Stacking DataFrames

RESHAPING DATA WITH PANDAS

Maria Eugenia Inzaugarat
Data Scientist

datacamp

Row multi-indices

		height	weight
Last	First		
Wick	John	185	68
	Julien	164	61
Shelley	Mary	164	59
	Frank	155	58

Setting the index

```
churn
```

```
   credit_score age  country  num_products exited
0           619  43   France             1    Yes
1           608  34  Germany             0     No
2           502  23   France             1    Yes
```

Setting the index

```
churn.set_index(['country', 'age'], inplace=True)
```

```
                credit_score num_products exited
age  country
 43   France            619            1    Yes
 34  Germany            608            0     No
 23   France            502            1    Yes
```

MultiIndex from array

```
new_array = [['yes', 'no', 'yes'], ['no', 'yes', 'yes']]
churn.index = pd.MultiIndex.from_arrays(new_array, names=['member', 'credit_card'])
churn
```

```
                    credit_score age  country  num_products exited
member credit_card
   yes          no           619  43   France             1    Yes
    no         yes           608  34  Germany             0     No
   yes         yes           502  23   France             1    Yes
```

MultiIndex DataFrames

		2019		2020	
		height	weight	height	weight
Last	First				
Wick	John	185	68	185	70
	Julien	164	61	164	60
Shelley	Mary	164	59	164	60
	Frank	155	65	155	58

MultiIndex DataFrames

```
index = pd.MultiIndex.from_arrays([['Wick', 'Wick', 'Shelley', 'Shelley'],
                                   ['John', 'Julien', 'Mary', 'Frank']],
                          names=['last', 'first'])
columns = pd.MultiIndex.from_arrays([['2019', '2019', '2020', '2020'],
                                     ['age', 'weight', 'age', 'weight']],
                            names=['year', 'feature'])
patients = pd.DataFrame(data, index=index, columns=columns)
patients
```

```
            year        2019        2020
         feature  age weight  age weight
   last    first
   Wick     John   25     68   26     72
          Julien   31     72   32     73
Shelley     Mary   41     68   42     69
          Frank   32     75   33     74
```

The .stack() method

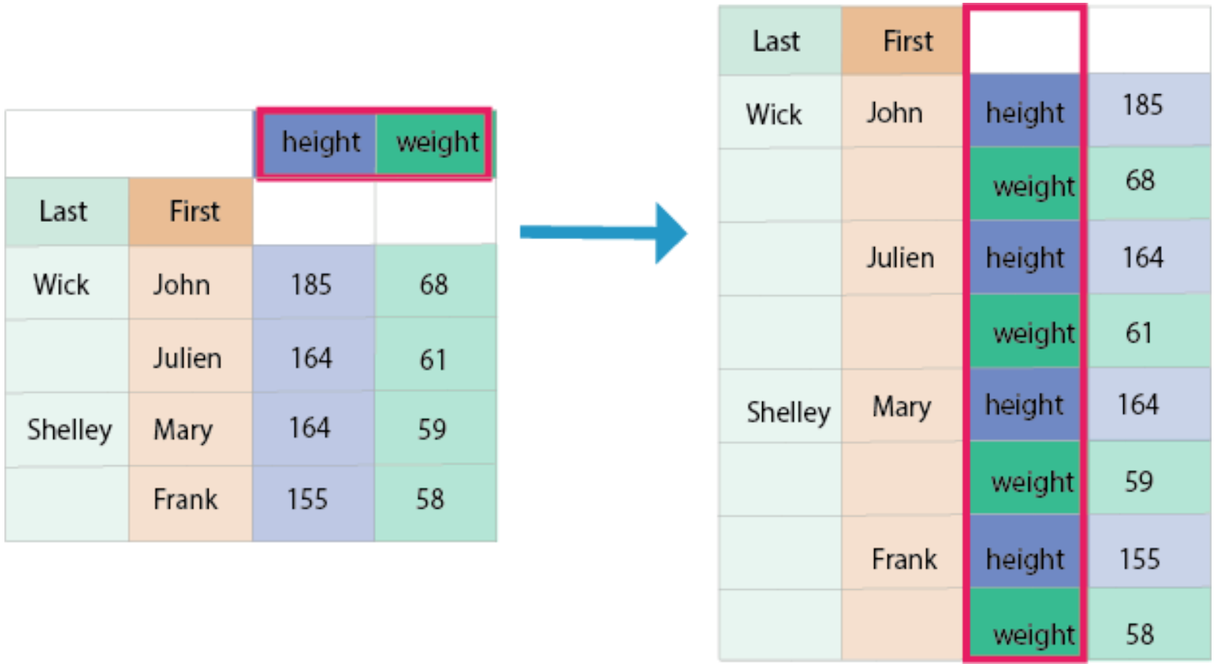
		height	weight
Last	First		
Wick	John	185	68
	Julien	164	61
Shelley	Mary	164	59
	Frank	155	58

Last	First		
Wick	John	height	185
		weight	68
	Julien	height	164
		weight	61
Shelley	Mary	height	164
		weight	59
	Frank	height	155
		weight	58

df.stack()

The .stack() method

> Rearrange a level of the columns to obtain a reshaped DataFrame with a new inner-most level row index



		height	weight
Last	First		
Wick	John	185	68
	Julien	164	61
Shelley	Mary	164	59
	Frank	155	58

Last	First		
Wick	John	height	185
		weight	68
	Julien	height	164
		weight	61
Shelley	Mary	height	164
		weight	59
	Frank	height	155
		weight	58

Stack into a series

```
churn
```

```
   credit_score age  country  num_products exited
0           619  43   France             1    Yes
1           608  34  Germany             0     No
2           502  23   France             1    Yes
```

```
churned_stacked = churn.stack()
churned_stacked.head(10)
```

```
member  credit_card
yes     no           credit_score        619
                     age                  43
                     country          France
                     num_products          1
                     churn                Yes
no      yes          credit_score        608
                     age                  34
                     country         Germany
                     num_products          0
                     churn                No
```

Stack into a DataFrame

```
patients
```

```
           year        2019        2020
        feature  age weight  age weight
   last    first
   Wick     John   25     68   26     72
           Julien   31     72   32     73
Shelley     Mary   41     68   42     69
           Frank   32     75   33     74
```

```
patients_stacked = patients.stack()
patients_stacked
```

```
                      year  2019 2020
  last   first  feature
  Wick    John       age    25   26
                  weight    68   72
         Julien      age    31   32
                  weight    72   73
Shelley  Mary       age    41   42
                  weight    68   69
         Frank       age    32   33
                  weight    75   74
```

Stack a level by number

```
patients
```

		year	2019		2020	
		feature	age	weight	age	weight
last	first					
Wick	John		25	68	26	72
	Julien		31	72	32	73
Shelley	Mary		41	68	42	69
	Frank		32	75	33	74

```
patients.stack(level=0)
```

		feature	age	weight
last	first	year		
Wick	John	2019	25	68
		2020	26	72
	Julien	2019	31	72
		2020	32	73
Shelley	Mary	2019	41	68
		2020	42	69
	Frank	2019	32	75
		2020	33	74

Stack a level by name

```
patients
```

	year	2019		2020	
	feature	age	weight	age	weight
last	first				
Wick	John	25	68	26	72
	Julien	31	72	32	73
Shelley	Mary	41	68	42	69
	Frank	32	75	33	74

```
patients.stack(level='year')
```

		feature	age	weight
last	first	year		
Wick	John	2019	25	68
		2020	26	72
	Julien	2019	31	72
		2020	32	73
Shelley	Mary	2019	41	68
		2020	42	69
	Frank	2019	32	75
		2020	33	74

Let's practice!

RESHAPING DATA WITH PANDAS

Unstacking DataFrames

RESHAPING DATA WITH PANDAS

Maria Eugenia Inzaugarat
Data Scientist

datacamp

Review

		height	weight
Last	First		
Wick	John	185	68
	Julien	164	61
Shelley	Mary	164	59
	Frank	155	58

Last	First		
Wick	John	height	185
		weight	68
	Julien	height	164
		weight	61
Shelley	Mary	height	164
		weight	59
	Frank	height	155
		weight	58

df.stack()

Undoing stacking process

Last	First		
Wick	John	height	185
		weight	68
	Julien	height	164
		weight	61
Shelley	Mary	height	164
		weight	59
	Frank	height	155
		weight	58

		height	weight
Last	First		
Wick	John	185	68
	Julien	164	61
Shelley	Mary	164	59
	Frank	155	58

The .unstack() method

Last	First		
Wick	John	height	185
		weight	68
	Julien	height	164
		weight	61
Shelley	Mary	height	164
		weight	59
	Frank	height	155
		weight	58

		height	weight
Last	First		
Wick	John	185	68
	Julien	164	61
Shelley	Mary	164	59
	Frank	155	58

df.unstack()

The .unstack() method

> Rearrange a level of the row index into the columns to obtain a reshaped DataFrame with a new inner-most level column index.

Last	First		
Wick	John	height	185
		weight	68
	Julien	height	164
		weight	61
Shelley	Mary	height	164
		weight	59
	Frank	height	155
		weight	58

		height	weight
Last	First		
Wick	John	185	68
	Julien	164	61
Shelley	Mary	164	59
	Frank	155	58

Unstack Series

```
churn_stacked
```

```
member  credit_card
yes     no           credit_score        619
                     age                  43
                     country          France
                     num_products          1
                     churn               Yes
no      yes          credit_score        608
                     age                  34
                     country         Germany
                     num_products          0
                     churn                No
yes     yes          credit_score        502
                     age                  23
                     country          France
                     num_products          1
                     churn               Yes
```

Unstack Series

```
churned_stacked.unstack()
```

```
                    credit_score age  country  num_products exited
member credit_card
    no         yes            608  34  Germany             0     No
   yes          no            619  43   France             1    Yes
                yes            502  23   France             1    Yes
```

Unstacking a DataFrame

```
patients_stacked
```

```
                  year  2019 2020
  first   last feature
   Wick   John     age    25   26
                weight    68   72
         Julien    age    31   32
                weight    72   73
Shelley   Mary     age    41   42
                weight    68   69
          Frank    age    32   33
                weight    75   74
```

Unstacking a DataFrame

```
patients_stacked.unstack()
```

```
                    2019       2020
         feature  age weight age weight
   last    first
Shelley    Frank   32     75  33     74
            Mary   41     68  42     69
   Wick     John   25     68  26     72
          Julien   31     72  32     73
```

Unstack a level

Last	First		
Johnson	Louis	age	32
		weight	68
	Mary	age	42
		weight	61
Smith	Louis	age	20
		weight	59
	Mary	age	32
		weight	58

	First	Louis	Mary
Last			
Johnson	age	32	42
	weight	68	61
Smith	age	20	32
	weight	59	58

df.unstack(level=1) or df.unstack(level='First')

Unstack level by number

```
churn_stacked.head(10)
```

```
member  credit_card
yes     no           credit_score        619
                     age                  43
                     country          France
                     num_products          1
                     churn               Yes
no      yes          credit_score        608
                     age                  34
                     country         Germany
                     num_products          0
                     churn                No
```

```
churn_stacked.unstack(level=0)
```

```
                    member     no    yes
credit_card
         no credit_score     NaN    619
                     age     NaN     43
                 country     NaN France
             num_products     NaN      1
                    churn     NaN    Yes
        yes credit_score     608    502
                     age      34     23
                 country Germany France
             num_products       0      1
                    churn      No    Yes
```

Unstack level by name

```
churn_stacked.head(10)
```

```
member  credit_card
yes     no           credit_score        619
                     age                  43
                     country          France
                     num_products          1
                     churn               Yes
no      yes          credit_score        608
                     age                  34
                     country         Germany
                     num_products          0
                     churn                No
```

```
churn_stacked.unstack(level='credit_card')
```

```
              credit_card      no     yes
member
    no  credit_score     NaN     608
                 age     NaN      34
             country     NaN Germany
          num_products     NaN       0
               churn     NaN      No
    yes credit_score     619     NaN
                 age      43     NaN
             country  France     NaN
          num_products       1     NaN
               churn     Yes     NaN
```

Sort index

```
patients_stacked.unstack().sort_index(ascending=False)
```

```
          year         2019       2020
       feature   age weight age weight
   last   first
   Wick  Julien    31     72  32     73
          John     25     68  26     72
Shelley    Mary    41     68  42     69
         Frank     32     75  33     74
```

Rearranging levels

```
patients_stacked
```

```
                  year  2019 2020
  first   last feature
   Wick   John     age    25   26
                weight    68   72
         Julien     age    31   32
                weight    72   73
Shelley   Mary     age    41   42
                weight    68   69
          Frank     age    32   33
                weight    75   74
```

```
patients_stacked.unstack(level=1).stack(level=0)
```

```
first                  Frank  John  Julien  Mary
 last   feature year
Shelley age     2019   32.0   NaN     NaN  41.0
                2020   33.0   NaN     NaN  42.0
        weight  2019   75.0   NaN     NaN  68.0
                2020   74.0   NaN     NaN  69.0
Wick    age     2019    NaN  25.0    31.0   NaN
                2020    NaN  26.0    32.0   NaN
        weight  2019    NaN  68.0    72.0   NaN
                2020    NaN  72.0    73.0   NaN
```

Let's practice!

RESHAPING DATA WITH PANDAS

Working with multiple levels

RESHAPING DATA WITH PANDAS

Maria Eugenia Inzaugarat
Instructor

datacamp

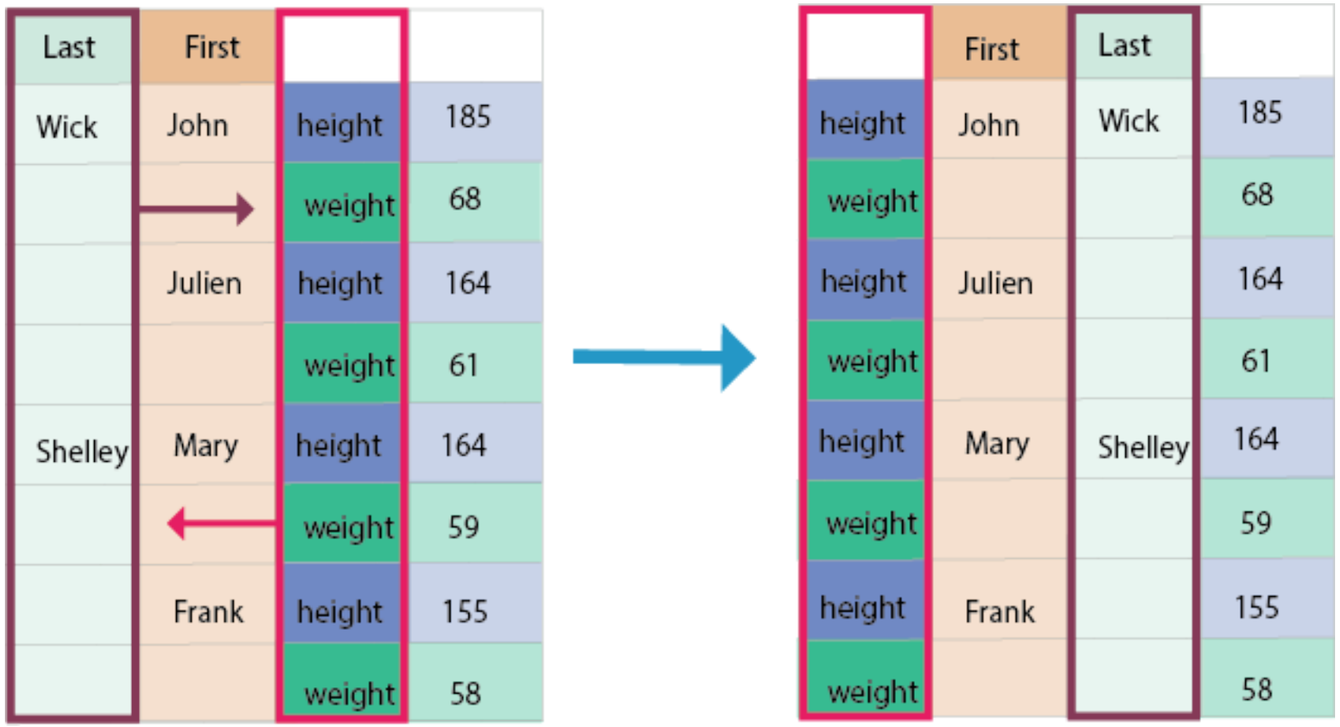
Review

- Stack and unstack DataFrames and Series
- Choose a level to stack or unstack by name or number
- Rearrange levels by combining unstack and stack

Rearranging multiple levels

- Swap levels
- Stack and unstack multiple levels at the same time

Swap levels



df.swaplevel(0 , 2)

Swap levels

```
cars
```

```
                          2019  2020
price    Golf       VW     25    26
 sold    Golf       VW     68    72
price  Passat       VW     31    32
 sold  Passat       VW     72    73
price A-class Mercedes     41    42
 sold A-class Mercedes     68    69
price C-class Mercedes     32    33
sold  C-class Mercedes     75    74
```

Swap levels

```
cars
```

```
                        2019  2020
price    Golf       VW    25    26
 sold    Golf       VW    68    72
price  Passat       VW    31    32
 sold  Passat       VW    72    73
price A-class Mercedes    41    42
 sold A-class Mercedes    68    69
price C-class Mercedes    32    33
sold  C-class Mercedes    75    74
```

```
cars.swaplevel(0, 2)
```

```
                              2019  2020
VW       Golf    price          25    26
                 sold           68    72
         Passat  price          31    32
                 sold           72    73
Mercedes A-class price          41    42
                 sold           68    69
         C-class price          32    33
                 sold           75    74
```

Swap levels and unstack

```
cars
```

```
                        2019  2020
price    Golf       VW    25    26
 sold    Golf       VW    68    72
price  Passat       VW    31    32
 sold  Passat       VW    72    73
price A-class Mercedes    41    42
 sold A-class Mercedes    68    69
price C-class Mercedes    32    33
sold  C-class Mercedes    75    74
```

```
cars.swaplevel(0, 2).unstack()
```

```
                      2019       2020
                     price sold price sold
Mercedes A-class        41   68    42   69
         C-class        32   75    33   74
     VW      Golf       25   68    26   72
             Passat     31   72    32   73
```

Swap levels and unstack

```
cars
```

```
                          2019  2020
price    Golf       VW     25    26
 sold    Golf       VW     68    72
price  Passat       VW     31    32
 sold  Passat       VW     72    73
price A-class Mercedes     41    42
 sold A-class Mercedes     68    69
price C-class Mercedes     32    33
sold  C-class Mercedes     75    74
```

```
cars.unstack()
```

```
             Mercedes    VW Mercedes    VW
                 2019  2019     2020  2020
price A-class    41.0   NaN     42.0   NaN
      C-class    32.0   NaN     33.0   NaN
         Golf     NaN  25.0      NaN  26.0
       Passat     NaN  31.0      NaN  32.0
sold  A-class    68.0   NaN     69.0   NaN
      C-class    75.0   NaN     74.0   NaN
         Golf     NaN  68.0      NaN  72.0
       Passat     NaN  72.0      NaN  73.0
```

Swap levels and unstack

```
cars
```

```
                        2019  2020
price    Golf       VW    25    26
 sold    Golf       VW    68    72
price  Passat       VW    31    32
 sold  Passat       VW    72    73
price A-class Mercedes    41    42
 sold A-class Mercedes    68    69
price C-class Mercedes    32    33
sold  C-class Mercedes    75    74
```

```
cars.unstack().swaplevel(0, 1, axis=1)
```

```
                      2019           2020
                 Mercedes   VW Mercedes   VW
price A-class        41.0  NaN     42.0  NaN
      C-class        32.0  NaN     33.0  NaN
         Golf         NaN 25.0      NaN 26.0
       Passat         NaN 31.0      NaN 32.0
sold  A-class        68.0  NaN     69.0  NaN
      C-class        75.0  NaN     74.0  NaN
         Golf         NaN 68.0      NaN 72.0
       Passat         NaN 72.0      NaN 73.0
```

Swap levels and stack

```
cars
```

```
                        2019  2020
price    Golf       VW    25    26
 sold    Golf       VW    68    72
price  Passat       VW    31    32
 sold  Passat       VW    72    73
price A-class Mercedes    41    42
 sold A-class Mercedes    68    69
price C-class Mercedes    32    33
sold  C-class Mercedes    75    74
```

```
cars.stack()
```

```
price     Golf       VW   2019    25
                          2020    26
 sold     Golf       VW   2019    68
                          2020    72
price   Passat       VW   2019    31
                          2020    32
 sold   Passat       VW   2019    72
                          2020    73
price  A-class  Mercedes  2019    41
                          2020    42
 sold  A-class  Mercedes  2019    68
                          2020    69
```

Swap levels and stack

```
cars
```

```
                          2019  2020
price    Golf       VW     25    26
 sold    Golf       VW     68    72
price  Passat       VW     31    32
 sold  Passat       VW     72    73
price A-class Mercedes     41    42
 sold A-class Mercedes     68    69
price C-class Mercedes     32    33
sold  C-class Mercedes     75    74
```

```
cars.stack().swaplevel(0, 2)
```

```
     VW     Golf   price  2019    25
                          2020    26
                    sold  2019    68
                          2020    72
           Passat   price  2019    31
                          2020    32
                    sold  2019    72
                          2020    73
Mercedes  A-class  price  2019    41
                          2020    42
                    sold  2019    68
                          2020    69
```

Multiple levels

		day				night	
		2019		2020		2020	
		high	low	high	low	high	low
Last	First						
Wick	John	110	68	120	70	110	70
	Julien	120	61	121	60	115	60
Shelley	Mary	90	59	90	60	100	60
	Frank	100	65	92	58	105	58

Unstacking multiple levels

```
cars
```

```
year                        2019  2020
  brand      model  feature
     VW       Golf    price   25    26
                       sold   68    72
            Passat    price   31    32
                       sold   72    73
Mercedes  A-class    price   41    42
                       sold   68    69
          C-class    price   32    33
                       sold   75    74
```

Unstacking levels by number

```
cars.unstack(level=[0, 1])
```

```
               year            2019                        2020
brand            VW         Mercedes          VW         Mercedes
model    Golf Passat  A-class C-class Golf Passat  A-class C-class
feature
price      25     31        41      32    26     32       42      33
sold       68     72        68      75    72     73       69      74
```

Unstacking levels by name

```
cars.unstack(level=['brand', 'model'])
```

```
               year            2019                          2020
brand            VW         Mercedes          VW         Mercedes
model    Golf Passat  A-class C-class Golf Passat  A-class C-class
feature
price      25     31        41      32    26     32       42      33
sold       68     72        68      75    72     73       69      74
```

Stacking multiple levels

```
cars_unstacked
```

```
  year                    2019                    2020
 brand              VW          Mercedes          VW          Mercedes
 model    Golf Passat  A-class C-class Golf Passat  A-class C-class
feature
 price      25     31        41      32    26     32        42      33
  sold      68     72        68      75    72     73        69      74
```

Stacking by name or number

```
cars_unstacked.stack(level=[0, 1])
```

		model	A-class	C-class	Golf	Passat
feature	year	brand				
price	2019	Mercedes	41.0	32.0	NaN	NaN
		VW	NaN	NaN	25.0	31.0
	2020	Mercedes	42.0	33.0	NaN	NaN
		VW	NaN	NaN	26.0	32.0
sold	2019	Mercedes	68.0	75.0	NaN	NaN
		VW	NaN	NaN	68.0	72.0
	2020	Mercedes	69.0	74.0	NaN	NaN
		VW	NaN	NaN	72.0	73.0

```
cars_unstacked.stack(levels=['year', 'brand'])
```

		model	A-class	C-class	Golf	Passat
feature	year	brand				
price	2019	Mercedes	41.0	32.0	NaN	NaN
		VW	NaN	NaN	25.0	31.0
	2020	Mercedes	42.0	33.0	NaN	NaN
		VW	NaN	NaN	26.0	32.0
sold	2019	Mercedes	68.0	75.0	NaN	NaN
		VW	NaN	NaN	68.0	72.0
	2020	Mercedes	69.0	74.0	NaN	NaN
		VW	NaN	NaN	72.0	73.0

Let's practice!

RESHAPING DATA WITH PANDAS

Handling missing data

RESHAPING DATA WITH PANDAS

Maria Eugenia Inzaugarat
Data Scientist

datacamp

Review

- Stack and unstack DataFrames:
  - All columns index levels
  - A row index level
  - Choose which levels to stack or unstack

Unstacking leads to missing values

Subgroups do not have the same set of labels

```
animals
```

```
                              jump  run  fly
class    order          name
Mammalia carnivora      dog    No  Yes   No
         Diprotodontia  Kangaroo  Yes   No   No
Aves     hervibora      bird       No   No  Yes
```

Unstacking leads to missing values

Subgroups do not have the same set of labels

```
animals
```

```
                              jump  run  fly
class    order         name
   Mammalia carnivora     dog        No  Yes   No <--
         Diprotodontia Kangaroo  Yes   No   No
Aves     hervibora     bird       No   No  Yes
```

Unstacking leads to missing values

Subgroups do not have the same set of labels

```
animals.unstack(level='class')
```

		jump		run		fly	
clas		Aves	Mammalia	Aves	Mammalia	Aves	Mammalia
order	name						
Diprotodontia	Kangaroo	NaN	Yes	NaN	No	NaN	No
carnivora	Dog	NaN	No	NaN	Yes	NaN	No
Charadriiformes	Avocet	No	NaN	No	NaN	Yes	NaN

Unstacking leads to missing values

Subgroups do not have the same set of labels

```
animals.unstack(level='class')
```

```
                              jump            run           fly
       clas                 Aves Mammalia Aves Mammalia Aves Mammalia
       order       name
  Diprotodontia Kangaroo  NaN      Yes  NaN        No  NaN        No
  ----------------------------
      carnivora      Dog  NaN <--  No   NaN       Yes  NaN        No
  ----------------------------
Charadriiformes   Avocet   No      NaN   No       NaN  Yes       NaN
```

Handling NaN with unstack

```
animals.unstack(level='class', fill_value=    )
```

Handling NaN with unstack

```
animals.unstack(level='class', fill_value='No')
```

Handling NaN with unstack

```
animals.unstack(level='class', fill_value='No').sort_index(level=['order', 'name'], ascending=[True, False])
```

```
                            jump            run           fly
clas                       Aves Mammalia Aves Mammalia Aves Mammalia
order          name
Diprotodontia  Kangaroo    No      Yes   No       No   No       No
carnivora      Dog         No       No   No      Yes   No       No
Charadriiformes Avocet     No       No   No       No  Yes       No
```

Stack and missing values

Combinations of index and column values missing from the original DataFrame

```
flowers
```

```
      petals Stigma
      number   size
rose      40    NaN
Lily       8    big
```

Stack and missing values

Combinations of index and column values missing from the original DataFrame

```
flowers.stack()
```

```
             Stigma  petals
rose number     NaN    40.0
Lily number     NaN     8.0
       size       5     NaN
```

Stack and missing values

Combinations of index and column values missing from the original DataFrame

```
flowers.stack(dropna=True)
```

```
             Stigma  petals
rose number     NaN    40.0
Lily number     NaN     8.0
       size       5     NaN
```

Stack and missing values

Combinations of index and column values missing from the original DataFrame

```
flowers.stack(dropna=False)
```

```
             Stigma  petals
rose number     NaN    40.0
         size    NaN     NaN <--
Lily number     NaN     8.0
       size      5     NaN
```

Handling NaN with stack

```
flowers.stack(dropna=False).fillna(0)
```

```
             Stigma  petals
rose number       0    40.0
       size       0       0
Lily number       0     8.0
       size       5       0
```

Let's practice!

RESHAPING DATA WITH PANDAS