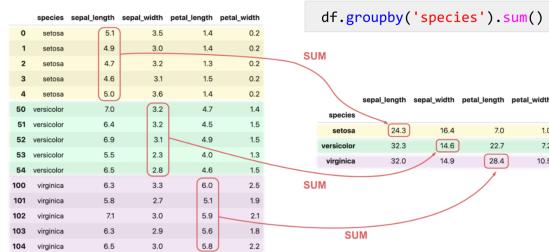
- ▶ DataFrame.groupby operation involves some combination of **splitting the object, applying a function, and combining the results.**
- ▶ This can be used to group large amounts of data and compute operations on these groups.

7

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Slide 8

▶ Grouping Data (DataFrame.groupby()) ➤



Use this space to take notes:

Slide 9

▶ Useful Operations ➤

DataFrame.aggregate/agg

```
>>> df = pd.DataFrame([[1, 2, 3],  
...                   [4, 5, 6],  
...                   [7, 8, 9],  
...                   [np.nan, np.nan, np.nan]],  
...                   columns=['A', 'B', 'C'])
```

Aggregate these functions over the rows.

```
>>> df.agg(['sum', 'min'])  
          A    B    C  
sum  12.0  15.0  18.0  
min  1.0   2.0   3.0
```

Different aggregations per column.

```
>>> df.agg({'A' : ['sum', 'min'], 'B' : ['min', 'max']})  
          A    B  
sum  12.0  NaN  
min  1.0   2.0  
max  NaN   8.0
```

Aggregate different functions over the columns and rename the index

```
>>> df.agg(x='A', max, y='B', min= 'min', z='C', np.mean)  
          A    C  
x  7.0  6.0  
y  NaN  2.0  
z  NaN  6.0
```

Aggregate over the columns.

```
>>> df.agg("mean", axis="columns")  
0  2.0  
1  5.0  
2  8.0  
3  NaN
```

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Slide 10

▶ Useful Operations

DataFrame.groupby.aggregate/agg

```
>>> df
   A   B   C
0  1  1  0.36238
0  1  1  0.227877
2  2  3  1.267767
3  2  4 -0.562668

The aggregation is for each column.

>>> df.groupby('A').agg('min')
   B
A
1  1  0.227877
2  3 -0.562668

Multiple aggregations

>>> df.groupby('A').agg(['min', 'max'])
   B
A   min   max
1  1  2  0.36238
2  3  4 -0.562668
```

Select a column for aggregation

```
>>> df.groupby('A').B.agg(['min', 'max'])
   min   max
A
1  1  2
2  3  4
```

Different aggregations per column

```
>>> df.groupby('A').agg({'B': ['min', 'max'], 'C': 'sum'})
   B   C
A   min   max   sum
1  1  2  0.590715
2  3  4  0.704907
```



10

Use this space to take notes:

Slide 11

▶ Useful Operations

DataFrame.filter

- Subset the dataframe rows or columns according to the specified index labels.

```
>>> df = pd.DataFrame(np.array([[1, 2, 3], [4, 5, 6]]),
...                   index=['mouse', 'rabbit'],
...                   columns=['one', 'two', 'three'])
>>> df
   one two three
mouse    1    2    3
rabbit   4    5    6
```

```
>>> # select columns by name
>>> df.filter(items=['one', 'three'])
   one three
mouse    1    3
rabbit   4    6

>>> # select columns by regular expression
>>> df.filter(regex='e$', axis=1)
   one three
mouse    1    3
rabbit   4    6

>>> # select rows containing 'bbi'
>>> df.filter(like='bbi', axis=0)
   one two three
rabbit   4    5    6
```



11

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Slide 12

▶ Useful Operations

DataFrame.groupby.filter

- Return a copy of a DataFrame excluding filtered elements.

```
df = pd.DataFrame({'A' : ['foo', 'bar', 'foo', 'bar',
                           'foo', 'bar'],
                   'B' : [1, 2, 3, 4, 5, 6],
                   'C' : [2.0, 5., 8., 1., 2., 9.]})
```

	A	B	C
0	foo	1	2.0
1	bar	2	5.0
2	foo	3	8.0
3	bar	4	1.0
4	foo	5	2.0
5	bar	6	9.0


```
df.groupby('A').mean()
```

	B	C
bar	4	5.0
foo	3	4.0


```
df.groupby('A').filter(lambda x: x['B'].mean() > 3.)
```

	A	B	C
1	bar	2	5.0
3	bar	4	1.0
5	bar	6	9.0

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Slide 13

▶ Useful Operations

DataFrame.transform

- Produced DataFrame will have same axis length as self.

```
>>> df = pd.DataFrame({'A': range(3), 'B': range(1, 4)})
>>> df
   A  B
0  0  1
1  1  2
2  2  3
>>> df.transform(lambda x: x + 1)
   A  B
0  1  2
1  2  3
2  3  4
```



```
>>> s = pd.Series(range(3))
>>> s
0    0
1    1
2    2
dtype: int64
>>> s.transform([np.sqrt, np.exp])
          sqrt      exp
0  0.000000  1.000000
1  1.000000  2.718282
2  1.414214  7.389056
```

13

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Slide 14

▶ Useful Operations

DataFrame.groupby.transform

df2		
groups	var1	var2
0	A	10
1	B	23
2	C	33
3	A	22
4	B	11
5	C	99
6	A	76
7	B	84
8	C	45

df2.groupby("groups")["var1"].mean()
groups
A: 36.000000
B: 39.333333
C: 59.000000
Name: var1, dtype: float64
df2.groupby("groups")["var1"].transform("mean")
0 36.000000
1 39.333333
2 59.000000
3 36.000000
4 39.333333
5 59.000000
6 36.000000
7 39.333333
8 59.000000



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Slide 15

▶ Useful Operations

Types of "Apply"s

Series.apply
For applying more complex functions on a Series.
DataFrame.apply
Apply a function row-/column-wise.
DataFrame.applymap
Apply a function elementwise on a whole DataFrame.



Use this space to take notes:

Slide 16

▶ Useful Operations

Series.apply

- ▶ Invoke function on values of Series.

```
>>> s = pd.Series([20, 21, 12],  
...                 index=['London', 'New York', 'Helsinki'])  
>>> s  
London    20  
New York  21  
Helsinki 12
```

```
>>> def square(x):  
...     return x ** 2  
>>> s.apply(square)  
London    400  
New York  441  
Helsinki 144
```

```
>>> s.apply(lambda x: x ** 2)  
London    400  
New York  441  
Helsinki 144
```

```
>>> s.apply(np.log)  
London    2.995732  
New York  3.044522  
Helsinki 2.484907
```



18

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Slide 17

▶ Useful Operations

DataFrame.apply

- ▶ Apply a function along an axis of the DataFrame.

```
>>> df = pd.DataFrame([[4, 9]] * 3, columns=['A', 'B'])  
>>> df  
   A  B  
0  4  9  
1  4  9  
2  4  9
```

Using a numpy universal function (in this case the same as `np.sqrt(df)`):

```
>>> df.apply(np.sqrt)  
   A    B  
0  2.0  3.0  
1  2.0  3.0  
2  2.0  3.0
```

Using a reducing function on either axis

```
>>> df.apply(np.sum, axis=0)  
   A    B  
0  12  27  
dtype: int64
```

```
>>> df.apply(np.sum, axis=1)  
0    13  
1    13  
2    13  
dtype: int64
```



17

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Slide 18

▶ Useful Operations

DataFrame.applymap

- ▶ Apply a function elementwise on a whole DataFrame.

```
>>> df = pd.DataFrame([[1, 2.12], [3.356, 4.567]])  
>>> df  
          0      1  
0  1.000   2.120  
1  3.356   4.567
```

```
>>> df.applymap(lambda x: len(str(x)))  
          0      1  
0  3   4  
1  5   5
```

```
>>> df.applymap(lambda x: x**2)  
          0      1  
0  1.000000  4.494400  
1  11.262736 20.857489
```

But it's better to avoid applymap in that case.

```
>>> df ** 2  
          0      1  
0  1.000000  4.494400  
1  11.262736 20.857489
```

18

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Slide 19

▶ Useful Operations

Series.map

- ▶ Map values of Series according to input correspondence.

```
>>> s = pd.Series(['cat', 'dog', np.nan, 'rabbit'])  
>>> s  
0    cat  
1    dog  
2    NaN  
3  rabbit
```

```
>>> s.map({'cat': 'kitten', 'dog': 'puppy'})  
0    kitten  
1     puppy  
2      NaN  
3      NaN
```

```
>>> s.map('I am a {}'.format)  
0    I am a cat  
1    I am a dog  
2    I am a nan  
3  I am a rabbit
```

```
>>> s.map('I am a {}'.format, na_action='ignore')  
0    I am a cat  
1    I am a dog  
2      NaN  
3  I am a rabbit
```

19

Use this space to take notes:

Slide 20

▶ Useful Operations

apply() vs applymap() vs map()

	DataFrame	Series
apply	✓	✓
map		✓
applymap	✓	

- ▶ **apply()** is used to apply a function **along an axis of the DataFrame or on values of Series**.
- ▶ **applymap()** is used to apply a function to a **DataFrame elementwise**.
- ▶ **map()** is used to **substitute each value in a Series with another value**.



20

Use this space to take notes:

Slide 21

▶ Useful Operations

apply() vs transform()



21

df5.apply(lambda x: x+10)	
	A B
0	1 10
1	2 20
2	3 30

A	B
0	1 10
1	2 20
2	3 30

df5.transform(lambda x: x+10)	
	A B
0	11 20
1	12 30
2	13 40

A	B
0	11 20
1	12 30
2	13 40

Use this space to take notes:

Slide 22

▶ Useful Operations

apply() vs transform()



- ▶ **transform()** cannot produce aggregated results.
- ▶ **apply()** works with multiple Series at a time. But, **transform()** is only allowed to work with a single Series at a time.
- ▶ **transform()** returns a DataFrame that has the same length as the input

22

Use this space to take notes:

Slide 23

▶ DataFrame/Series Operations

apply() vs transform()



- ▶ **transform()** cannot produce aggregated results.

A	B
0	1 10
1	2 20
2	3 30

```
df5.apply(lambda x: x.sum())
# df5.transform(Lambda x:x.sum()) gives an error
```

```
A      6
B     60
dtype: int64
```

23

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Slide 24

▶ Useful Operations

apply() vs transform()

- ▶ `apply()` works with multiple Series at a time. But, `transform()` is only allowed to work with a single Series at a time.

A	B
0	1 10
1	2 20
2	3 30

```
df5.apply(lambda x: x["B"]-x["A"], axis=1)
# df5.transform(Lambda x: x["B"]-x["A"], axis=1) gives an error
```

0	9
1	18
2	27

dtype: int64



24

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Slide 25

▶ Useful Operations

apply() vs transform()

- ▶ `apply()` works with multiple Series at a time. But, `transform()` is only allowed to work with a single Series at a time.

key	A	B
0	a 0 1	
1	b 1 2	
2	c 2 3	
3	a 3 1	
4	b 4 2	
5	c 5 3	
6	a 6 1	
7	b 7 2	
8	c 8 3	

```
df6.groupby('key').apply(lambda x: x["B"]-x["A"])
# df6.groupby('key').transform(Lambda x: x["B"]-x["A"]) gives an error
```

key	0	1
a	0	1
	3	-2
	6	-5
b	1	1
	4	-2
	7	-5
c	2	1
	5	-2
	8	-5



25

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Slide 26

▶ Useful Operations

apply() vs transform()

- ▶ `transform()` returns a DataFrame that has the same length as the input

key	A	B
0	a	0 1
1	b	1 2
2	c	2 3
3	a	3 1
4	b	4 2
5	c	5 3
6	a	6 1
7	b	7 2
8	c	8 3

```
df6.groupby('key')[['A']].sum()
```

```
key
```

```
a 9
```

```
b 12
```

```
c 15
```

```
df6.groupby('key')[['A']].apply(lambda x: x.sum())
```

```
key
```

```
a 9
```

```
b 12
```

```
c 15
```

```
df6.groupby('key')[['A']].transform(lambda x: x.sum())
```

```
0 9
```

```
1 12
```

```
2 15
```

```
3 9
```

```
4 12
```

```
5 15
```

```
6 9
```

```
7 12
```

```
8 15
```



28

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Slide 27

▶ Useful Operations

DataFrame.pivot

	Row index in the new table		Columns in the new table	
ix	Item	CType	USD	EU
0	Item0	Gold	1\$	1€
1	Item0	Bronze	2\$	2€
2	Item1	Gold	3\$	3€
3	Item1	Silver	4\$	4€

d.pivot(index='Item', columns='CType', values='USD')

27

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Slide 28

▶ Useful Operations

DataFrame.pivot_table

ix	Item	CType	USD	EU	ix=Item	Bronze	Gold	Silver
0	Item0	Gold	1	1	Item0	2	2 = mean(1,3)	NaN
1	Item0	Bronze	2	2	Item1	NaN	NaN	4
2	Item0	Gold	3	3				
3	Item1	Silver	4	4				

d.pivot_table(index='Item', columns='CType', values='USD', aggfunc=np.mean)

28

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Slide 29

▶ Useful Operations

.pivot() vs .pivot_table()

- ▶ **Pivot_table** is a generalization of **pivot** that can handle duplicate values for **one pivoted index/column pair**.
- ▶ **Pivot_table** will only allow **numeric types** as "values=", whereas **pivot** will take **string types** as "values=".

29

Use this space to take notes:

Slide 30

▶ Useful Operations

.pivot() vs .pivot_table()

gender	sport	age	height	weight
0	male	baseball	21	200
1	female	basketball	21	130
2	female	golf	22	150
3	male	basketball	20	175
4	female	archery	22	170
				68

df.pivot_table(index='gender', columns='sport', values=['age','height','weight'], aggfunc='mean')				
gender	age	baseball	basketball	golf
female	22.0	Nan	21.0	22.0
male	NaN	21.0	20.0	NaN
				68.0

Pivot and pivot_table may only exhibit the same functionality if the data allows.

df.pivot(index='gender', columns='sport', values=['age','height','weight'])				
gender	age	baseball	basketball	golf
female	22.0	Nan	21.0	22.0
male	NaN	21.0	20.0	NaN
				68.0

30

Use this space to take notes:

Slide 31

▶ Useful Operations

.pivot() vs .pivot_table()

gender	sport	age	height	weight
0	male	baseball	21	200
1	female	basketball	21	130
2	female	golf	22	150
3	male	basketball	20	175
4	female	basketball	22	170
				68

df.pivot_table(index='gender', columns='sport', values=['age','height','weight'], aggfunc='mean')				
gender	age	baseball	basketball	golf
female	NaN	21.5	22.0	NaN
male	21.0	20.0	NaN	72.0
				68.0

If there are duplicate entries possible from the index(es) of interest you will need to aggregate the data in pivot_table, not pivot.

df.pivot(columns='sport', values=['age','height','weight'])				
age	baseball	basketball	golf	height
0	21.0	NaN	NaN	72.0
1	NaN	21.0	NaN	72.0
2	NaN	NaN	22.0	NaN
3	NaN	20.0	NaN	75.0
4	NaN	NaN	22.0	NaN

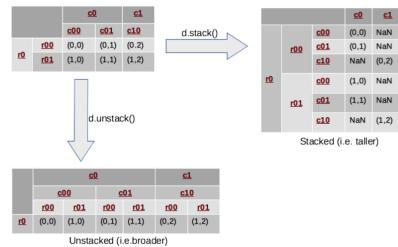
31

Use this space to take notes:

Slide 32

▶ Useful Operations

.stack() vs .unstack()



Use this space to take notes:

Slide 33

▶ Data Analysis with Python



let's start the
hands-on phase

Use this space to take notes:

Slide 34

Your Response

Slide 34

Your Response

Did you find this lesson interesting and challenging?

Too hard Just right Too easy

Peer Deck
Students, drag the icon!

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Slide 35

THANKS!
Any questions?

You can find us at:
► #questions-answers@Slack



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35

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