Summary statistics

DATA MANIPULATION WITH PANDAS

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Summarizing numerical data

```
dogs["height_cm"].mean()
```

```
49.714285714285715
```

- `.median()`, `.mode()`
- `.min()`, `.max()`
- `.var()`, `.std()`
- `.sum()`
- `.quantile()`

Summarizing dates

Oldest dog:

```
dogs["date_of_birth"].min()
```

```
'2011-12-11'
```

Youngest dog:

```
dogs["date_of_birth"].max()
```

```
'2018-02-27'
```

The .agg() method

```
def pct30(column):
    return column.quantile(0.3)
```

```
dogs["weight_kg"].agg(pct30)
```

```
22.599999999999998
```

Summaries on multiple columns

```
dogs[["weight_kg", "height_cm"]].agg(pct30)
```

```
weight_kg    22.6
height_cm    45.4
dtype: float64
```

Multiple summaries

```
def pct40(column):
    return column.quantile(0.4)
```

```
dogs["weight_kg"].agg([pct30, pct40])
```

```
pct30    22.6
pct40    24.0
Name: weight_kg, dtype: float64
```

Cumulative sum

```
dogs["weight_kg"]
```

```
0    24
1    24
2    24
3    17
4    29
5    2
6    74
Name: weight_kg, dtype: int64
```

```
dogs["weight_kg"].cumsum()
```

```
0      24
1      48
2      72
3      89
4     118
5     120
6     194
Name: weight_kg, dtype: int64
```

Cumulative statistics

- `.cummax()`
- `.cummin()`
- `.cumprod()`

Walmart

```
sales.head()
```

	store	type	dept	date	weekly_sales	is_holiday	temp_c	fuel_price	unemp
0	1	A	1	2010-02-05	24924.50	False	5.73	0.679	8.106
1	1	A	2	2010-02-05	50605.27	False	5.73	0.679	8.106
2	1	A	3	2010-02-05	13740.12	False	5.73	0.679	8.106
3	1	A	4	2010-02-05	39954.04	False	5.73	0.679	8.106
4	1	A	5	2010-02-05	32229.38	False	5.73	0.679	8.106

Let's practice!

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Counting

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Avoiding double counting

Vet visits

```
print(vet_visits)
```

```
          date     name         breed  weight_kg
0   2018-09-02    Bella     Labrador      24.87
1   2019-06-07      Max     Labrador      28.35
2   2018-01-17   Stella    Chihuahua       1.51
3   2019-10-19     Lucy    Chow Chow      24.07
..         ...      ...          ...        ...
71  2018-01-20   Stella    Chihuahua       2.83
72  2019-06-07      Max    Chow Chow      24.01
73  2018-08-20     Lucy    Chow Chow      24.40
74  2019-04-22      Max     Labrador      28.54
```

Dropping duplicate names

```
vet_visits.drop_duplicates(subset="name")
```

```
          date     name         breed  weight_kg
0   2018-09-02    Bella      Labrador      24.87
1   2019-06-07      Max     Chow Chow      24.01
2   2019-03-19  Charlie        Poodle      24.95
3   2018-01-17   Stella     Chihuahua       1.51
4   2019-10-19     Lucy     Chow Chow      24.07
7   2019-03-30   Cooper     Schnauzer      16.91
10  2019-01-04   Bernie  St. Bernard      74.98
(6  2019-06-07      Max      Labrador      28.35)
```

Dropping duplicate pairs

```
unique_dogs = vet_visits.drop_duplicates(subset=["name", "breed"])
print(unique_dogs)
```

```
         date     name         breed  weight_kg
0  2018-09-02    Bella     Labrador      24.87
1  2019-03-13      Max    Chow Chow      24.13
2  2019-03-19  Charlie       Poodle      24.95
3  2018-01-17   Stella    Chihuahua       1.51
4  2019-10-19     Lucy    Chow Chow      24.07
6  2019-06-07      Max     Labrador      28.35
7  2019-03-30   Cooper    Schnauzer      16.91
10 2019-01-04   Bernie  St. Bernard      74.98
```

Easy as 1, 2, 3

```
unique_dogs["breed"].value_counts()
```

```
Labrador       2
Schnauzer      1
St. Bernard    1
Chow Chow      2
Poodle         1
Chihuahua      1
Name: breed, dtype: int64
```

```
unique_dogs["breed"].value_counts(sort=True)
```

```
Labrador       2
Chow Chow      2
Schnauzer      1
St. Bernard    1
Poodle         1
Chihuahua      1
Name: breed, dtype: int64
```

Proportions

```
unique_dogs["breed"].value_counts(normalize=True)
```

```
Labrador        0.250
Chow Chow       0.250
Schnauzer       0.125
St. Bernard     0.125
Poodle          0.125
Chihuahua       0.125
Name: breed, dtype: float64
```

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Grouped summary statistics

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Summaries by group

```
dogs[dogs["color"] == "Black"]["weight_kg"].mean()
dogs[dogs["color"] == "Brown"]["weight_kg"].mean()
dogs[dogs["color"] == "White"]["weight_kg"].mean()
dogs[dogs["color"] == "Gray"]["weight_kg"].mean()
dogs[dogs["color"] == "Tan"]["weight_kg"].mean()
```

```
26.0
24.0
74.0
17.0
2.0
```

Grouped summaries

```
dogs.groupby("color")["weight_kg"].mean()
```

```
color
Black    26.5
Brown    24.0
Gray     17.0
Tan       2.0
White    74.0
Name: weight_kg, dtype: float64
```

Multiple grouped summaries

```
dogs.groupby("color")["weight_kg"].agg([min, max, sum])
```

```
       min  max  sum
color
Black   24   29   53
Brown   24   24   48
Gray    17   17   17
Tan      2    2    2
White   74   74   74
```

Grouping by multiple variables

```
dogs.groupby(["color", "breed"])["weight_kg"].mean()
```

```
color  breed
Black  Chow Chow      25
       Labrador       29
       Poodle         24
Brown  Chow Chow      24
       Labrador       24
Gray   Schnauzer      17
Tan    Chihuahua       2
White  St. Bernard    74
Name: weight_kg, dtype: int64
```

Many groups, many summaries

```
dogs.groupby(["color", "breed"])[["weight_kg", "height_cm"]].mean()
```

```
                 weight_kg  height_cm
color breed
Black Labrador          29         59
      Poodle            24         43
Brown Chow Chow         24         46
      Labrador          24         56
Gray  Schnauzer         17         49
Tan   Chihuahua         2          18
White St. Bernard       74         77
```

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Pivot tables

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Group by to pivot table

```
dogs.groupby("color")["weight_kg"].mean()
```

```
color
Black    26
Brown    24
Gray     17
Tan       2
White    74
Name: weight_kg, dtype: int64
```

```
dogs.pivot_table(values="weight_kg",
                 index="color")
```

```
       weight_kg
color
Black       26.5
Brown       24.0
Gray        17.0
Tan          2.0
White       74.0
```

Different statistics

```
import numpy as np
dogs.pivot_table(values="weight_kg", index="color", aggfunc=np.median)
```

```
       weight_kg
color
Black       26.5
Brown       24.0
Gray        17.0
Tan          2.0
White       74.0
```

Multiple statistics

```
dogs.pivot_table(values="weight_kg", index="color", aggfunc=[np.mean, np.median])
```

```
           mean    median
      weight_kg weight_kg
color
Black      26.5      26.5
Brown      24.0      24.0
Gray       17.0      17.0
Tan         2.0       2.0
White      74.0      74.0
```

Pivot on two variables

```
dogs.groupby(["color", "breed"])["weight_kg"].mean()
```

```
dogs.pivot_table(values="weight_kg", index="color", columns="breed")
```

breed	Chihuahua	Chow Chow	Labrador	Poodle	Schnauzer	St. Bernard
color						
Black	NaN	NaN	29.0	24.0	NaN	NaN
Brown	NaN	24.0	24.0	NaN	NaN	NaN
Gray	NaN	NaN	NaN	NaN	17.0	NaN
Tan	2.0	NaN	NaN	NaN	NaN	NaN
White	NaN	NaN	NaN	NaN	NaN	74.0

Filling missing values in pivot tables

```
dogs.pivot_table(values="weight_kg", index="color", columns="breed", fill_value=0)
```

breed	Chihuahua	Chow Chow	Labrador	Poodle	Schnauzer	St. Bernard
color						
Black	0	0	29	24	0	0
Brown	0	24	24	0	0	0
Gray	0	0	0	0	17	0
Tan	2	0	0	0	0	0
White	0	0	0	0	0	74

Summing with pivot tables

```
dogs.pivot_table(values="weight_kg", index="color", columns="breed",
                 fill_value=0, margins=True)
```

breed	Chihuahua	Chow Chow	Labrador	Poodle	Schnauzer	St. Bernard	All
color							
Black	0	0	29	24	0	0	26.500000
Brown	0	24	24	0	0	0	24.000000
Gray	0	0	0	0	17	0	17.000000
Tan	2	0	0	0	0	0	2.000000
White	0	0	0	0	0	74	74.000000
All	2	24	26	24	17	74	27.714286

Let's practice!

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