免費電子書

學習

pandas

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#pandas

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1:

PandasPython“”“”。 Python。

Pandas 。

0.19.1	2016113
0.19.0	2016102
0.18.1	201653
0.18.0	2016313
0.17.1	20151121
0.17.0	2015109
0.16.2	2015612
0.16.1	2015511
0.16.0	2015322
0.15.2	2014-12-12
0.15.1	2014-11-09
0.15.0	20141018
0.14.1	2014711
0.14.0	2014531
0.13.1	201423
0.13.0	201413
0.12.0	2013723

Examples

pandas 。

Anaconda

pandasNumPySciPy。

pandasPythonSciPyIPythonNumPyMatplotlib.....Anaconda LinuxMac OS XWindowsPython。

pandasSciPy。

Anaconda。

Anaconda。

AnacondaAnaconda。

Miniconda

Anacondapandas。 。

Minicondapandas。

CondaAnaconda。 pipvirtualenv。

MinicondaPythonConda。

CondaMiniconda。 。

condavirtualenvPython。

```
conda create -n name_of_my_env python
```

Python。

```
source activate name_of_my_env
```

Windows

```
activate name_of_my_env
```

pandas。

```
conda install pandas
```

pandas

```
conda install pandas=0.13.1
```

IPython

```
conda install ipython
```

Anaconda

```
conda install anaconda
```

pipcondapippip

```
conda install pip
pip install django
```

pandas。

```
pip install pandas
```

NumPy。

anaconda

Continuumanaconda 。 Windows / OSXshellOSX / Linux。

---

anaconda150miniconda 。 WindowsshellOSX / Linux。

minicondapandas

```
conda install pandas
```

---

anacondaminiconda

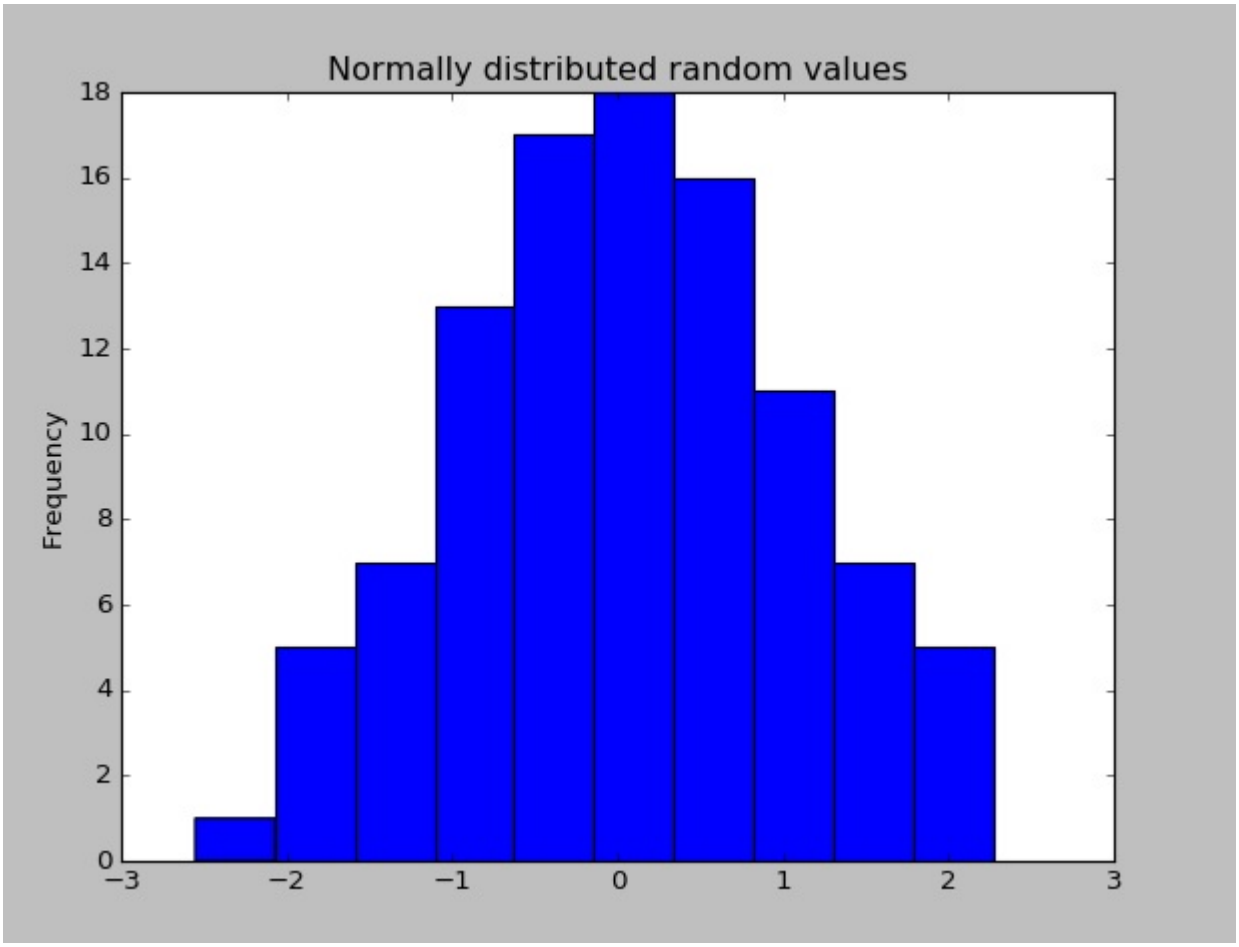
```
conda update pandas
```

Pandas。

```
import pandas as pd  # This is always assumed but is included here as an introduction.
import numpy as np
import matplotlib.pyplot as plt

np.random.seed(0)

values = np.random.randn(100) # array of normally distributed random numbers
s = pd.Series(values) # generate a pandas series
s.plot(kind='hist', title='Normally distributed random values') # hist computes distribution
plt.show()
```




```
s.describe()
# Output: count    100.000000
# mean       0.059808
# std        1.012960
# min       -2.552990
# 25%       -0.643857
# 50%        0.094096
# 75%        0.737077
# max        2.269755
# dtype: float64
```

`.describe()`pandas。

```
In [1]: df = pd.DataFrame({'A': [1, 2, 1, 4, 3, 5, 2, 3, 4, 1],
                           'B': [12, 14, 11, 16, 18, 18, 22, 13, 21, 17],
                           'C': ['a', 'a', 'b', 'a', 'b', 'c', 'b', 'a', 'b', 'a']})

In [2]: df
Out[2]:
   A   B  C
0  1  12  a
1  2  14  a
2  1  11  b
3  4  16  a
4  3  18  b
5  5  18  c
6  2  22  b
7  3  13  a
8  4  21  b
```

```
9  1  17  a

In [3]: df.describe()
Out[3]:
                A          B
count  10.000000  10.000000
mean    2.600000  16.200000
std     1.429841   3.705851
min     1.000000  11.000000
25%     1.250000  13.250000
50%     2.500000  16.500000
75%     3.750000  18.000000
max     5.000000  22.000000
```

C。

```
In [4]: df['C'].describe()
Out[4]:
count     10
unique     3
freq       5
Name: C, dtype: object
```

。

https://riptutorial.com/zh-TW/pandas/topic/796/

2: JSON

Examples

JSON

jsonjson

```
In [99]: pd.read_json('[{"A": 1, "B": 2}, {"A": 3, "B": 4}]')
Out[99]:
   A  B
0  1  2
1  3  4
```

```
with open('test.json') as f:
    data = pd.DataFrame(json.loads(line) for line in f)
```

JSOND3.jsflare.js

```
def to_flare_json(df, filename):
    """Convert dataframe into nested JSON as in flare files used for D3.js"""
    flare = dict()
    d = {"name":"flare", "children": []}

    for index, row in df.iterrows():
        parent = row[0]
        child = row[1]
        child_size = row[2]

        # Make a list of keys
        key_list = []
        for item in d['children']:
            key_list.append(item['name'])

        #if 'parent' is NOT a key in flare.JSON, append it
        if not parent in key_list:
            d['children'].append({"name": parent, "children":[{"value": child_size, "name":
child}]})
        # if parent IS a key in flare.json, add a new child to it
        else:
            d['children'][key_list.index(parent)]['children'].append({"value": child_size,
"name": child})
    flare = d
    # export the final result to a json file
    with open(filename +'.json', 'w') as outfile:
        json.dump(flare, outfile, indent=4)
    return ("Done")
```

JSON

file.jsonJSON

```
{"A": 1, "B": 2}
{"A": 3, "B": 4}
```

```
pd.read_json('file.json', lines=True)
# Output:
#    A  B
# 0  1  2
# 1  3  4
```

JSON https://riptutorial.com/zh-TW/pandas/topic/4752/json

3: Meta

pythonhttp://stackoverflow.com/documentation/python/394/meta-documentation-guidelines#t=20160724005840635952 1。

/:)

Examples

ipython

```
In [11]: df = pd.DataFrame([[1, 2], [3, 4]])

In [12]: df
Out[12]:
   0  1
0  1  2
1  3  4
```

python

```
df.columns  # Out: RangeIndex(start=0, stop=2, step=1)

df[0]
# Out:
# 0    1
# 1    3
# Name: 0, dtype: int64

for col in df:
    print(col)
# prints:
# 0
# 1
```

。

- ipython

```
In [21]: [print(col) for col in df]
0
1
Out[21]: [None, None]
```

pandas`pd`

```
import pandas as pd
```

PEP8

- 4
- kwargs`f(a=1)`
- 80

“”。

`sort_values` ◦

Out◦

```
a
# Out: 1
```

```
print(a)
# prints: 1
```

python 23

```
print(x)     # yes! (works same in python 2 and 3)
print x      # no! (python 2 only)
print(x, y) # no! (works differently in python 2 and 3)
```

Meta https://riptutorial.com/zh-TW/pandas/topic/3253/meta-

4: Pandas IO

pandasIO Tools。

Examples

csvDataFrame

data_file.csv

```
index,header1,header2,header3
1,str_data,12,1.4
3,str_data,22,42.33
4,str_data,2,3.44
2,str_data,43,43.34

7, str_data, 25, 23.32
```

```
pd.read_csv('data_file.csv')
```

```
   index    header1  header2  header3
0      1   str_data       12     1.40
1      3   str_data       22    42.33
2      4   str_data        2     3.44
3      2   str_data       43    43.34
4      7   str_data       25    23.32
```

- **sep**, ◦ pd.read_csv('data_file.csv', sep=';')
- **index_col**index_col = n npandasnDataFrame。

  ```
  pd.read_csv('data_file.csv',  index_col=0)
  ```

  ```
            header1  header2  header3
  index
   1       str_data       12     1.40
   3       str_data       22    42.33
   4       str_data        2     3.44
   2       str_data       43    43.34
   7       str_data       25    23.32
  ```

- **skip_blank_lines**◦ skip_blank_lines=FalseNaN

  ```
  pd.read_csv('data_file.csv',  index_col=0,skip_blank_lines=False)
  ```

  ```
           header1  header2  header3
  index
   1      str_data       12     1.40
  ```

```
 3      str_data       22    42.33
 4      str_data        2     3.44
 2      str_data       43    43.34
NaN          NaN      NaN      NaN
 7      str_data       25    23.32
```

- **parse_dates**◦

```
date_begin;date_end;header3;header4;header5
1/1/2017;1/10/2017;str_data;1001;123,45
2/1/2017;2/10/2017;str_data;1001;67,89
3/1/2017;3/10/2017;str_data;1001;0
```

01 0

```
pd.read_csv('f.csv', sep=';', parse_dates=[0,1])
```

```
  date_begin   date_end   header3  header4 header5
0 2017-01-01 2017-01-10  str_data     1001  123,45
1 2017-02-01 2017-02-10  str_data     1001   67,89
2 2017-03-01 2017-03-10  str_data     1001       0
```

◦

```
dateparse = lambda x: pd.datetime.strptime(x, '%d/%m/%Y')
pd.read_csv('f.csv', sep=';',parse_dates=[0,1],date_parser=dateparse)
```

```
  date_begin   date_end   header3  header4 header5
0 2017-01-01 2017-10-01  str_data     1001  123,45
1 2017-01-02 2017-10-02  str_data     1001   67,89
2 2017-01-03 2017-10-03  str_data     1001       0
```

◦

csv

```
raw_data = {'first_name': ['John', 'Jane', 'Jim'],
            'last_name': ['Doe', 'Smith', 'Jones'],
            'department': ['Accounting', 'Sales', 'Engineering'],}
df = pd.DataFrame(raw_data,columns=raw_data.keys())
df.to_csv('data_file.csv')
```

csv

csvpandas

```
pandas.read_csv('data_file.csv', parse_dates=['date_column'])
```

DataFrames

```
with pd.ExcelFile('path_to_file.xls) as xl:
    d = {sheet_name: xl.parse(sheet_name) for sheet_name in xl.sheet_names}
```

```
pd.read_excel('path_to_file.xls', sheetname='Sheet1')
```

read_excel *read_csv* ◦

```
pd.read_excel('path_to_file.xls',
              sheetname='Sheet1', header=[0, 1, 2],
              skiprows=3, index_col=0)  # etc.
```

read_csv

```
import pandas as pd
import io

temp=u"""index; header1; header2; header3
1; str_data; 12; 1.4
3; str_data; 22; 42.33
4; str_data; 2; 3.44
2; str_data; 43; 43.34
7; str_data; 25; 23.32"""
#after testing replace io.StringIO(temp) to filename
df = pd.read_csv(io.StringIO(temp),
                 sep = ';',
                 index_col = 0,
                 skip_blank_lines = True)
print (df)
         header1   header2   header3
index
1       str_data        12      1.40
3       str_data        22     42.33
4       str_data         2      3.44
2       str_data        43     43.34
7       str_data        25     23.32
```

files ◦ DataFrames concat

```
import pandas as pd
import glob

#a.csv
#a,b
#1,2
#5,8

#b.csv
#a,b
#9,6
#6,4

#c.csv
#a,b
#4,3
#7,0
```

```
files = glob.glob('files/*.csv')
dfs = [pd.read_csv(fp) for fp in files]
```

```
#duplicated index inherited from each Dataframe
df = pd.concat(dfs)
print (df)
   a  b
0  1  2
1  5  8
0  9  6
1  6  4
0  4  3
1  7  0
#'reseting' index
df = pd.concat(dfs, ignore_index=True)
print (df)
   a  b
0  1  2
1  5  8
2  9  6
3  6  4
4  4  3
5  7  0
#concat by columns
df1 = pd.concat(dfs, axis=1)
print (df1)
   a  b  a  b  a  b
0  1  2  9  6  4  3
1  5  8  6  4  7  0
#reset column names
df1 = pd.concat(dfs, axis=1, ignore_index=True)
print (df1)
   0  1  2  3  4  5
0  1  2  9  6  4  3
1  5  8  6  4  7  0
```

```
import pandas as pd

chunksize = [n]
for chunk in pd.read_csv(filename, chunksize=chunksize):
    process(chunk)
    delete(chunk)
```

CSV

```
df.to_csv(file_name)
```

```
df.to_csv(file_name, columns =['col'])
```

Difault" -

```
df.to_csv(file_name,sep="|")
```

```
df.to_csv(file_name, header=False)
```

```
df.to_csv(file_name, header = ['A','B','C',...]
```

'utf-8'encoding

df.to_csvfile_nameencoding ='utf-8'

read_csv

parse_dates。

input.csv

```
2016 06 10 20:30:00    foo
2016 07 11 19:45:30    bar
2013 10 12 4:30:00     foo
```

```
mydateparser = lambda x: pd.datetime.strptime(x, "%Y %m %d %H:%M:%S")
df = pd.read_csv("file.csv", sep='\t', names=['date_column', 'other_column'],
parse_dates=['date_column'], date_parser=mydateparser)
```

parse_dates
date_parser

CSVDF

```
import os
import glob
import pandas as pd

def get_merged_csv(flist, **kwargs):
    return pd.concat([pd.read_csv(f, **kwargs) for f in flist], ignore_index=True)

path = 'C:/Users/csvfiles'
fmask = os.path.join(path, '*mask*.csv')

df = get_merged_csv(glob.glob(fmask), index_col=None, usecols=['col1', 'col3'])

print(df.head())
```

CSV`pd.concat()axis=1`

```
def merged_csv_horizontally(flist, **kwargs):
    return pd.concat([pd.read_csv(f, **kwargs) for f in flist], axis=1)
```

cvspandas

```
1;str_data;12;1.4
3;str_data;22;42.33
4;str_data;2;3.44
2;str_data;43;43.34

7; str_data; 25; 23.32
```

names

```
df = pandas.read_csv('data_file.csv', sep=';', index_col=0,
                     skip_blank_lines=True, names=['a', 'b', 'c'])

df
Out:
           a   b      c
1   str_data  12   1.40
3   str_data  22  42.33
4   str_data   2   3.44
2   str_data  43  43.34
7   str_data  25  23.32
```

HDFStore

```
import string
import numpy as np
import pandas as pd
```

dtypesDF

```
df = pd.DataFrame({
     'int32':    np.random.randint(0, 10**6, 10),
     'int64':    np.random.randint(10**7, 10**9, 10).astype(np.int64)*10,
     'float':    np.random.rand(10),
     'string':   np.random.choice([c*10 for c in string.ascii_uppercase], 10),
     })

In [71]: df
Out[71]:
      float   int32       int64      string
0  0.649978  848354  5269162190  DDDDDDDDDD
1  0.346963  490266  6897476700  OOOOOOOOOO
2  0.035069  756373  6711566750  ZZZZZZZZZZ
3  0.066692  957474  9085243570  FFFFFFFFFF
4  0.679182  665894  3750794810  MMMMMMMMMM
5  0.861914  630527  6567684430  TTTTTTTTTT
6  0.697691  825704  8005182860  FFFFFFFFFF
7  0.474501  942131  4099797720  QQQQQQQQQQ
8  0.645817  951055  8065980030  VVVVVVVVVV
9  0.083500  349709  7417288920  EEEEEEEEEE
```

DF10 * 100.000 = 1.000.000

```
df = pd.concat([df] * 10**5, ignore_index=True)
```

HDFStore

```
store = pd.HDFStore('d:/temp/example.h5')
```

h5 HDFStore[int32int64string]

```
store.append('store_key', df, data_columns=['int32','int64','string'])
```

HDFStore

```
In [78]: store.get_storer('store_key').table
Out[78]:
/store_key/table (Table(10,)) ''
  description := {
  "index": Int64Col(shape=(), dflt=0, pos=0),
  "values_block_0": Float64Col(shape=(1,), dflt=0.0, pos=1),
  "int32": Int32Col(shape=(), dflt=0, pos=2),
  "int64": Int64Col(shape=(), dflt=0, pos=3),
  "string": StringCol(itemsize=10, shape=(), dflt=b'', pos=4)}
  byteorder := 'little'
  chunkshape := (1724,)
  autoindex := True
  colindexes := {
    "index": Index(6, medium, shuffle, zlib(1)).is_csi=False,
    "int32": Index(6, medium, shuffle, zlib(1)).is_csi=False,
    "string": Index(6, medium, shuffle, zlib(1)).is_csi=False,
    "int64": Index(6, medium, shuffle, zlib(1)).is_csi=False}
```

```
In [80]: store.get_storer('store_key').table.colindexes
Out[80]:
{
    "int32": Index(6, medium, shuffle, zlib(1)).is_csi=False,
    "index": Index(6, medium, shuffle, zlib(1)).is_csi=False,
    "string": Index(6, medium, shuffle, zlib(1)).is_csi=False,
    "int64": Index(6, medium, shuffle, zlib(1)).is_csi=False}
```

```
store.close()
```

Nginx

sep

```
df = pd.read_csv(log_file,
                 sep=r'\s(?=(?:[^"]*"[^"]*")*[^"]*$)(?![^\[]*\])',
                 engine='python',
                 usecols=[0, 3, 4, 5, 6, 7, 8],
                 names=['ip', 'time', 'request', 'status', 'size', 'referer', 'user_agent'],
                 na_values='-',
                 header=None
                   )
```

Pandas IO https://riptutorial.com/zh-TW/pandas/topic/2896/pandas-io--

5: pd.DataFrame.apply

Examples

pandas.DataFrame.apply

pandas.DataFrame.apply`DataFrame` - `DataFrameDataFrameDataFrameSeries` ◦

```
# create a random DataFrame with 7 rows and 2 columns
df = pd.DataFrame(np.random.randint(0,100,size = (7,2)),
                  columns = ['fst','snd'])

>>> df
   fst  snd
0   40   94
1   58   93
2   95   95
3   88   40
4   25   27
5   62   64
6   18   92

# apply the square root function to each column:
# (this returns a DataFrame where each entry is the sqrt of the entry in df;
# setting axis=0 or axis=1 doesn't make a difference)
>>> df.apply(np.sqrt)
        fst       snd
0  6.324555  9.695360
1  7.615773  9.643651
2  9.746794  9.746794
3  9.380832  6.324555
4  5.000000  5.196152
5  7.874008  8.000000
6  4.242641  9.591663

# sum across the row (axis parameter now makes a difference):
>>> df.apply(np.sum, axis=1)
0    134
1    151
2    190
3    128
4     52
5    126
6    110
dtype: int64

>>> df.apply(np.sum)
fst    386
snd    505
dtype: int64
```

pd.DataFrame.apply https://riptutorial.com/zh-TW/pandas/topic/7024/pd-dataframe-apply

6: .ix.iloc.loc.at.iatDataFrame

Examples

.iloc

.ilocDataFrame。

DataFrame

```
df = pd.DataFrame({'one': [1, 2, 3, 4, 5],
                   'two': [6, 7, 8, 9, 10],
                }, index=['a', 'b', 'c', 'd', 'e'])
```

DataFrame

```
   one  two
a    1    6
b    2    7
c    3    8
d    4    9
e    5   10
```

.iloc。

```
print df.iloc[0, 0]
```

```
1
```

。

```
df.iloc[1, 1] = '21'
```

```
print df

   one two
a    1   6
b    2  21
c    3   8
d    4   9
e    5  10
```

.loc

.loc。

DataFrame

```
df = pd.DataFrame({'one': [1, 2, 3, 4, 5],
                   'two': [6, 7, 8, 9, 10],
                  }, index=['a', 'b', 'c', 'd', 'e'])
```

DataFrame

```
print df
```

```
   one  two
a    1    6
b    2    7
c    3    8
d    4    9
e    5   10
```

.loc。'c''two'33

```
df.loc['c', 'two'] = 33
```

DataFrame

```
   one  two
a    1    6
b    2    7
c    3   33
d    4    9
e    5   10
```

```
df['two'].loc['c'] = 33df.loc['c', 'two']。
```

```
print df.loc['a':'c']
```

ac。。

```
   one  two
a    1    6
b    2    7
c    3    8
```

```
print df.loc['b':'d', 'two']
```

b"'b。。

```
b    7
c    8
d    9
```

.loc.iloc。

```
df.loc['b', 1]
```

'b'0

```
7
```

.ix.iloc.loc.at.iatDataFrame https://riptutorial.com/zh-TW/pandas/topic/7074/-ix--iloc--loc--at-iat dataframe

7: MultiIndex

Examples

.xs

```
In [1]:
import pandas as pd
import numpy as np
arrays = [['bar', 'bar', 'baz', 'baz', 'foo', 'foo', 'qux', 'qux'],
          ['one', 'two', 'one', 'two', 'one', 'two', 'one', 'two']]
idx_row = pd.MultiIndex.from_arrays(arrays, names=['Row_First', 'Row_Second'])
idx_col = pd.MultiIndex.from_product([['A','B'], ['i', 'ii']],
names=['Col_First','Col_Second'])
df = pd.DataFrame(np.random.randn(8,4), index=idx_row, columns=idx_col)

Out[1]:
Col_First                   A                   B
Col_Second                  i        ii         i        ii
Row_First Row_Second
bar       one        -0.452982 -1.872641  0.248450 -0.319433
          two        -0.460388 -0.136089 -0.408048  0.998774
baz       one         0.358206 -0.319344 -2.052081 -0.424957
          two        -0.823811 -0.302336  1.158968  0.272881
foo       one        -0.098048 -0.799666  0.969043 -0.595635
          two        -0.358485  0.412011 -0.667167  1.010457
qux       one         1.176911  1.578676  0.350719  0.093351
          two         0.241956  1.082138 -0.516898 -0.196605
```

.xslevel axis 01。

.xspandas.Seriespandas.DataFrame 。

```
In [2]: df.xs('two', level='Row_Second', axis=0)
Out[2]:
Col_First          A                   B
Col_Second         i        ii         i        ii
Row_First
bar        -0.460388 -0.136089 -0.408048  0.998774
baz        -0.823811 -0.302336  1.158968  0.272881
foo        -0.358485  0.412011 -0.667167  1.010457
qux         0.241956  1.082138 -0.516898 -0.196605
```

```
In [3]: df.xs('ii', level=1, axis=1)
Out[3]:
Col_First                   A         B
Row_First Row_Second
bar       one        -1.872641 -0.319433
          two        -0.136089  0.998774
baz       one        -0.319344 -0.424957
          two        -0.302336  0.272881
foo       one        -0.799666 -0.595635
          two         0.412011  1.010457
qux       one         1.578676  0.093351
```

```
          two         1.082138 -0.196605
```

.xs..

```
In [4]: df.xs('ii', level='Col_Second', axis=1) = 0
  File "<ipython-input-10-92e0785187ba>", line 1
    df.xs('ii', level='Col_Second', axis=1) = 0
                                            ^
SyntaxError: can't assign to function call
```

.loc

.xs◦ 0.14.0◦

```
In [1]:
import pandas as pd
import numpy as np
arrays = [['bar', 'bar', 'baz', 'baz', 'foo', 'foo', 'qux', 'qux'],
          ['one', 'two', 'one', 'two', 'one', 'two', 'one', 'two']]
idx_row = pd.MultiIndex.from_arrays(arrays, names=['Row_First', 'Row_Second'])
idx_col = pd.MultiIndex.from_product([['A','B'], ['i', 'ii']],
names=['Col_First','Col_Second'])
df = pd.DataFrame(np.random.randn(8,4), index=idx_row, columns=idx_col)

Out[1]:
Col_First                   A                   B
Col_Second                  i        ii         i        ii
Row_First Row_Second
bar       one        -0.452982 -1.872641  0.248450 -0.319433
          two        -0.460388 -0.136089 -0.408048  0.998774
baz       one         0.358206 -0.319344 -2.052081 -0.424957
          two        -0.823811 -0.302336  1.158968  0.272881
foo       one        -0.098048 -0.799666  0.969043 -0.595635
          two        -0.358485  0.412011 -0.667167  1.010457
qux       one         1.176911  1.578676  0.350719  0.093351
          two         0.241956  1.082138 -0.516898 -0.196605
```

```
In [2]: df.loc[(slice(None),'two'),:]
Out[2]:
Col_First                   A                   B
Col_Second                  i        ii         i        ii
Row_First Row_Second
bar       two        -0.460388 -0.136089 -0.408048  0.998774
baz       two        -0.823811 -0.302336  1.158968  0.272881
foo       two        -0.358485  0.412011 -0.667167  1.010457
qux       two         0.241956  1.082138 -0.516898 -0.196605
```

```
In [3]: df.loc[:,(slice(None),'ii')]
Out[3]:
Col_First                   A         B
Col_Second                 ii        ii
Row_First Row_Second
bar       one        -1.872641 -0.319433
          two        -0.136089  0.998774
baz       one        -0.319344 -0.424957
          two        -0.302336  0.272881
```

```
foo       one         -0.799666 -0.595635
          two          0.412011  1.010457
qux       one          1.578676  0.093351
          two          1.082138 -0.196605
```

```
In [4]: df.loc[(slice(None),'two'),(slice(None),'ii')]
Out[4]:
Col_First                   A         B
Col_Second                 ii        ii
Row_First Row_Second
bar       two        -0.136089  0.998774
baz       two        -0.302336  0.272881
foo       two         0.412011  1.010457
qux       two         1.082138 -0.196605
```

.xs

```
In [5]: df.loc[(slice(None),'two'),(slice(None),'ii')]=0
        df
Out[5]:
Col_First                   A                   B
Col_Second                  i        ii         i        ii
Row_First Row_Second
bar       one        -0.452982 -1.872641  0.248450 -0.319433
          two        -0.460388  0.000000 -0.408048  0.000000
baz       one         0.358206 -0.319344 -2.052081 -0.424957
          two        -0.823811  0.000000  1.158968  0.000000
foo       one        -0.098048 -0.799666  0.969043 -0.595635
          two        -0.358485  0.000000 -0.667167  0.000000
qux       one         1.176911  1.578676  0.350719  0.093351
          two         0.241956  0.000000 -0.516898  0.000000
```

MultiIndex https://riptutorial.com/zh-TW/pandas/topic/8099/multiindex

8:

Examples

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```
import pandas as pd
import numpy as np

# The number of sample to generate
nb_sample = 100

# Seeding to obtain a reproductible dataset
np.random.seed(0)

se = pd.Series(np.random.randint(0, 100, nb_sample),
                  index = pd.date_range(start = pd.to_datetime('2016-09-24'),
                                        periods = nb_sample, freq='D'))
se.head(2)

# 2016-09-24    44
# 2016-09-25    47

se.tail(2)

# 2016-12-31    85
# 2017-01-01    48
```

。 。

```
se.head(2).append(se.tail(2))

# 2016-09-24    44
# 2016-09-25    47
# 2016-12-31    85
# 2017-01-01    48
```

。

```
se['2017']

# 2017-01-01    48
```

```
se['2017-01']

# 2017-01-01    48
```

```
se['2017-01-01']
```

```
# 48
```

。

```
se['2016-12-31':'2017-01-01']

# 2016-12-31    85
# 2017-01-01    48
```

pandas`afterbeforetruncate` -。

```
se.truncate(before='2017')

# 2017-01-01    48

se.truncate(before='2016-12-30', after='2016-12-31')

# 2016-12-30    13
# 2016-12-31    85
```

https://riptutorial.com/zh-TW/pandas/topic/7029/

9: PythonPandas

Examples

PandasPythonNumpy

```
In [1]: df = pd.DataFrame({'A': [1, 2, 3], 'B': [1.0, 2.0, 3.0], 'C': ['a', 'b', 'c'],
                           'D': [True, False, True]})

In [2]: df
Out[2]:
   A    B  C      D
0  1  1.0  a   True
1  2  2.0  b  False
2  3  3.0  c   True
```

python

```
In [3]: df['A'].tolist()
Out[3]: [1, 2, 3]
```

DataFrames`tolist()`。 AttributeError

```
In [4]: df.tolist()
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
<ipython-input-4-fc6763af1ff7> in <module>()
----> 1 df.tolist()

//anaconda/lib/python2.7/site-packages/pandas/core/generic.pyc in __getattr__(self, name)
   2742             if name in self._info_axis:
   2743                 return self[name]
-> 2744             return object.__getattribute__(self, name)
   2745
   2746     def __setattr__(self, name, value):

AttributeError: 'DataFrame' object has no attribute 'tolist'
```

numpy

```
In [5]: df['B'].values
Out[5]: array([ 1.,  2.,  3.])
```

numpy

```
In [6]: df.values
Out[6]:
array([[1, 1.0, 'a', True],
       [2, 2.0, 'b', False],
       [3, 3.0, 'c', True]], dtype=object)
```

```
In [7]: df['C'].to_dict()
Out[7]: {0: 'a', 1: 'b', 2: 'c'}
```

DataFrame

```
In [8]: df.to_dict()
Out[8]:
{'A': {0: 1, 1: 2, 2: 3},
 'B': {0: 1.0, 1: 2.0, 2: 3.0},
 'C': {0: 'a', 1: 'b', 2: 'c'},
 'D': {0: True, 1: False, 2: True}}
```

`to_dict` dicts

```
In [9]: df.to_dict('records')
Out[9]:
[{'A': 1, 'B': 1.0, 'C': 'a', 'D': True},
 {'A': 2, 'B': 2.0, 'C': 'b', 'D': False},
 {'A': 3, 'B': 3.0, 'C': 'c', 'D': True}]
```

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PythonPandas https://riptutorial.com/zh-TW/pandas/topic/8008/pythonpandas

10:

Examples

◦ - ◦

```
from pandas.tseries.holiday import AbstractHolidayCalendar, Holiday, EasterMonday, Easter
from pandas.tseries.offsets import Day, CustomBusinessDay

class FrBusinessCalendar(AbstractHolidayCalendar):
    """ Custom Holiday calendar for France based on
        https://en.wikipedia.org/wiki/Public_holidays_in_France
      - 1 January: New Year's Day
      - Moveable: Easter Monday (Monday after Easter Sunday)
      - 1 May: Labour Day
      - 8 May: Victory in Europe Day
      - Moveable Ascension Day (Thursday, 39 days after Easter Sunday)
      - 14 July: Bastille Day
      - 15 August: Assumption of Mary to Heaven
      - 1 November: All Saints' Day
      - 11 November: Armistice Day
      - 25 December: Christmas Day
    """
    rules = [
        Holiday('New Years Day', month=1, day=1),
        EasterMonday,
        Holiday('Labour Day', month=5, day=1),
        Holiday('Victory in Europe Day', month=5, day=8),
        Holiday('Ascension Day', month=1, day=1, offset=[Easter(), Day(39)]),
        Holiday('Bastille Day', month=7, day=14),
        Holiday('Assumption of Mary to Heaven', month=8, day=15),
        Holiday('All Saints Day', month=11, day=1),
        Holiday('Armistice Day', month=11, day=11),
        Holiday('Christmas Day', month=12, day=25)
    ]
```

◦

```
import pandas as pd
from datetime import date

# Creating some boundaries
year = 2016
start = date(year, 1, 1)
end = start + pd.offsets.MonthEnd(12)

# Creating a custom calendar
cal = FrBusinessCalendar()
# Getting the holidays (off-days) between two dates
cal.holidays(start=start, end=end)

# DatetimeIndex(['2016-01-01', '2016-03-28', '2016-05-01', '2016-05-05',
#                '2016-05-08', '2016-07-14', '2016-08-15', '2016-11-01',
#                '2016-11-11', '2016-12-25'],
```

```
#               dtype='datetime64[ns]', freq=None)
```

◦ ◦

```
from pandas.tseries.offsets import CDay

# Creating a series of dates between the boundaries
# by using the custom calendar
se = pd.bdate_range(start=start,
                    end=end,
                    freq=CDay(calendar=cal)).to_series()
# Counting the number of working days by month
se.groupby(se.dt.month).count().head()

# 1    20
# 2    21
# 3    22
# 4    21
# 5    21
```

https://riptutorial.com/zh-TW/pandas/topic/7976/

11:

Examples

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```
import pandas as pd
import numpy as np

num_securities = 1000
num_periods = 1000
period_frequency = 'W'
start_date = '2000-12-31'

np.random.seed([3,1415])

means = [0, 0]
covariance = [[  1., 5e-3],
              [5e-3,   1.]]

# generates to sets of data m[0] and m[1] with ~0.005 correlation
m = np.random.multivariate_normal(means, covariance,
                                  (num_periods, num_securities)).T
```

ID。

```
ids = pd.Index(['s{:05d}'.format(s) for s in range(num_securities)], 'ID')
tidx = pd.date_range(start=start_date, periods=num_periods, freq=period_frequency)
```

m[0]25 。 1e-7。

```
security_returns = pd.DataFrame(m[0] / 25 + 1e-7, tidx, ids)
security_signals = pd.DataFrame(m[1], tidx, ids)
```

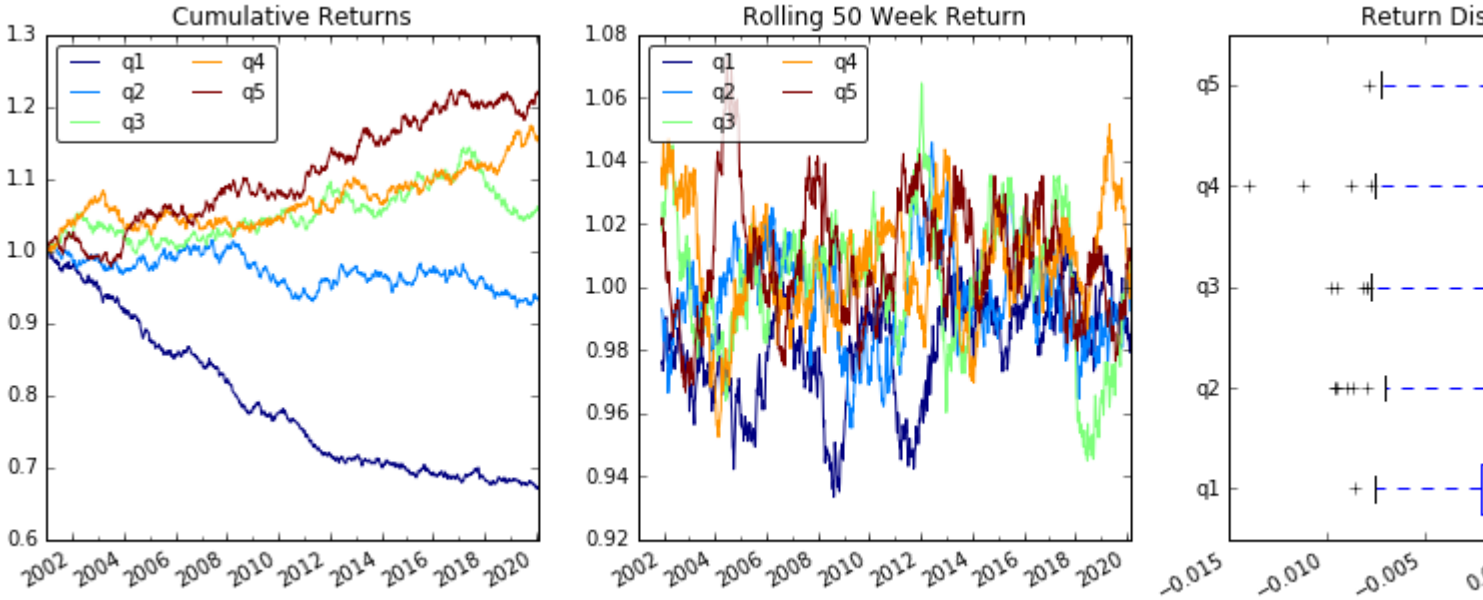
pd.qcut - Quintile Buckets

pd.qcut。

```
def qcut(s, q=5):
    labels = ['q{}'.format(i) for i in range(1, 6)]
    return pd.qcut(s, q, labels=labels)

cut = security_signals.stack().groupby(level=0).apply(qcut)
```

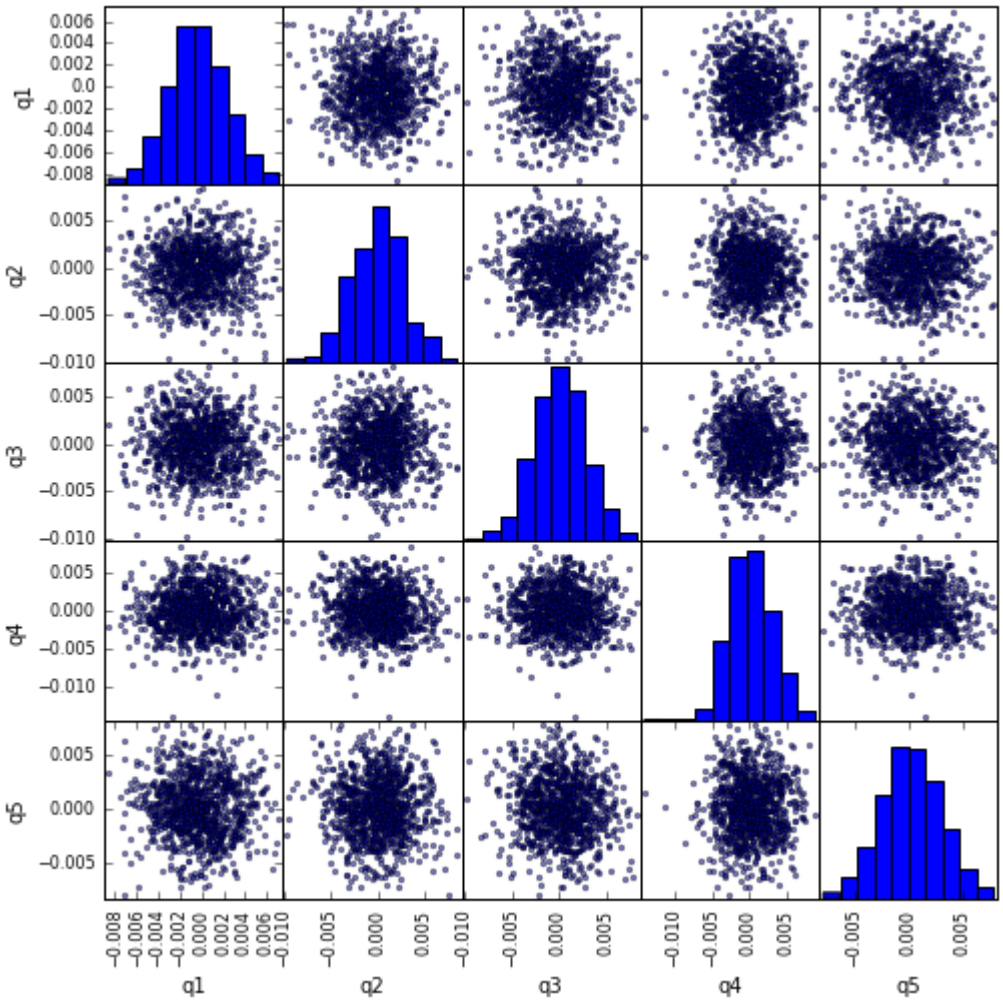
```
returns_cut = security_returns.stack().rename('returns') \
    .to_frame().set_index(cut, append=True) \
    .swaplevel(2, 1).sort_index().squeeze() \
    .groupby(level=[0, 1]).mean().unstack()
```

```
import matplotlib.pyplot as plt

fig = plt.figure(figsize=(15, 5))
ax1 = plt.subplot2grid((1,3), (0,0))
ax2 = plt.subplot2grid((1,3), (0,1))
ax3 = plt.subplot2grid((1,3), (0,2))

# Cumulative Returns
returns_cut.add(1).cumprod() \
    .plot(colormap='jet', ax=ax1, title="Cumulative Returns")
leg1 = ax1.legend(loc='upper left', ncol=2, prop={'size': 10}, fancybox=True)
leg1.get_frame().set_alpha(.8)

# Rolling 50 Week Return
returns_cut.add(1).rolling(50).apply(lambda x: x.prod()) \
    .plot(colormap='jet', ax=ax2, title="Rolling 50 Week Return")
leg2 = ax2.legend(loc='upper left', ncol=2, prop={'size': 10}, fancybox=True)
leg2.get_frame().set_alpha(.8)

# Return Distribution
returns_cut.plot.box(vert=False, ax=ax3, title="Return Distribution")

fig.autofmt_xdate()

plt.show()
```



scatter_matrixscatter_matrix

```
from pandas.tools.plotting import scatter_matrix

scatter_matrix(returns_cut, alpha=0.5, figsize=(8, 8), diagonal='hist')
plt.show()
```

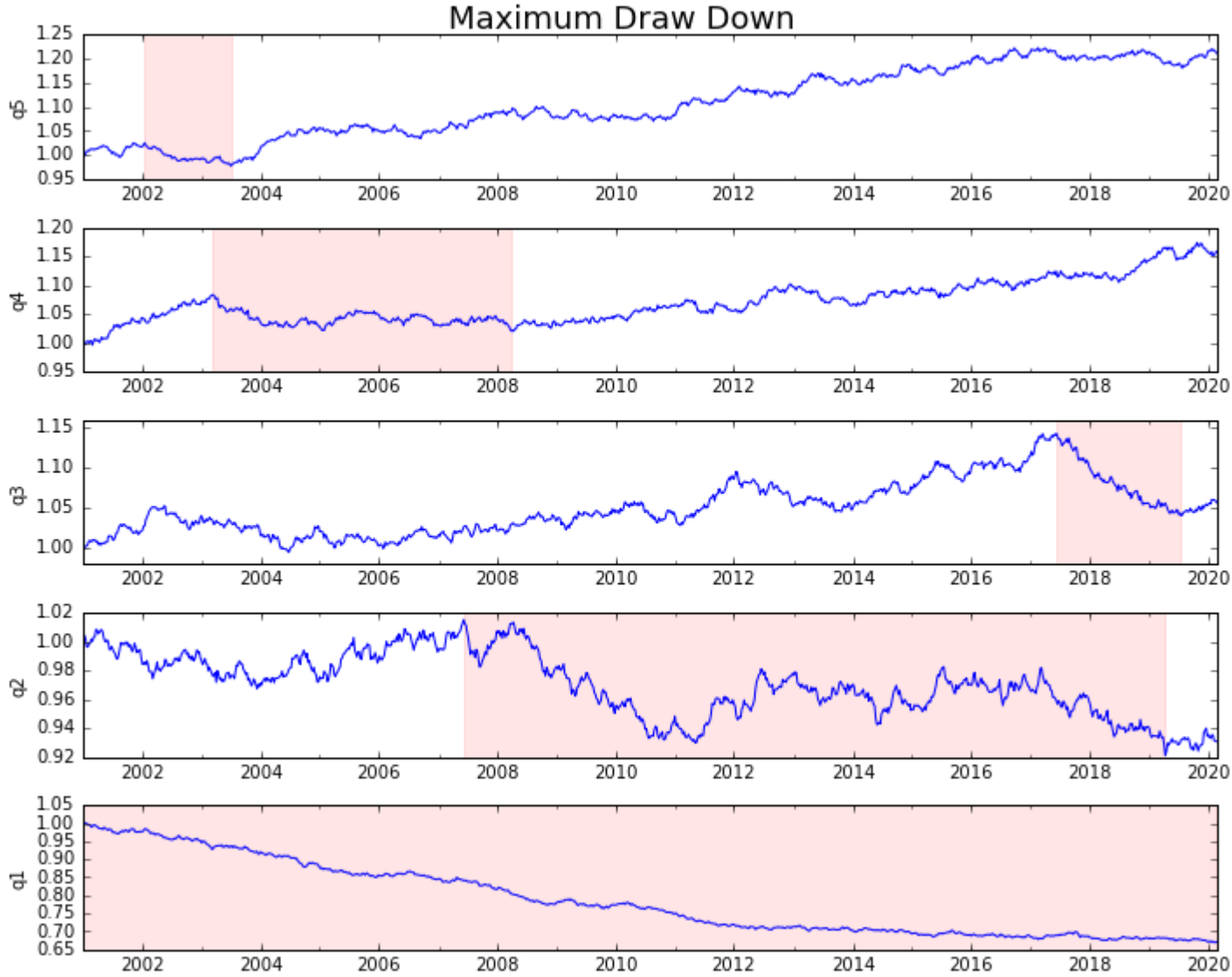


```
def max_dd(returns):
    """returns is a series"""
    r = returns.add(1).cumprod()
    dd = r.div(r.cummax()).sub(1)
    mdd = dd.min()
    end = dd.argmin()
    start = r.loc[:end].argmax()
    return mdd, start, end

def max_dd_df(returns):
    """returns is a dataframe"""
    series = lambda x: pd.Series(x, ['Draw Down', 'Start', 'End'])
    return returns.apply(max_dd).apply(series)
```

```
max_dd_df(returns_cut)
```

	Draw Down	Start	End
q1	-0.333527	2001-01-07	2020-02-16
q2	-0.092659	2007-06-10	2019-04-14
q3	-0.089682	2017-06-11	2019-07-21
q4	-0.058225	2003-03-16	2008-03-30
q5	-0.046822	2002-01-20	2003-07-06

```
draw_downs = max_dd_df(returns_cut)

fig, axes = plt.subplots(5, 1, figsize=(10, 8))
for i, ax in enumerate(axes[::-1]):
    returns_cut.iloc[:, i].add(1).cumprod().plot(ax=ax)
    sd, ed = draw_downs[['Start', 'End']].iloc[i]
    ax.axvspan(sd, ed, alpha=0.1, color='r')
    ax.set_ylabel(returns_cut.columns[i])

fig.suptitle('Maximum Draw Down', fontsize=18)
fig.tight_layout()
plt.subplots_adjust(top=.95)
```



。 。

```
def frequency_of_time_series(df):
    start, end = df.index.min(), df.index.max()
    delta = end - start
    return round((len(df) - 1.) * 365.25 / delta.days, 2)

def annualized_return(df):
    freq = frequency_of_time_series(df)
    return df.add(1).prod() ** (1 / freq) - 1

def annualized_volatility(df):
    freq = frequency_of_time_series(df)
    return df.std().mul(freq ** .5)

def sharpe_ratio(df):
    return annualized_return(df) / annualized_volatility(df)

def describe(df):
    r = annualized_return(df).rename('Return')
    v = annualized_volatility(df).rename('Volatility')
    s = sharpe_ratio(df).rename('Sharpe')
    skew = df.skew().rename('Skew')
    kurt = df.kurt().rename('Kurtosis')
```

```
    desc = df.describe().T

    return pd.concat([r, v, s, skew, kurt, desc], axis=1).T.drop('count')
```

describe◦

```
describe(returns_cut)
```

	q1	q2	q3	q4	q5
Return	-0.007609	-0.001375	0.001067	0.002821	0.003687
Volatility	0.019584	0.020445	0.020629	0.021185	0.020172
Sharpe	-0.388525	-0.067278	0.051709	0.133176	0.182792
Skew	0.040430	-0.085828	-0.078071	-0.067522	0.005652
Kurtosis	-0.174206	0.203038	0.026385	0.370249	-0.160678
mean	-0.000395	-0.000068	0.000060	0.000151	0.000196
std	0.002711	0.002830	0.002856	0.002933	0.002792
min	-0.008608	-0.009614	-0.009845	-0.014037	-0.007913
25%	-0.002196	-0.002018	-0.001956	-0.001833	-0.001694
50%	-0.000434	0.000065	0.000210	0.000029	0.000146
75%	0.001444	0.001768	0.001989	0.002107	0.002081
max	0.007070	0.008432	0.008100	0.008687	0.007791

◦ ◦ ◦

https://riptutorial.com/zh-TW/pandas/topic/5238/-

12:

Examples

DataFrame

```
df = pd.DataFrame({'A': ['a', 'b', 'c', 'a', 'b', 'b'],
                   'B': [2, 8, 1, 4, 3, 8],
                   'C': [102, 98, 107, 104, 115, 87]})

df
# Output:
#    A  B    C
# 0  a  2  102
# 1  b  8   98
# 2  c  1  107
# 3  a  4  104
# 4  b  3  115
# 5  b  8   87
```

A

```
df.groupby('A').mean()
# Output:
#           B    C
# A
# a  3.000000  103
# b  6.333333  100
# c  1.000000  107
```

```
df.groupby(['A','B']).mean()
# Output:
#          C
# A B
# a 2  102.0
#   4  104.0
# b 3  115.0
#   8   92.5
# c 1  107.0
```

DataFrameMultiIndex AB。

`agg`

```
df.groupby(['A','B']).agg(['count', 'mean'])
# Output:
#         C
#     count   mean
# A B
# a 2     1  102.0
#   4     1  104.0
# b 3     1  115.0
#   8     2   92.5
```

```
# c 1     1  107.0
```

DataFrame

```
import numpy as np
import pandas as pd
np.random.seed(0)
df = pd.DataFrame({'Age': np.random.randint(20, 70, 100),
                   'Sex': np.random.choice(['Male', 'Female'], 100),
                   'number_of_foo': np.random.randint(1, 20, 100)})
df.head()
# Output:

#    Age     Sex  number_of_foo
# 0   64  Female             14
# 1   67  Female             14
# 2   20  Female             12
# 3   23    Male             17
# 4   23  Female             15
```

Age。

- n - n
- -bins=[19, 40, 65, np.inf](19, 40] (40, 65] (65, np.inf] 。

Pandas。 labels。

```
pd.cut(df['Age'], bins=4)
# this creates four age groups: (19.951, 32.25] < (32.25, 44.5] < (44.5, 56.75] < (56.75, 69]
Name: Age, dtype: category
Categories (4, object): [(19.951, 32.25] < (32.25, 44.5] < (44.5, 56.75] < (56.75, 69]]

pd.cut(df['Age'], bins=[19, 40, 65, np.inf])
# this creates three age groups: (19, 40], (40, 65] and (65, infinity)
Name: Age, dtype: category
Categories (3, object): [(19, 40] < (40, 65] < (65, inf]]
```

groupbyfoo

```
age_groups = pd.cut(df['Age'], bins=[19, 40, 65, np.inf])
df.groupby(age_groups)['number_of_foo'].mean()
# Output:
# Age
# (19, 40]     9.880000
# (40, 65]     9.452381
# (65, inf]    9.250000
# Name: number_of_foo, dtype: float64
```

```
pd.crosstab(age_groups, df['Sex'])
# Output:
# Sex        Female  Male
# Age
# (19, 40]       22    28
# (40, 65]       18    24
# (65, inf]       3     5
```

groupby

```
In [11]: df = pd.DataFrame([[1, 1, 2], [1, 2, 3], [2, 3, 4]], columns=["A", "B", "C"])

In [12]: df
Out[12]:
   A  B  C
0  1  1  2
1  1  2  3
2  2  3  4

In [13]: g = df.groupby("A")

In [14]: g["B"].mean()           # just column B
Out[14]:
A
1    1.5
2    3.0
Name: B, dtype: float64

In [15]: g[["B", "C"]].mean()    # columns B and C
Out[15]:
     B    C
A
1  1.5  2.5
2  3.0  4.0
```

agg

```
In [16]: g.agg({'B': 'mean', 'C': 'count'})
Out[16]:
   C    B
A
1  2  1.5
2  1  3.0
```

sizecount

sizeNaN countcount ◦

```
df = pd.DataFrame(
        {"Name":["Alice", "Bob", "Mallory", "Mallory", "Bob" , "Mallory"],
         "City":["Seattle", "Seattle", "Portland", "Seattle", "Seattle", "Portland"],
         "Val": [4, 3, 3, np.nan, np.nan, 4]})

df
# Output:
#        City     Name  Val
# 0   Seattle    Alice  4.0
# 1   Seattle      Bob  3.0
# 2  Portland  Mallory  3.0
# 3   Seattle  Mallory  NaN
# 4   Seattle      Bob  NaN
# 5  Portland  Mallory  4.0


df.groupby(["Name", "City"])['Val'].size().reset_index(name='Size')
# Output:
```

```
#       Name      City  Size
# 0    Alice   Seattle     1
# 1      Bob   Seattle     2
# 2  Mallory  Portland     2
# 3  Mallory   Seattle     1

df.groupby(["Name", "City"])['Val'].count().reset_index(name='Count')
# Output:
#       Name      City  Count
# 0    Alice   Seattle      1
# 1      Bob   Seattle      1
# 2  Mallory  Portland      2
# 3  Mallory   Seattle      0
```

```
In [1]: import numpy as np
In [2]: import pandas as pd

In [3]: df = pd.DataFrame({'A': list('XYZXYZXYZX'), 'B': [1, 2, 1, 3, 1, 2, 3, 3, 1, 2],
                           'C': [12, 14, 11, 12, 13, 14, 16, 12, 10, 19]})

In [4]: df.groupby('A')['B'].agg({'mean': np.mean, 'standard deviation': np.std})
Out[4]:
   standard deviation      mean
A
X            0.957427  2.250000
Y            1.000000  2.000000
Z            0.577350  1.333333
```

```
In [5]: df.groupby('A').agg({'B': [np.mean, np.std], 'C': [np.sum, 'count']})
Out[5]:
    C              B
  sum count      mean       std
A
X  59     4  2.250000  0.957427
Y  39     3  2.000000  1.000000
Z  35     3  1.333333  0.577350
```

groupby()◦ (Category, DataFrame)◦

```
# Same example data as in the previous example.
import numpy as np
import pandas as pd
np.random.seed(0)
df = pd.DataFrame({'Age': np.random.randint(20, 70, 100),
                   'Sex': np.random.choice(['Male', factor'Female'], 100),
                   'number_of_foo': np.random.randint(1, 20, 100)})

# Export to Male.csv and Female.csv files.
for sex, data in df.groupby('Sex'):
    data.to_csv("{}.csv".format(sex))
```

transform

```
df = pd.DataFrame({'group1' :  ['A', 'A', 'A', 'A',
                                'B', 'B', 'B', 'B'],
                   'group2' :  ['C', 'C', 'C', 'D',
```

```
                                'E', 'E', 'F', 'F'],
                   'B'      :  ['one', np.NaN, np.NaN, np.NaN,
                                np.NaN, 'two', np.NaN, np.NaN],
                   'C'      :  [np.NaN, 1, np.NaN, np.NaN,
                               np.NaN, np.NaN, np.NaN, 4]})

 df
Out[34]:
     B    C group1 group2
0  one  NaN      A      C
1  NaN  1.0      A      C
2  NaN  NaN      A      C
3  NaN  NaN      A      D
4  NaN  NaN      B      E
5  two  NaN      B      E
6  NaN  NaN      B      F
7  NaN  4.0      B      F
```

group1group2B。 groupby.transform。

```
df['count_B']=df.groupby(['group1','group2']).B.transform('count')

df
Out[36]:
     B    C group1 group2  count_B
0  one  NaN      A      C        1
1  NaN  1.0      A      C        1
2  NaN  NaN      A      C        1
3  NaN  NaN      A      D        0
4  NaN  NaN      B      E        1
5  two  NaN      B      E        1
6  NaN  NaN      B      F        0
7  NaN  4.0      B      F        0
```

https://riptutorial.com/zh-TW/pandas/topic/1822/

13:

Examples

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt

# I want 7 days of 24 hours with 60 minutes each
periods = 7 * 24 * 60
tidx = pd.date_range('2016-07-01', periods=periods, freq='T')
#                     ^                                   ^
#                     |                                   |
#                 Start Date        Frequency Code for Minute
# This should get me 7 Days worth of minutes in a datetimeindex

# Generate random data with numpy.  We'll seed the random
# number generator so that others can see the same results.
# Otherwise, you don't have to seed it.
np.random.seed([3,1415])

# This will pick a number of normally distributed random numbers
# where the number is specified by periods
data = np.random.randn(periods)

ts = pd.Series(data=data, index=tidx, name='HelloTimeSeries')

ts.describe()

count    10080.000000
mean        -0.008853
std          0.995411
min         -3.936794
25%         -0.683442
50%          0.002640
75%          0.654986
max          3.906053
Name: HelloTimeSeries, dtype: float64
```

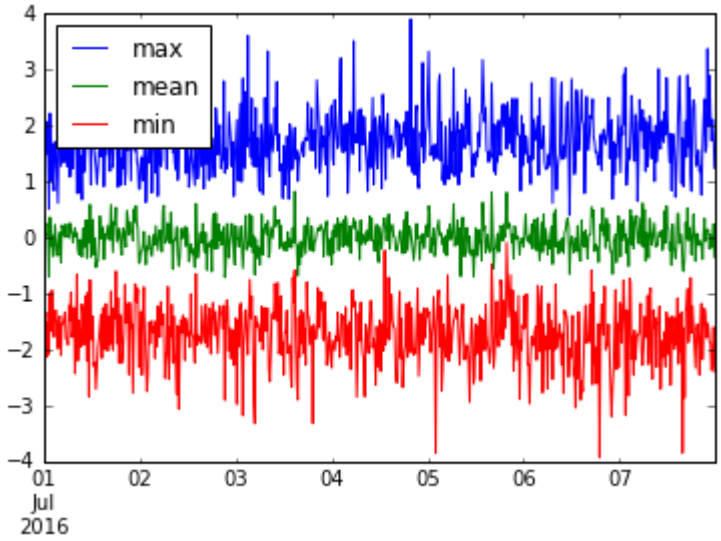
715。 。

```
# resample says to group by every 15 minutes.  But now we need
# to specify what to do within those 15 minute chunks.

# We could take the last value.
ts.resample('15T').last()
```

groupby 。

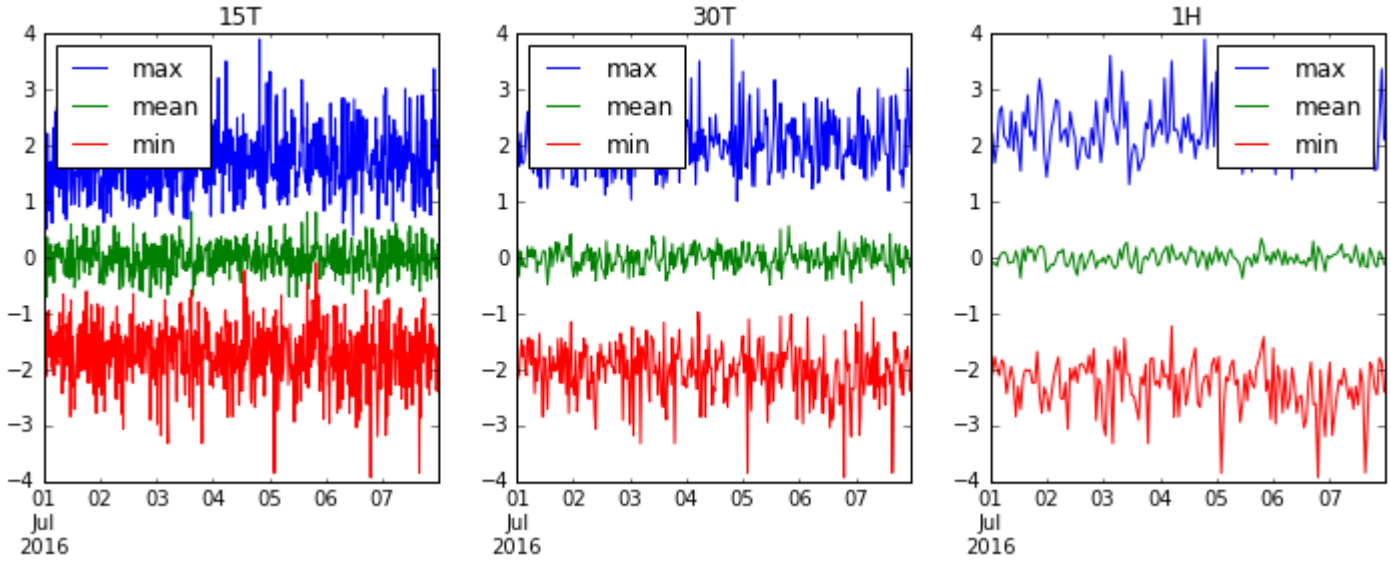
。 resample('15M')min meanmax 。

```
ts.resample('15T').agg(['min', 'mean', 'max']).plot()
```



`'15T'` 15 `'30T'` `'1H'` 1。

```
fig, axes = plt.subplots(1, 3, figsize=(12, 4))
for i, freq in enumerate(['15T', '30T', '1H']):
    ts.resample(freq).agg(['max', 'mean', 'min']).plot(ax=axes[i], title=freq)
```



https://riptutorial.com/zh-TW/pandas/topic/4747/

14:

; R。 。

Examples

```
In [188]: s = pd.Series(["a","b","c","a","c"], dtype="category")

In [189]: s
Out[189]:
0    a
1    b
2    c
3    a
4    c
dtype: category
Categories (3, object): [a, b, c]

In [190]: df = pd.DataFrame({"A":["a","b","c","a", "c"]})

In [191]: df["B"] = df["A"].astype('category')

In [192]: df["C"] = pd.Categorical(df["A"])

In [193]: df
Out[193]:
   A  B  C
0  a  a  a
1  b  b  b
2  c  c  c
3  a  a  a
4  c  c  c

In [194]: df.dtypes
Out[194]:
A      object
B    category
C    category
dtype: object
```

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

In [2]: df = pd.DataFrame(np.random.choice(['foo','bar','baz'], size=(100000,3)))
        df = df.apply(lambda col: col.astype('category'))

In [3]: df.head()
Out[3]:
     0    1    2
0  bar  foo  baz
1  baz  bar  baz
2  foo  foo  bar
3  bar  baz  baz
4  foo  bar  baz

In [4]: df.dtypes
```

```
Out[4]:
0    category
1    category
2    category
dtype: object

In [5]: df.shape
Out[5]: (100000, 3)
```

https://riptutorial.com/zh-TW/pandas/topic/3887/

15: DataFrame

DataFramepandas*Series* *Panel* 。 。

0..NDataFrame。 。

/DataFrame。 。 Numpy。

Examples

DataFrame

```
import pandas as pd
```

DataFrame `numberscolors` 。

```
df = pd.DataFrame({'numbers': [1, 2, 3], 'colors': ['red', 'white', 'blue']})
```

dataframe

```
print(df)
# Output:
#   colors  numbers
# 0    red        1
# 1  white        2
# 2   blue        3
```

`dict` Pandas。 `columns`。

```
df = pd.DataFrame({'numbers': [1, 2, 3], 'colors': ['red', 'white', 'blue']},
                  columns=['numbers', 'colors'])

print(df)
# Output:
#    numbers colors
# 0        1    red
# 1        2  white
# 2        3   blue
```

NumpyDataFrame

`DataFrame`

```
import numpy as np
import pandas as pd

# Set the seed for a reproducible sample
np.random.seed(0)
```

```
df = pd.DataFrame(np.random.randn(5, 3), columns=list('ABC'))

print(df)
# Output:
#           A         B         C
# 0  1.764052  0.400157  0.978738
# 1  2.240893  1.867558 -0.977278
# 2  0.950088 -0.151357 -0.103219
# 3  0.410599  0.144044  1.454274
# 4  0.761038  0.121675  0.443863
```

DataFrame

```
df = pd.DataFrame(np.arange(15).reshape(5,3),columns=list('ABC'))

print(df)
# Output:
#     A   B   C
# 0   0   1   2
# 1   3   4   5
# 2   6   7   8
# 3   9  10  11
# 4  12  13  14
```

DataFrameDataFrame NaT, NaN, 'nan', None

```
df = pd.DataFrame(np.arange(48).reshape(8,6),columns=list('ABCDEF'))

print(df)
# Output:
#     A   B   C   D   E   F
# 0   0   1   2   3   4   5
# 1   6   7   8   9  10  11
# 2  12  13  14  15  16  17
# 3  18  19  20  21  22  23
# 4  24  25  26  27  28  29
# 5  30  31  32  33  34  35
# 6  36  37  38  39  40  41
# 7  42  43  44  45  46  47

df.ix[::2,0] = np.nan # in column 0, set elements with indices 0,2,4, ... to NaN
df.ix[::4,1] = pd.NaT # in column 1, set elements with indices 0,4, ... to np.NaT
df.ix[:3,2] = 'nan'   # in column 2, set elements with index from 0 to 3 to 'nan'
df.ix[:,5] = None     # in column 5, set all elements to None
df.ix[5,:] = None     # in row 5, set all elements to None
df.ix[7,:] = np.nan   # in row 7, set all elements to NaN

print(df)
# Output:
#     A     B     C   D   E     F
# 0 NaN   NaT   nan   3   4  None
# 1   6     7   nan   9  10  None
# 2 NaN    13   nan  15  16  None
# 3  18    19   nan  21  22  None
# 4 NaN   NaT    26  27  28  None
# 5 NaN  None  None NaN NaN  None
# 6 NaN    37    38  39  40  None
# 7 NaN   NaN   NaN NaN NaN   NaN
```

DictionaryDataFrame

```
import pandas as pd
import numpy as np

np.random.seed(123)
x = np.random.standard_normal(4)
y = range(4)
df = pd.DataFrame({'X':x, 'Y':y})
>>> df
          X  Y
0 -1.085631  0
1  0.997345  1
2  0.282978  2
3 -1.506295  3
```

DataFrame

DataFrame。DataFrame。

```
import pandas as pd

data = [
('p1', 't1', 1, 2),
('p1', 't2', 3, 4),
('p2', 't1', 5, 6),
('p2', 't2', 7, 8),
('p2', 't3', 2, 8)
]

df = pd.DataFrame(data)

print(df)
#     0   1  2  3
# 0  p1  t1  1  2
# 1  p1  t2  3  4
# 2  p2  t1  5  6
# 3  p2  t2  7  8
# 4  p2  t3  2  8
```

DataFrame

dictDataFrame。。ndarrays。/ ndarray。

```
import pandas as pd

# Create DF from dict of lists/ndarrays
df = pd.DataFrame({'A' : [1, 2, 3, 4],
                   'B' : [4, 3, 2, 1]})
df
# Output:
#       A  B
#    0  1  4
#    1  2  3
#    2  3  2
```

```
#    3  4  1
```

```
df = pd.DataFrame({'A' : [1, 2, 3, 4], 'B' : [5, 5, 5]}) # a ValueError is raised
```

ndarrays

```
import pandas as pd
import numpy as np

np.random.seed(123)
x = np.random.standard_normal(4)
y = range(4)
df = pd.DataFrame({'X':x, 'Y':y})
df
# Output:           X  Y
#         0 -1.085631  0
#         1  0.997345  1
#         2  0.282978  2
#         3 -1.506295  3
```

http //pandas.pydata.org/pandas-docs/stable/dsintro.html#from-dict-of-ndarrays-lists

datetimeDataFrame

```
import pandas as pd
import numpy as np

np.random.seed(0)
# create an array of 5 dates starting at '2015-02-24', one per minute
rng = pd.date_range('2015-02-24', periods=5, freq='T')
df = pd.DataFrame({ 'Date': rng, 'Val': np.random.randn(len(rng)) })

print (df)
# Output:
#                  Date       Val
# 0 2015-02-24 00:00:00  1.764052
# 1 2015-02-24 00:01:00  0.400157
# 2 2015-02-24 00:02:00  0.978738
# 3 2015-02-24 00:03:00  2.240893
# 4 2015-02-24 00:04:00  1.867558

# create an array of 5 dates starting at '2015-02-24', one per day
rng = pd.date_range('2015-02-24', periods=5, freq='D')
df = pd.DataFrame({ 'Date': rng, 'Val' : np.random.randn(len(rng))})

print (df)
# Output:
#         Date       Val
# 0 2015-02-24 -0.977278
# 1 2015-02-25  0.950088
# 2 2015-02-26 -0.151357
# 3 2015-02-27 -0.103219
# 4 2015-02-28  0.410599

# create an array of 5 dates starting at '2015-02-24', one every 3 years
rng = pd.date_range('2015-02-24', periods=5, freq='3A')
df = pd.DataFrame({ 'Date': rng, 'Val' : np.random.randn(len(rng))})
```

```
print (df)
# Output:
#         Date       Val
# 0 2015-12-31  0.144044
# 1 2018-12-31  1.454274
# 2 2021-12-31  0.761038
# 3 2024-12-31  0.121675
# 4 2027-12-31  0.443863
```

DataFrame DatetimeIndex

```
import pandas as pd
import numpy as np

np.random.seed(0)
rng = pd.date_range('2015-02-24', periods=5, freq='T')
df = pd.DataFrame({ 'Val' : np.random.randn(len(rng)) }, index=rng)

print (df)
# Output:
#                           Val
# 2015-02-24 00:00:00  1.764052
# 2015-02-24 00:01:00  0.400157
# 2015-02-24 00:02:00  0.978738
# 2015-02-24 00:03:00  2.240893
# 2015-02-24 00:04:00  1.867558
```

date_rangefreq Offset-aliases

```
Alias     Description
B         business day frequency
C         custom business day frequency (experimental)
D         calendar day frequency
W         weekly frequency
M         month end frequency
BM        business month end frequency
CBM       custom business month end frequency
MS        month start frequency
BMS       business month start frequency
CBMS      custom business month start frequency
Q         quarter end frequency
BQ        business quarter endfrequency
QS        quarter start frequency
BQS       business quarter start frequency
A         year end frequency
BA        business year end frequency
AS        year start frequency
BAS       business year start frequency
BH        business hour frequency
H         hourly frequency
T, min    minutely frequency
S         secondly frequency
L, ms     milliseconds
U, us     microseconds
N         nanoseconds
```

MultiIndexDataFrame

```
import pandas as pd
import numpy as np
```

from_tuples

```
np.random.seed(0)
tuples = list(zip(*[['bar', 'bar', 'baz', 'baz',
                     'foo', 'foo', 'qux', 'qux'],
                      ['one', 'two', 'one', 'two',
                       'one', 'two', 'one', 'two']]))

idx = pd.MultiIndex.from_tuples(tuples, names=['first', 'second'])
```

from_product

```
idx = pd.MultiIndex.from_product([['bar', 'baz', 'foo', 'qux'],['one','two']])
```

MultiIndex

```
df = pd.DataFrame(np.random.randn(8, 2), index=idx, columns=['A', 'B'])
print (df)
                     A         B
first second
bar   one     1.764052  0.400157
      two     0.978738  2.240893
baz   one     1.867558 -0.977278
      two     0.950088 -0.151357
foo   one    -0.103219  0.410599
      two     0.144044  1.454274
qux   one     0.761038  0.121675
      two     0.443863  0.333674
```

pickle.plkDataFrame

```
import pandas as pd

# Save dataframe to pickled pandas object
df.to_pickle(file_name) # where to save it usually as a .plk

# Load dataframe from pickled pandas object
df= pd.read_pickle(file_name)
```

DataFrame

DataFrame。。

```
import pandas as pd
L = [{'Name': 'John', 'Last Name': 'Smith'},
        {'Name': 'Mary', 'Last Name': 'Wood'}]
pd.DataFrame(L)
```

```
# Output:  Last Name  Name
# 0      Smith  John
# 1       Wood  Mary
```

NaN

```
L = [{'Name': 'John', 'Last Name': 'Smith', 'Age': 37},
     {'Name': 'Mary', 'Last Name': 'Wood'}]
pd.DataFrame(L)
# Output:     Age Last Name  Name
#          0   37     Smith  John
#          1  NaN      Wood  Mary
```

DataFrame https://riptutorial.com/zh-TW/pandas/topic/1595/dataframe

16:

- 。 **merge** *how ='inner'on = Noneleft_on = Noneright_on = Noneleft_index = False right_index = Falsesort = Falsesuffixes ='_ x''_ y'copy = True=*
- DataFrame。
- DataFrame。 。

	{'left''right''outer''inner'}'inner'
	。DataFrame。DataFrame
right_on	。DataFrameleft_on/
left_index	False。DataFrame。MultiIndexDataFrame
right_index	False。DataFrame。left_index
	Fals。DataFrame
	2.....。
	True。False
	False。True“_merge”DataFrame。stringDataFramestring。“”DataFrame “left_only”“”DataFrame“right_only”。

Examples

T1

```
id    x        y
8    42        1.9
9    30        1.9
```

T2

```
id    signal
8    55
8    56
8    59
9    57
9    58
9    60
```

T3

```
id    x        y        s1        s2        s3
8    42        1.9        55        56        58
9    30        1.9        57        58        60
```

`s1` `s2`s3 `id`3

`join` onDataFrameDataFrame。

df = df1.mergedf2.groupby'id'['signal']。applylambda xx.reset_indexdrop = True。unstack。reset_index

```
df
Out[63]:
   id   x    y   0   1   2
0   8  42  1.9  55  56  59
1   9  30  1.9  57  58  60
```

```
df2t = df2.groupby('id')['signal'].apply(lambda x:
x.reset_index(drop=True)).unstack().reset_index()

df2t
Out[59]:
   id   0   1   2
0   8  55  56  59
1   9  57  58  60

df = df1.merge(df2t)

df
Out[61]:
   id   x    y   0   1   2
0   8  42  1.9  55  56  59
1   9  30  1.9  57  58  60
```

DataFrame

```
In [1]: df1 = pd.DataFrame({'x': [1, 2, 3], 'y': ['a', 'b', 'c']})

In [2]: df2 = pd.DataFrame({'y': ['b', 'c', 'd'], 'z': [4, 5, 6]})

In [3]: df1
Out[3]:
   x  y
0  1  a
1  2  b
2  3  c

In [4]: df2
Out[4]:
   y  z
0  b  4
1  c  5
2  d  6
```

DataFrames。

```
In [5]: df1.merge(df2) # by default, it does an inner join on the common column(s)
Out[5]:
   x  y  z
0  2  b  4
1  3  c  5
```

Dataframe。

```
In [5]: merged_inner = pd.merge(left=df1, right=df2, left_on='y', right_on='y')
Out[5]:
   x  y  z
0  2  b  4
1  3  c  5
```

DataFrame。

```
In [6]: df1.merge(df2, how='outer')
Out[6]:
     x  y    z
0  1.0  a  NaN
1  2.0  b  4.0
2  3.0  c  5.0
3  NaN  d  6.0
```

DataFrame。

```
In [7]: df1.merge(df2, how='left')
Out[7]:
   x  y    z
0  1  a  NaN
1  2  b  4.0
2  3  c  5.0
```

DataFrame。

```
In [8]: df1.merge(df2, how='right')
Out[8]:
     x  y  z
0  2.0  b  4
1  3.0  c  5
2  NaN  d  6
```

//

```
In [57]: df3 = pd.DataFrame({'col1':[211,212,213], 'col2': [221,222,223]})

In [58]: df1 = pd.DataFrame({'col1':[11,12,13], 'col2': [21,22,23]})

In [59]: df2 = pd.DataFrame({'col1':[111,112,113], 'col2': [121,122,123]})

In [60]: df3 = pd.DataFrame({'col1':[211,212,213], 'col2': [221,222,223]})

In [61]: df1
Out[61]:
   col1  col2
0    11    21
1    12    22
2    13    23

In [62]: df2
Out[62]:
   col1  col2
0   111   121
1   112   122
2   113   123

In [63]: df3
Out[63]:
   col1  col2
0   211   221
1   212   222
2   213   223
```

//[df1df2df3] -

```
In [64]: pd.concat([df1,df2,df3], ignore_index=True)
Out[64]:
   col1  col2
0    11    21
1    12    22
2    13    23
3   111   121
4   112   122
5   113   123
6   211   221
7   212   222
8   213   223
```

//

```
In [65]: pd.concat([df1,df2,df3], axis=1)
Out[65]:
   col1  col2  col1  col2  col1  col2
0    11    21   111   121   211   221
1    12    22   112   122   212   222
2    13    23   113   123   213   223
```

Concat

```
pd.merge(df1, df2, on='key')
```

```
pd.merge(df1, df2, left_on='l_key', right_on='r_key')
```

```
pd.merge(df1, df2, on='key', how='left')
```

```
pd.merge(df1, df2, on=['key1', 'key2'])
```

```
pd.merge(df1, df2, on='key', suffixes=('_left', '_right'))
```

```
pd.merge(df1, df2, right_index=True, left_index=True)
```

.join

```
pd.merge(df1, df2, right_index=True, left_on='l_key')
```

```
pd.concat([df1, df2, df3], axis=0)
```

```
pd.concat([df1, df2, df3], axis=1)
```

joinmerge

dataframes `leftright`

```
left = pd.DataFrame([['a', 1], ['b', 2]], list('XY'), list('AB'))
left

   A  B
X  a  1
Y  b  2
```

```
right = pd.DataFrame([['a', 3], ['b', 4]], list('XY'), list('AC'))
right

   A  C
X  a  3
Y  b  4
```

join

join◦ join◦ A

```
left.join(right, lsuffix='_')

  A_  B  A  C
X  a  1  a  3
Y  b  2  b  4
```

4◦ 2`left` 2`right` ◦

```
left.join(right.reset_index(), lsuffix='_', how='outer')

    A_    B index    A    C
0  NaN  NaN     X    a  3.0
1  NaN  NaN     Y    b  4.0
X    a  1.0   NaN  NaN  NaN
Y    b  2.0   NaN  NaN  NaN
```

◦ ◦

join◦

```
left.reset_index().join(right, on='index', lsuffix='_')

  index A_  B  A  C
0     X  a  1  a  3
1     Y  b  2  b  4
```

merge

merge◦ mergemerge◦ mergeon◦

merge◦

'A'◦

```
left.merge(right)

   A  B  C
0  a  1  3
1  b  2  4
```

[0, 1]['X', 'Y']

left_indexright_index

```
left.merge(right, left_index=True, right_index=True, suffixes=['_', ''])

  A_  B  A  C
X  a  1  a  3
Y  b  2  b  4
```

join◦

https://riptutorial.com/zh-TW/pandas/topic/1966/-

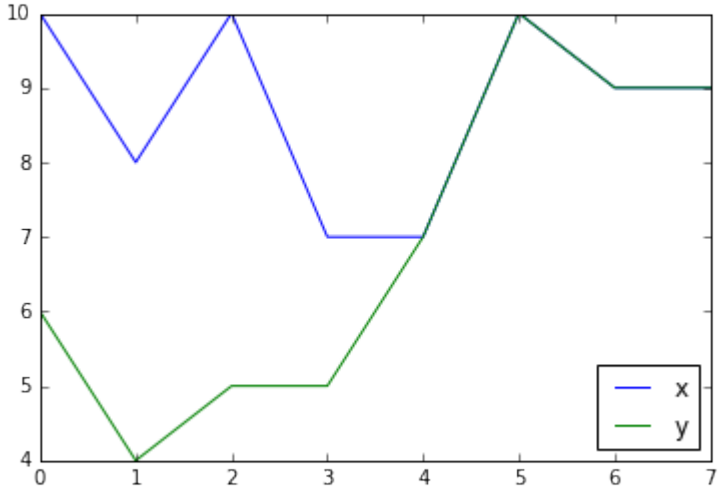
17:

Examples

Pandas。 matplotlib。

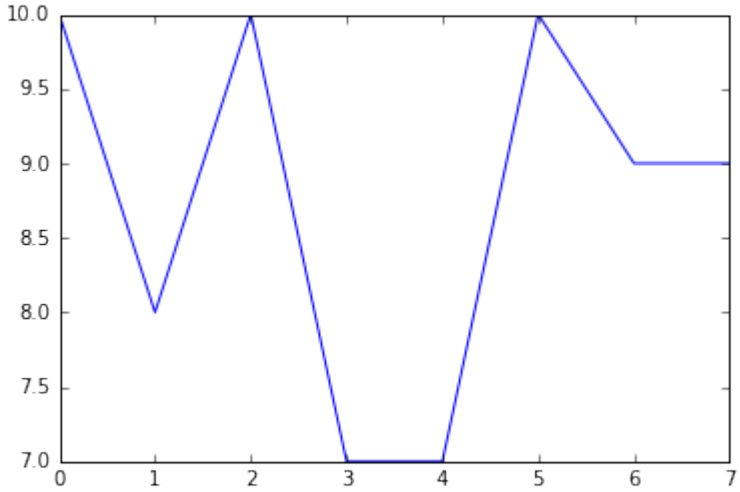
DataFrameSeries

```
df = pd.DataFrame({'x': [10, 8, 10, 7, 7, 10, 9, 9],
                   'y': [6, 4, 5, 5, 7, 10, 9, 9]})
df.plot()
```



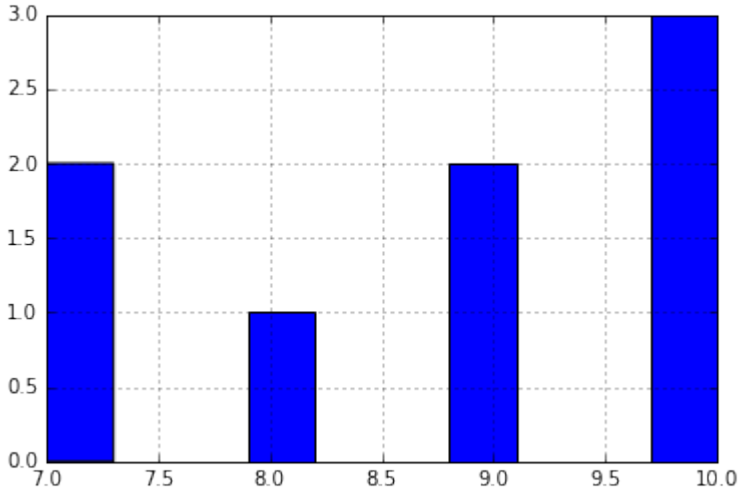
Series

```
df['x'].plot()
```



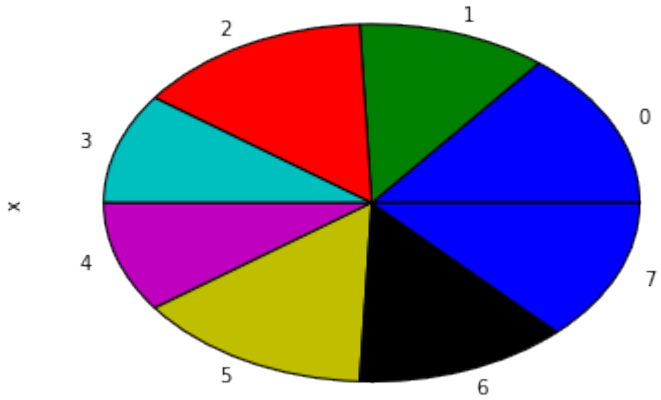
hist()。

```
df['x'].hist()
```



- **kind**

```
df['x'].plot(kind='pie')
```



-

```
from matplotlib import pyplot

pyplot.axis('equal')
df['x'].plot(kind='pie')
```

`plot()`matplotlib

```
df.plot(style='o')  # plot as dots, not lines
df.plot(style='g--')  # plot as green dashed line
df.plot(style='o', markeredgecolor='white')  # plot as dots with white edge
```

matplotlib

`plot()` ax

```
plt.figure()  # create a new figure
```

```
ax = plt.subplot(121)  # create the left-side subplot
df1.plot(ax=ax)  # plot df1 on that subplot
ax = plt.subplot(122)  # create the right-side subplot
df2.plot(ax=ax)  # and plot df2 there
plt.show()  # show the plot
```

https://riptutorial.com/zh-TW/pandas/topic/3839/

18:

KeyError merge get

Examples

df

```
  U   L
111  en
112  en
112  es
113  es
113  ja
113  zh
114  es
```

S

```
d = {112: 'en', 113: 'es', 114: 'es', 111: 'en'}
```

map

```
df['S'] = df['U'].map(d)
```

```
  U   L   S
111  en  en
112  en  en
112  es  en
113  es  es
113  ja  es
113  zh  es
114  es  es
```

https://riptutorial.com/zh-TW/pandas/topic/3928/

19:

Examples

MultiIndex

DataFrame

```
In [11]: df = pd.DataFrame(np.random.randn(6, 3), columns=['A', 'B', 'C'])

In [12]: df.set_index(['A', 'B'], inplace=True)

In [13]: df
Out[13]:
                          C
A         B
 0.902764 -0.259656 -1.864541
-0.695893  0.308893  0.125199
 1.696989 -1.221131 -2.975839
-1.132069 -1.086189 -1.945467
 2.294835 -1.765507  1.567853
-1.788299  2.579029  0.792919
```

A

```
In [14]: df.index.get_level_values('A')
Out[14]:
Float64Index([0.902764041011, -0.69589264969,  1.69698924476, -1.13206872067,
               2.29483481146,   -1.788298829],
             dtype='float64', name='A')
```

```
In [15]: df.index.get_level_values(level=0)
Out[15]:
Float64Index([0.902764041011, -0.69589264969,  1.69698924476, -1.13206872067,
               2.29483481146,   -1.788298829],
             dtype='float64', name='A')
```

```
In [16]: df.loc[(df.index.get_level_values('A') > 0.5) & (df.index.get_level_values('A') <
2.1)]
Out[16]:
                          C
A        B
0.902764 -0.259656 -1.864541
1.696989 -1.221131 -2.975839
```

```
In [17]: df.loc[(df.index.get_level_values('A') > 0.5) & (df.index.get_level_values('B') < 0)]
Out[17]:
                          C
A        B
0.902764 -0.259656 -1.864541
1.696989 -1.221131 -2.975839
2.294835 -1.765507  1.567853
```

xs

```
In [18]: df.xs(key=0.9027639999999999)
Out[18]:
                  C
B
-0.259656 -1.864541

In [19]: df.xs(key=0.9027639999999999, drop_level=False)
Out[19]:
                           C
A        B
0.902764 -0.259656 -1.864541
```

MultiIndexDataFrame

DataFrame

```
In [11]: df = pd.DataFrame({'a':[1,1,1,2,2,3],'b':[4,4,5,5,6,7,],'c':[10,11,12,13,14,15]})

In [12]: df.set_index(['a','b'], inplace=True)

In [13]: df
Out[13]:
      c
a b
1 4  10
  4  11
  5  12
2 5  13
  6  14
3 7  15
```

MultiIndex◦ `level=0` `level='a'`

```
In[21]: for idx, data in df.groupby(level=0):
            print('---')
            print(data)
---
      c
a b
1 4  10
  4  11
  5  12
---
      c
a b
2 5  13
  6  14
---
      c
a b
3 7  15
```

`level ='b'

```
In[22]: for idx, data in df.groupby(level='b'):
            print('---')
            print(data)
---
      c
a b
1 4  10
  4  11
---
      c
a b
1 5  12
2 5  13
---
      c
a b
2 6  14
---
      c
a b
3 7  15
```

MultiIndex

MultiIndexpandas.DataFrame ◦

```
In [1]: df = pd.DataFrame([['one', 'A', 100], ['two', 'A', 101], ['three', 'A', 102],
   ...:                    ['one', 'B', 103], ['two', 'B', 104], ['three', 'B', 105]],
   ...:                   columns=['c1', 'c2', 'c3'])


In [2]: df
Out[2]:
      c1 c2   c3
0    one  A  100
1    two  A  101
2  three  A  102
3    one  B  103
4    two  B  104
5  three  B  105



In [3]: df.set_index(['c1', 'c2'])
Out[3]:
           c3
c1    c2
one   A   100
two   A   101
three A   102
one   B   103
two   B   104
three B   105
```

```
In [4]: df.set_index(['c1', 'c2']).sort_index()
Out[4]:
           c3
c1    c2
```

```
one   A   100
      B   103
three A   102
      B   105
two   A   101
      B   104
```

```
In [5]: df_01 = df.set_index(['c1', 'c2'])

In [6]: %timeit df_01.loc['one']
1000 loops, best of 3: 607 µs per loop


In [7]: df_02 = df.set_index(['c1', 'c2']).sort_index()

In [8]: %timeit df_02.loc['one']
1000 loops, best of 3: 413 µs per loop
```

```
In [9]: df_indexed = df.set_index(['c1', 'c2']).sort_index()

In [10]: df_indexed.loc['one']
Out[10]:
     c3
c2
A   100
B   103


In [11]: df_indexed.loc['one', 'A']
Out[11]:
c3    100
Name: (one, A), dtype: int64


In [12]: df_indexed.xs((slice(None), 'A'))
Out[12]:
        c3
c1
one    100
three  102
two    101
```

MultiIndex

MultiIndexDataFrame

```
# build an example DataFrame
midx = pd.MultiIndex(levels=[['zero', 'one'], ['x','y']], labels=[[1,1,0,],[1,0,1,]])
df = pd.DataFrame(np.random.randn(2,3), columns=midx)

In [2]: df
Out[2]:
        one                zero
          y         x         y
0  0.785806 -0.679039  0.513451
1 -0.337862 -0.350690 -1.423253
```

MultiIndex。

```
df.columns = ['A','B','C']
In [3]: df
Out[3]:
          A         B         C
0  0.785806 -0.679039  0.513451
1 -0.337862 -0.350690 -1.423253
```

MultiIndex

DataFrame

```
df = pd.DataFrame(np.random.randn(2,3), columns=['a','b','c'])

In [91]: df
Out[91]:
          a         b         c
0 -0.911752 -1.405419 -0.978419
1  0.603888 -1.187064 -0.035883
```

MultiIndex`MultiIndexdf.columns` 。

```
midx = pd.MultiIndex(levels=[['zero', 'one'], ['x','y']], labels=[[1,1,0,],[1,0,1,]])
df.columns = midx

In [94]: df
Out[94]:
            one                zero
              y         x         y
    0 -0.911752 -1.405419 -0.978419
    1  0.603888 -1.187064 -0.035883
```

MultiIndex

MultiIndexDataFrame。 DataFrame`columns`。

```
midx = pd.MultiIndex(levels=[['zero', 'one'], ['x','y']], labels=[[1,1,0,],[1,0,1,]])
df = pd.DataFrame(np.random.randn(6,4), columns=midx)

In [86]: df
Out[86]:
        one                zero
          y         x         y
0  0.625695  2.149377  0.006123
1 -1.392909  0.849853  0.005477
```

“”MultiIndex。

```
pd.set_option('display.multi_sparse', False)
df.groupby(['A','B']).mean()
# Output:
#        C
```

```
# A B
# a 1  107
# a 2  102
# a 3  115
# b 5   92
# b 8   98
# c 2   87
# c 4  104
# c 9  123
```

https://riptutorial.com/zh-TW/pandas/topic/3840/

20:

。 。

Pandas。

Examples

np.nan

```
df=pd.DataFrame({'col':[1,np.nan]})
df==np.nan
```

```
col
0    False
1    False
```

-

```
df=pd.DataFrame({'col':[1,np.nan]})
df.isnull()
```

```
col
0    False
1    True
```

NA

Pandasinteger。

```
df= pd.read_csv("data.csv", dtype={'grade': int})
error: Integer column has NA values
```

floatdtype。

[1,2]dataframe dfNaN

```
import pandas as pd

series=pd.Series([1,2])
df=pd.DataFrame(index=[3,4])
df['col']=series
df

   col
3    NaN
4    NaN
```

120134

```
df=pd.DataFrame(index=[1,2])
df['col']=series
df

   col
1      2.0
2      NaN
```

.values

```
df['col']=series.values

   col
3    1
4    2
```

https://riptutorial.com/zh-TW/pandas/topic/6425/

21:

Examples

```
# Extract strings with a specific regex
df= df['col_name'].str.extract[r'[Aa-Zz]']

# Replace strings within a regex
df['col_name'].str.replace('Replace this', 'With this')
```

。

.str.slice() .str[] 。

```
In [1]: ser = pd.Series(['Lorem ipsum', 'dolor sit amet', 'consectetur adipiscing elit'])
In [2]: ser
Out[2]:
0                    Lorem ipsum
1                 dolor sit amet
2    consectetur adipiscing elit
dtype: object
```

```
In [3]: ser.str[0]
Out[3]:
0    L
1    d
2    c
dtype: object
```

```
In [4]: ser.str[:3]
Out[4]:
0    Lor
1    dol
2    con
dtype: object
```

```
In [5]: ser.str[-1]
Out[5]:
0    m
1    t
2    t
dtype: object
```

```
In [6]: ser.str[-3:]
Out[6]:
0    sum
1    met
2    lit
dtype: object
```

```
In [7]: ser.str[:10:2]
Out[7]:
0    Lrmis
1    dlrst
2    cnett
dtype: object
```

PandasPython。 Python

```
In [8]:'Lorem ipsum'[12]
# IndexError: string index out of range
```

```
In [9]: 'Lorem ipsum'[12:15]
Out[9]: ''
```

PandasNaN

```
In [10]: ser.str[12]
Out[10]:
0    NaN
1      e
2      a
dtype: object
```

```
In [11]: ser.str[12:15]
Out[11]:
0
1     et
2    adi
dtype: object
```

`str.contains()`Series。 `str.startswith()` `str.endswith()`。

```
In [1]: animals = pd.Series(['cat', 'dog', 'bear', 'cow', 'bird', 'owl', 'rabbit', 'snake'])
```

'a'

```
In [2]: animals.str.contains('a')
Out[2]:
0      True
1     False
2      True
3     False
4     False
5     False
6      True
7      True
8      True
dtype: bool
```

'a'

```
In [3]: animals[animals.str.contains('a')]
Out[3]:
0       cat
2      bear
6    rabbit
7     snake
dtype: object
```

str.startswithstr.endswith◦

```
In [4]: animals[animals.str.startswith(('b', 'c'))]
# Returns animals starting with 'b' or 'c'
Out[4]:
0     cat
2    bear
3     cow
4    bird
dtype: object
```

```
In [1]: ser = pd.Series(['lORem ipSuM', 'Dolor sit amet', 'Consectetur Adipiscing Elit'])
```

```
In [2]: ser.str.upper()
Out[2]:
0                    LOREM IPSUM
1                 DOLOR SIT AMET
2    CONSECTETUR ADIPISCING ELIT
dtype: object
```

```
In [3]: ser.str.lower()
Out[3]:
0                    lorem ipsum
1                 dolor sit amet
2    consectetur adipiscing elit
dtype: object
```

```
In [4]: ser.str.capitalize()
Out[4]:
0                    Lorem ipsum
1                 Dolor sit amet
2    Consectetur adipiscing elit
dtype: object
```

```
In [5]: ser.str.title()
Out[5]:
0                    Lorem Ipsum
1                 Dolor Sit Amet
2    Consectetur Adipiscing Elit
dtype: object
```

```
In [6]: ser.str.swapcase()
Out[6]:
0                    LorEM IPsUm
1                 dOLOR SIT AMET
2    cONSECTETUR aDIPISCING eLIT
```

```
dtype: object
```

。

```
In [7]: ser = pd.Series(['LOREM IPSUM', 'dolor sit amet', 'Consectetur Adipiscing Elit'])
```

```
In [8]: ser.str.islower()
Out[8]:
0    False
1     True
2    False
dtype: bool
```

```
In [9]: ser.str.isupper()
Out[9]:
0     True
1    False
2    False
dtype: bool
```

```
In [10]: ser.str.istitle()
Out[10]:
0    False
1    False
2     True
dtype: bool
```

https://riptutorial.com/zh-TW/pandas/topic/2372/

22: MySQLDataFrame

Examples

sqlalchemyPyMySQL

```
from sqlalchemy import create_engine

cnx = create_engine('mysql+pymysql://username:password@server:3306/database').connect()
sql = 'select * from mytable'
df = pd.read_sql(sql, cnx)
```

mysqldataframe

pandas。

```
import pandas as pd
from sqlalchemy import create_engine
from sqlalchemy.engine.url import URL


# sqlalchemy engine
engine = create_engine(URL(
    drivername="mysql"
    username="user",
    password="password"
    host="host"
    database="database"
))

conn = engine.connect()

generator_df = pd.read_sql(sql=query,  # mysql query
                           con=conn,
                           chunksize=chunksize)  # size you want to fetch each time

for dataframe in generator_df:
    for row in dataframe:
        pass  # whatever you want to do
```

MySQLDataFrame https://riptutorial.com/zh-TW/pandas/topic/8809/mysqldataframe

23: pandascsv

path_or_buf	“”。
	"。
na_rep	stringdefault''
float_format	stringdefault
	sequence
	True。
	booleandefault True
index_label	False。 NoneheaderindexTrue。 DataFrameMultiIndex。 False。 index_label = FalseR
nanRep	na_rep
	str Python'w'
	stringoptionalPython 2“ascii”Python 3“utf-8”。
	string'gzip''bz2''xz'
line_terminator	stringdefault'n'
	csvcsv.QUOTE_MINIMAL
quotechar	string1'''
	booleanTruequotechar
escapechar	stringlength 1defaultsepquotechar
CHUNKSIZE	intNone
tupleize_cols	booleandefault Falsemulti_indexTruenewFalse
	stringdefault
	'。'。''

Examples

DataFrame.csv

DataFrame。

```
import numpy as np
import pandas as pd

# Set the seed so that the numbers can be reproduced.
np.random.seed(0)

df = pd.DataFrame(np.random.randn(5, 3), columns=list('ABC'))

# Another way to set column names is
"columns=['column_1_name','column_2_name','column_3_name']"

df

      A         B         C
0  1.764052  0.400157  0.978738
1  2.240893  1.867558 -0.977278
2  0.950088 -0.151357 -0.103219
3  0.410599  0.144044  1.454274
4  0.761038  0.121675  0.443863
```

CSV

```
df.to_csv('example.csv', index=False)
```

example.csv

```
A,B,C
1.76405234597,0.400157208367,0.978737984106
2.2408931992,1.86755799015,-0.977277879876
0.950088417526,-0.151357208298,-0.103218851794
0.410598501938,0.144043571161,1.45427350696
0.761037725147,0.121675016493,0.443863232745
```

`index=False`#s 0,1,2,3,4CSV。

```
df.to_csv('example.csv', index=True)  # Or just leave off the index param; default is True
```

example.csv

```
,A,B,C
0,1.76405234597,0.400157208367,0.978737984106
1,2.2408931992,1.86755799015,-0.977277879876
2,0.950088417526,-0.151357208298,-0.103218851794
3,0.410598501938,0.144043571161,1.45427350696
4,0.761037725147,0.121675016493,0.443863232745
```

`header=False`。

```
df.to_csv('example.csv', index=False, header=False)
```

example.csv

```
1.76405234597,0.400157208367,0.978737984106
2.2408931992,1.86755799015,-0.977277879876
0.950088417526,-0.151357208298,-0.103218851794
0.410598501938,0.144043571161,1.45427350696
0.761037725147,0.121675016493,0.443863232745
```

`sep=` argumentcsv`','`。

```
df.to_csv('example.csv', index=False, header=False, sep='\t')
```

```
1.76405234597    0.400157208367    0.978737984106
2.2408931992    1.86755799015    -0.977277879876
0.950088417526    -0.151357208298    -0.103218851794
0.410598501938    0.144043571161    1.45427350696
0.761037725147    0.121675016493    0.443863232745
```

Pandas DataFramecsv

```
import pandas as pd
data = [
    {'name': 'Daniel', 'country': 'Uganda'},
    {'name': 'Yao', 'country': 'China'},
    {'name': 'James', 'country': 'Colombia'},
]
df = pd.DataFrame(data)
filename = 'people.csv'
df.to_csv(filename, index=False, encoding='utf-8')
```

pandascsv https://riptutorial.com/zh-TW/pandas/topic/1558/pandascsv

24: SQL ServerDataframe

Examples

pyodbc

```
import pandas.io.sql
import pyodbc
import pandas as pd
```

```
# Parameters
server = 'server_name'
db = 'database_name'
UID = 'user_id'
```

```
# Create the connection
conn = pyodbc.connect('DRIVER={SQL Server};SERVER=' + server + ';DATABASE=' + db + '; UID = '
+ UID + '; PWD = ' + UID + 'Trusted_Connection=yes')
```

pandas

```
# Query into dataframe
df= pandas.io.sql.read_sql('sql_query_string', conn)
```

pyodbc

```
import os, time
import pyodbc
import pandas.io.sql as pdsql

def todf(dsn='yourdsn', uid=None, pwd=None, query=None, params=None):
    ''' if `query` is not an actual query but rather a path to a text file
        containing a query, read it in instead '''
    if query.endswith('.sql') and os.path.exists(query):
        with open(query,'r') as fin:
            query = fin.read()

    connstr = "DSN={};UID={};PWD={}".format(dsn,uid,pwd)
    connected = False
    while not connected:
        try:
            with pyodbc.connect(connstr,autocommit=True) as con:
                cur = con.cursor()
                if params is not None: df = pdsql.read_sql(query, con,
                                                           params=params)
                else: df = pdsql.read_sql(query, con)
                cur.close()
            break
        except pyodbc.OperationalError:
            time.sleep(60) # one minute could be changed
    return df
```

SQL ServerDataframe https://riptutorial.com/zh-TW/pandas/topic/2176/sql-serverdataframe

25: pandas DataFrame

Examples

DataFrame

filetable.txt

```
This is a header that discusses the table file
to show space in a generic table file

index  name     occupation
1      Alice    Salesman
2      Bob      Engineer
3      Charlie  Janitor

This is a footer because your boss does not understand data files
```

```
import pandas as pd
# index_col=0 tells pandas that column 0 is the index and not data
pd.read_table('table.txt', delim_whitespace=True, skiprows=3, skipfooter=2, index_col=0)
```

```
          name occupation
index
1        Alice   Salesman
2          Bob   Engineer
3      Charlie    Janitor
```

filetable.txt

```
Alice    Salesman
Bob      Engineer
Charlie  Janitor
```

```
import pandas as pd
pd.read_table('table.txt', delim_whitespace=True, names=['name','occupation'])
```

```
      name occupation
0    Alice   Salesman
1      Bob   Engineer
2  Charlie    Janitor
```

pandas

CSV

filetable.csv

```
index;name;occupation
1;Alice;Saleswoman
2;Bob;Engineer
3;Charlie;Janitor
```

```
import pandas as pd
pd.read_csv('table.csv', sep=';', index_col=0)
```

```
          name occupation
index
1        Alice   Salesman
2          Bob   Engineer
3      Charlie    Janitor
```

filetable.csv

```
Alice,Saleswoman
Bob,Engineer
Charlie,Janitor
```

```
import pandas as pd
pd.read_csv('table.csv', names=['name','occupation'])
```

```
      name occupation
0    Alice   Salesman
1      Bob   Engineer
2  Charlie    Janitor
```

read_csv

Googlepandas

- **gspreadoauth2client**。

```
from __future__ import print_function
import gspread
from oauth2client.client import SignedJwtAssertionCredentials
import pandas as pd
import json

scope = ['https://spreadsheets.google.com/feeds']

credentials = ServiceAccountCredentials.from_json_keyfile_name('your-authorization-file.json',
scope)

gc = gspread.authorize(credentials)

work_sheet = gc.open_by_key("spreadsheet-key-here")
sheet = work_sheet.sheet1
data = pd.DataFrame(sheet.get_all_records())

print(data.head())
```

pandas DataFrame https://riptutorial.com/zh-TW/pandas/topic/1988/pandas-dataframe

26:

DataFrame.ix .loc .iloc◦

Examples

DataFrame

```
df = pd.DataFrame({"color": ['red', 'blue', 'red', 'blue']},
                  index=[True, False, True, False])
      color
True    red
False  blue
True    red
False  blue
```

.loc

```
df.loc[True]
     color
True   red
True   red
```

.iloc

```
df.iloc[True]
>> TypeError

df.iloc[1]
color    blue
dtype: object
```

pandas.iloc[True].iloc[1].iloc[1]

.ix

```
df.ix[True]
     color
True   red
True   red

df.ix[1]
color    blue
dtype: object
```

.ix◦ ◦ .iloc.loc◦

```
  color      name   size
0   red      rose    big
1  blue    violet    big
2   red     tulip  small
3  blue  harebell  small
```

__getitem__[]◦ TrueFalse

```
df[[True, False, True, False]]
  color   name   size
0   red   rose    big
2   red  tulip  small
```

```
  color      name   size
0   red      rose    big
1  blue    violet  small
2   red     tulip  small
3  blue  harebell  small
```

==pd.Series

```
df['size'] == 'small'
0    False
1     True
2     True
3     True
Name: size, dtype: bool
```

pd.Seriesnp.arraylist __getitem__[]◦

```
size_small_mask = df['size'] == 'small'
df[size_small_mask]
  color      name   size
1  blue    violet  small
2   red     tulip  small
3  blue  harebell  small
```

```
         color   size
name
rose       red    big
violet    blue  small
tulip      red  small
harebell  blue  small
```

◦

```
rose_mask = df.index == 'rose'
df[rose_mask]
     color size
name
rose   red  big
```

```
df.loc['rose']
color    red
size     big
Name: rose, dtype: object
```

.locpd.Series pd.DataFrame◦ ◦

.loc◦ ◦

```
df.loc[['rose']]
         color   size
name
rose       red    big
```

https://riptutorial.com/zh-TW/pandas/topic/9589/

27:

dtypes。 numpy。

dtypepython。

`pd.Series` 。 dtype`float` 。

`astype`“”。

```
pd.Series([1.,2.,3.,4.,5.]).astype(object)
0    1
1    2
2    3
3    4
4    5
dtype: object
```

dtype。 python。

```
type(pd.Series([1.,2.,3.,4.,5.]).astype(object)[0])
float
```

“”。

```
pd.Series([1.,2.,3.,4.,5.]).astype(str)
0    1.0
1    2.0
2    3.0
3    4.0
4    5.0
dtype: object
```

dtypeobjectstring。 `numpy`。

```
type(pd.Series([1.,2.,3.,4.,5.]).astype(str)[0])
str
```

dtypes。 dtype。

Examples

`.dtypes` .dtypes atrribute。

```
In [1]: df = pd.DataFrame({'A': [1, 2, 3], 'B': [1.0, 2.0, 3.0], 'C': [True, False, True]})

In [2]: df
Out[2]:
   A    B      C
```

```
0  1  1.0   True
1  2  2.0  False
2  3  3.0   True

In [3]: df.dtypes
Out[3]:
A      int64
B    float64
C       bool
dtype: object
```

.dtype◦

```
In [4]: df['A'].dtype
Out[4]: dtype('int64')
```

dtypes

astype()Seriesastype()Series◦

```
In [1]: df = pd.DataFrame({'A': [1, 2, 3], 'B': [1.0, 2.0, 3.0],
                           'C': ['1.1.2010', '2.1.2011', '3.1.2011'],
                           'D': ['1 days', '2 days', '3 days'],
                           'E': ['1', '2', '3']})
In [2]: df
Out[2]:
   A    B          C       D  E
0  1  1.0   1.1.2010  1 days  1
1  2  2.0   2.1.2011  2 days  2
2  3  3.0   3.1.2011  3 days  3

In [3]: df.dtypes
Out[3]:
A      int64
B    float64
C     object
D     object
E     object
dtype: object
```

AfloatB

```
In [4]: df['A'].astype('float')
Out[4]:
0    1.0
1    2.0
2    3.0
Name: A, dtype: float64

In [5]: df['B'].astype('int')
Out[5]:
0    1
1    2
2    3
Name: B, dtype: int32
```

astype().astype(float64') .astype(float32).astype(float16) ◦ pd.to_numeric pd.to_datetime pd.to_timedelta ◦

pd.to_numeric◦

```
In [6]: pd.to_numeric(df['E'])
Out[6]:
0    1
1    2
2    3
Name: E, dtype: int64
```

pd.to_numeric◦ errors◦

```
# Ignore the error, return the original input if it cannot be converted
In [7]: pd.to_numeric(pd.Series(['1', '2', 'a']), errors='ignore')
Out[7]:
0    1
1    2
2    a
dtype: object

# Return NaN when the input cannot be converted to a number
In [8]: pd.to_numeric(pd.Series(['1', '2', 'a']), errors='coerce')
Out[8]:
0    1.0
1    2.0
2    NaN
dtype: float64
```

isnull boolean indexing

```
In [9]: df = pd.DataFrame({'A': [1, 'x', 'z'],
                           'B': [1.0, 2.0, 3.0],
                           'C': [True, False, True]})

In [10]: pd.to_numeric(df.A, errors='coerce').isnull()
Out[10]:
0    False
1     True
2     True
Name: A, dtype: bool

In [11]: df[pd.to_numeric(df.A, errors='coerce').isnull()]
Out[11]:
   A    B      C
1  x  2.0  False
2  z  3.0   True
```

datetime

```
In [12]: pd.to_datetime(df['C'])
Out[12]:
0   2010-01-01
```

```
1   2011-02-01
2   2011-03-01
Name: C, dtype: datetime64[ns]
```

2.1.2011201121。 201112dayfirst。

```
In [13]: pd.to_datetime('2.1.2011', dayfirst=True)
Out[13]: Timestamp('2011-01-02 00:00:00')
```

timedelta

```
In [14]: pd.to_timedelta(df['D'])
Out[14]:
0   1 days
1   2 days
2   3 days
Name: D, dtype: timedelta64[ns]
```

dtype

select_dtypesdtype。

```
In [1]: df = pd.DataFrame({'A': [1, 2, 3], 'B': [1.0, 2.0, 3.0], 'C': ['a', 'b', 'c'],
                           'D': [True, False, True]})

In [2]: df
Out[2]:
   A    B  C      D
0  1  1.0  a   True
1  2  2.0  b  False
2  3  3.0  c   True
```

includeexclude

```
# Select numbers
In [3]: df.select_dtypes(include=['number'])  # You need to use a list
Out[3]:
   A    B
0  1  1.0
1  2  2.0
2  3  3.0

# Select numbers and booleans
In [4]: df.select_dtypes(include=['number', 'bool'])
Out[4]:
   A    B      D
0  1  1.0   True
1  2  2.0  False
2  3  3.0   True

# Select numbers and booleans but exclude int64
In [5]: df.select_dtypes(include=['number', 'bool'], exclude=['int64'])
Out[5]:
     B      D
```

```
0  1.0   True
1  2.0  False
2  3.0   True
```

dtypes

`get_dtype_counts`dtypes。

```
In [1]: df = pd.DataFrame({'A': [1, 2, 3], 'B': [1.0, 2.0, 3.0], 'C': ['a', 'b', 'c'],
                           'D': [True, False, True]})

In [2]: df.get_dtype_counts()
Out[2]:
bool       1
float64    1
int64      1
object     1
dtype: int64
```

https://riptutorial.com/zh-TW/pandas/topic/2959/

28: Datareader

Pandas datareader

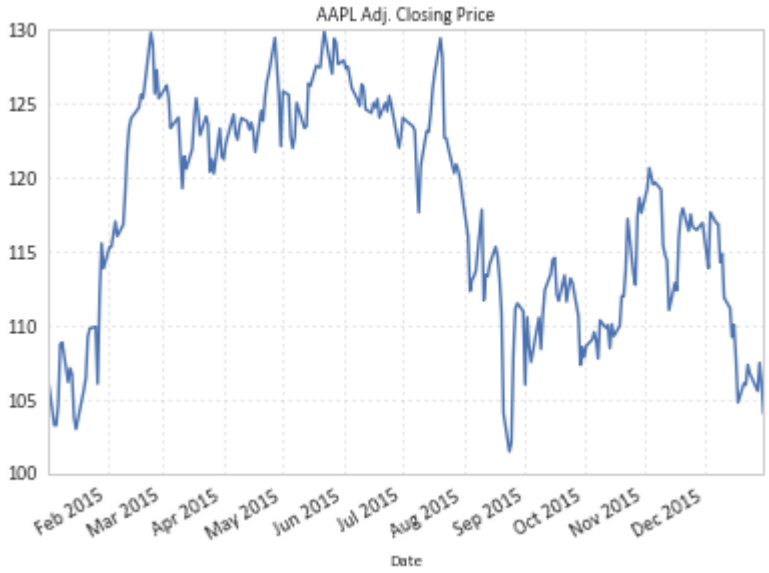
-
- Google
- St.Louis FEDFRED
- Kenneth French
-
-

。

Examples

Datareader

```
from pandas_datareader import data

# Only get the adjusted close.
aapl = data.DataReader("AAPL",
                       start='2015-1-1',
                       end='2015-12-31',
                       data_source='yahoo')['Adj Close']

>>> aapl.plot(title='AAPL Adj. Closing Price')
```




```
# Convert the adjusted closing prices to cumulative returns.
returns = aapl.pct_change()
>>> ((1 + returns).cumprod() - 1).plot(title='AAPL Cumulative Returns')
```

pandas -

```
from datetime import datetime
import pandas_datareader.data as wb

stocklist = ['AAPL','GOOG','FB','AMZN','COP']

start = datetime(2016,6,8)
end = datetime(2016,6,11)

p = wb.DataReader(stocklist, 'yahoo',start,end)
```

p -

```
In [388]: p.axes
Out[388]:
[Index(['Open', 'High', 'Low', 'Close', 'Volume', 'Adj Close'], dtype='object'),
 DatetimeIndex(['2016-06-08', '2016-06-09', '2016-06-10'], dtype='datetime64[ns]',
name='Date', freq='D'),
 Index(['AAPL', 'AMZN', 'COP', 'FB', 'GOOG'], dtype='object')]

In [389]: p.keys()
Out[389]: Index(['Open', 'High', 'Low', 'Close', 'Volume', 'Adj Close'], dtype='object')
```

```
In [390]: p['Adj Close']
Out[390]:
                AAPL        AMZN        COP          FB        GOOG
Date
2016-06-08  98.940002  726.640015  47.490002  118.389999  728.280029
2016-06-09  99.650002  727.650024  46.570000  118.559998  728.580017
2016-06-10  98.830002  717.909973  44.509998  116.620003  719.409973

In [391]: p['Volume']
Out[391]:
                 AAPL       AMZN        COP          FB       GOOG
Date
2016-06-08  20812700.0  2200100.0  9596700.0  14368700.0  1582100.0
2016-06-09  26419600.0  2163100.0  5389300.0  13823400.0   985900.0
```

```
2016-06-10  31462100.0  3409500.0  8941200.0  18412700.0  1206000.0

In [394]: p[:,:,'AAPL']
Out[394]:
                Open       High        Low      Close      Volume  Adj Close
Date
2016-06-08  99.019997  99.559998  98.680000  98.940002  20812700.0  98.940002
2016-06-09  98.500000  99.989998  98.459999  99.650002  26419600.0  99.650002
2016-06-10  98.529999  99.349998  98.480003  98.830002  31462100.0  98.830002

In [395]: p[:,'2016-06-10']
Out[395]:
            Open        High         Low       Close      Volume   Adj Close
AAPL   98.529999   99.349998   98.480003   98.830002  31462100.0   98.830002
AMZN  722.349976  724.979980  714.210022  717.909973   3409500.0  717.909973
COP    45.900002   46.119999   44.259998   44.509998   8941200.0   44.509998
FB    117.540001  118.110001  116.260002  116.620003  18412700.0  116.620003
GOOG  719.469971  725.890015  716.429993  719.409973   1206000.0  719.409973
```

Datareader https://riptutorial.com/zh-TW/pandas/topic/1912/datareader

29: DataFrame

Examples

DataFrame

DataFrame

```
import pandas as pd

df = pd.DataFrame({'integers': [1, 2, 3],
                   'floats': [1.5, 2.5, 3],
                   'text': ['a', 'b', 'c'],
                   'ints with None': [1, None, 3]})

df.info()
<class 'pandas.core.frame.DataFrame'>
Int64Index: 3 entries, 0 to 2
Data columns (total 4 columns):
floats            3 non-null float64
integers          3 non-null int64
ints with None    2 non-null float64
text              3 non-null object
dtypes: float64(2), int64(1), object(1)
memory usage: 120.0+ bytes
```

DataFrame

```
>>> df.info(memory_usage='deep')
<class 'pandas.core.frame.DataFrame'>
Int64Index: 3 entries, 0 to 2
Data columns (total 4 columns):
floats            3 non-null float64
integers          3 non-null int64
ints with None    2 non-null float64
text              3 non-null object
dtypes: float64(2), int64(1), object(1)
memory usage: 234.0 bytes
```

DataFrame

```
df = pd.DataFrame({'a': [1, 2, 3], 'b': [4, 5, 6], 'c': [7, 8, 9]})
```

DataFrame

```
>>> list(df)
['a', 'b', 'c']
```

```
>>> [c for c in df]
['a', 'b', 'c']
```

```
sampledf.columns.tolist()
```

```
df.columns
```

Dataframe◦

```
import pandas as pd
df = pd.DataFrame(np.random.randn(5, 5), columns=list('ABCDE'))
```

◦ NA / `count` `mean` `std`

- `min`
- `25%` Q1
- `50%` Q2
- `75%` Q3
- `max`

```
>>> df.describe()
              A         B         C         D         E
count  5.000000  5.000000  5.000000  5.000000  5.000000
mean  -0.456917 -0.278666  0.334173  0.863089  0.211153
std    0.925617  1.091155  1.024567  1.238668  1.495219
min   -1.494346 -2.031457 -0.336471 -0.821447 -2.106488
25%   -1.143098 -0.407362 -0.246228 -0.087088 -0.082451
50%   -0.536503 -0.163950 -0.004099  1.509749  0.313918
75%    0.092630  0.381407  0.120137  1.822794  1.060268
max    0.796729  0.828034  2.137527  1.891436  1.870520
```

DataFrame https://riptutorial.com/zh-TW/pandas/topic/6697/dataframe

30: DataFrames

Examples

DataFrame

DataFrame。

```
import numpy as np
import pandas as pd

np.random.seed(0)

pd.DataFrame(np.random.randn(5, 6), columns=list('ABCDEF'))

print(df)
# Output:
#           A         B         C         D         E         F
# 0 -0.895467  0.386902 -0.510805 -1.180632 -0.028182  0.428332
# 1  0.066517  0.302472 -0.634322 -0.362741 -0.672460 -0.359553
# 2 -0.813146 -1.726283  0.177426 -0.401781 -1.630198  0.462782
# 3 -0.907298  0.051945  0.729091  0.128983  1.139401 -1.234826
# 4  0.402342 -0.684810 -0.870797 -0.578850 -0.311553  0.056165
```

1`del`

```
del df['C']

print(df)
# Output:
#           A         B         D         E         F
# 0 -0.895467  0.386902 -1.180632 -0.028182  0.428332
# 1  0.066517  0.302472 -0.362741 -0.672460 -0.359553
# 2 -0.813146 -1.726283 -0.401781 -1.630198  0.462782
# 3 -0.907298  0.051945  0.128983  1.139401 -1.234826
# 4  0.402342 -0.684810 -0.578850 -0.311553  0.056165
```

2`drop`

```
df.drop(['B', 'E'], axis='columns', inplace=True)
# or df = df.drop(['B', 'E'], axis=1) without the option inplace=True

print(df)
# Output:
#           A         D         F
# 0 -0.895467 -1.180632  0.428332
# 1  0.066517 -0.362741 -0.359553
# 2 -0.813146 -0.401781  0.462782
# 3 -0.907298  0.128983 -1.234826
# 4  0.402342 -0.578850  0.056165
```

3`drop` with column number

```
df.drop(df.columns[[0, 2]], axis='columns')

print(df)
# Output:
#           D
# 0 -1.180632
# 1 -0.362741
# 2 -0.401781
# 3  0.128983
# 4 -0.578850
```

```
df = pd.DataFrame({'old_name_1': [1, 2, 3], 'old_name_2': [5, 6, 7]})

print(df)
# Output:
#    old_name_1  old_name_2
# 0           1           5
# 1           2           6
# 2           3           7
```

```
df.rename(columns={'old_name_1': 'new_name_1', 'old_name_2': 'new_name_2'}, inplace=True)
print(df)
# Output:
#   new_name_1  new_name_2
# 0           1           5
# 1           2           6
# 2           3           7
```

```
df.rename(columns=lambda x: x.replace('old_', '_new'), inplace=True)
print(df)
# Output:
#   new_name_1  new_name_2
# 0           1           5
# 1           2           6
# 2           3           7
```

`df.columns`

```
df.columns = ['new_name_1','new_name_2']
print(df)
# Output:
#   new_name_1  new_name_2
# 0           1           5
# 1           2           6
# 2           3           7
```

。

```
df = pd.DataFrame({'A': [1, 2, 3], 'B': [4, 5, 6]})

print(df)
# Output:
#    A  B
# 0  1  4
# 1  2  5
# 2  3  6
```

```
df['C'] = [7, 8, 9]

print(df)
# Output:
#    A  B  C
# 0  1  4  7
# 1  2  5  8
# 2  3  6  9
```

```
df['C'] = 1

print(df)

# Output:
#    A  B  C
# 0  1  4  1
# 1  2  5  1
# 2  3  6  1
```

```
df['C'] = df['A'] + df['B']

# print(df)
# Output:
#    A  B  C
# 0  1  4  5
# 1  2  5  7
# 2  3  6  9

df['C'] = df['A']**df['B']

print(df)
# Output:
#    A  B    C
# 0  1  4    1
# 1  2  5   32
# 2  3  6  729
```

```
a = [1, 2, 3]
b = [4, 5, 6]
```

```
c = [x**y for (x,y) in zip(a,b)]

print(c)
# Output:
# [1, 32, 729]
```

```
df_means = df.assign(D=[10, 20, 30]).mean()

print(df_means)
# Output:
# A     2.0
# B     5.0
# C     7.0
# D    20.0  # adds a new column D before taking the mean
# dtype: float64
```

```
df = pd.DataFrame({'A': [1, 2, 3], 'B': [4, 5, 6]})
df[['A2','B2']] = np.square(df)

print(df)
# Output:
#    A  B  A2  B2
# 0  1  4   1  16
# 1  2  5   4  25
# 2  3  6   9  36
```

```
new_df = df.assign(A3=df.A*df.A2, B3=5*df.B)

print(new_df)
# Output:
#    A  B  A2  B2  A3  B3
# 0  1  4   1  16   1  20
# 1  2  5   4  25   8  25
# 2  3  6   9  36  27  30
```

```
import pandas as pd

df = pd.DataFrame({'gender': ["male", "female","female"],
                   'id': [1, 2, 3] })
>>> df
   gender  id
0    male   1
1  female   2
2  female   3
```

01

```
df.loc[df["gender"] == "male","gender"] = 0
df.loc[df["gender"] == "female","gender"] = 1

>>> df
       gender  id
    0       0   1
    1       1   2
    2       1   3
```

DataFrame

DataFrame

```
s1 = pd.Series([1,2,3])
s2 = pd.Series(['a','b','c'])

df = pd.DataFrame([list(s1), list(s2)],  columns =  ["C1", "C2", "C3"])
print df
```

```
  C1 C2 C3
0  1  2  3
1  a  b  c
```

[10,11,12]

```
df = pd.DataFrame(np.array([[10,11,12]]), \
        columns=["C1", "C2", "C3"]).append(df, ignore_index=True)
print df
```

```
   C1  C2  C3
0  10  11  12
1   1   2   3
2   a   b   c
```

DataFrame/

DataFrame

```
df = pd.DataFrame(np.arange(10).reshape(5,2), columns=list('ab'))

print(df)
# Output:
#    a  b
# 0  0  1
# 1  2  3
# 2  4  5
# 3  6  7
# 4  8  9
```

drop([...], inplace=True)drop([...], inplace=True)04

```
df.drop([0,4], inplace=True)

print(df)
# Output
#    a  b
# 1  2  3
# 2  4  5
# 3  6  7
```

df = drop([...])df = drop([...])04

```
df = pd.DataFrame(np.arange(10).reshape(5,2), columns=list('ab'))

df = df.drop([0,4])

print(df)
# Output:
#    a  b
# 1  2  3
# 2  4  5
# 3  6  7
```

```
df = pd.DataFrame(np.arange(10).reshape(5,2), columns=list('ab'))

df = df[~df.index.isin([0,4])]

print(df)
```

```
# Output:
#    a  b
# 1  2  3
# 2  4  5
# 3  6  7
```

```
# get a list of columns
cols = list(df)

# move the column to head of list using index, pop and insert
cols.insert(0, cols.pop(cols.index('listing')))

# use ix to reorder
df2 = df.ix[:, cols]
```

DataFrames https://riptutorial.com/zh-TW/pandas/topic/6694/dataframes

31:

Examples

◦ ◦

```
import pandas as pd

s = pd.Series([10, 20, 30])

>>> s
0    10
1    20
2    30
dtype: int64
```

◦ 01.◦

```
s2 = pd.Series([1.5, 2.5, 3.5], index=['a', 'b', 'c'], name='my_series')

>>> s2
a    1.5
b    2.5
c    3.5
Name: my_series, dtype: float64

s3 = pd.Series(['a', 'b', 'c'], index=list('ABC'))

>>> s3
A    a
B    b
C    c
dtype: object
```

```
import pandas as pd
import numpy as np

np.random.seed(0)
rng = pd.date_range('2015-02-24', periods=5, freq='T')
s = pd.Series(np.random.randn(len(rng)), index=rng)
print (s)

2015-02-24 00:00:00    1.764052
2015-02-24 00:01:00    0.400157
2015-02-24 00:02:00    0.978738
2015-02-24 00:03:00    2.240893
2015-02-24 00:04:00    1.867558
Freq: T, dtype: float64

rng = pd.date_range('2015-02-24', periods=5, freq='T')
s1 = pd.Series(rng)
print (s1)

0   2015-02-24 00:00:00
```

```
1   2015-02-24 00:01:00
2   2015-02-24 00:02:00
3   2015-02-24 00:03:00
4   2015-02-24 00:04:00
dtype: datetime64[ns]
```

Pandas

```
>>> import pandas as pd
>>> s = pd.Series([1, 4, 6, 3, 8, 7, 4, 5])
>>> s
0    1
1    4
2    6
3    3
4    8
5    7
6    4
7    5
dtype: int64
```

Series

s

```
>>> len(s)
8
```

s

```
>>> s[4]
8
```

s

```
>>> s.loc[2]
6
```

s

```
>>> s[1:3]
1    4
2    6
dtype: int64
```

5

```
>>> s[s > 5]
2    6
4    8
5    7
dtype: int64
```

```
>>> s.min()
1
>>> s.max()
8
>>> s.mean()
4.75
>>> s.std()
2.2519832529192065
```

Seriesfloat

```
>>> s.astype(float)
0    1.0
1    4.0
2    6.0
3    3.0
4    8.0
5    7.0
6    4.0
7    5.0
dtype: float64
```

snumpy

```
>>> s.values
array([1, 4, 6, 3, 8, 7, 4, 5])
```

s

```
>>> d = s.copy()
>>> d
0    1
1    4
2    6
3    3
4    8
5    7
6    4
7    5
dtype: int64
```

PandasSeries。

```
>>> import pandas as pd
>>> s = pd.Series([3, 7, 5, 8, 9, 1, 0, 4])
>>> s
0    3
1    7
2    5
3    8
4    9
5    1
6    0
7    4
dtype: int64
```

```
>>> def square(x):
...     return x*x
```

squares

```
>>> t = s.apply(square)
>>> t
0     9
1    49
2    25
3    64
4    81
5     1
6     0
7    16
dtype: int64
```

lambda

```
>>> s.apply(lambda x: x ** 2)
0     9
1    49
2    25
3    64
4    81
5     1
6     0
7    16
dtype: int64
```

```
>>> q = pd.Series(['Bob', 'Jack', 'Rose'])
>>> q.apply(str.lower)
0     bob
1    jack
2    rose
dtype: object
```

Series

```
>>> q.str.lower()
0     bob
1    jack
2    rose
dtype: object
>>> q.str.len()
0    3
1    4
2    4
```

https://riptutorial.com/zh-TW/pandas/topic/1898/

32:

Examples

```
# Create a sample DF
df = pd.DataFrame(np.random.randn(5, 3), columns=list('ABC'))

# Show DF
df
          A         B         C
0 -0.467542  0.469146 -0.861848
1 -0.823205 -0.167087 -0.759942
2 -1.508202  1.361894 -0.166701
3  0.394143 -0.287349 -0.978102
4 -0.160431  1.054736 -0.785250

# Select column using a single label, 'A'
df['A']
0   -0.467542
1   -0.823205
2   -1.508202
3    0.394143
4   -0.160431

# Select multiple columns using an array of labels, ['A', 'C']
df[['A', 'C']]
          A         C
0 -0.467542 -0.861848
1 -0.823205 -0.759942
2 -1.508202 -0.166701
3  0.394143 -0.978102
4 -0.160431 -0.785250
```

http //pandas.pydata.org/pandas-docs/version/0.18.0/indexing.html#selection-by-label

`iloc` ◦ Python◦

```
df = pd.DataFrame([[11, 22], [33, 44], [55, 66]], index=list("abc"))

df
# Out:
#     0   1
# a  11  22
# b  33  44
# c  55  66

df.iloc[0]  # the 0th index (row)
# Out:
# 0    11
# 1    22
# Name: a, dtype: int64

df.iloc[1]  # the 1st index (row)
# Out:
# 0    33
```

```
# 1    44
# Name: b, dtype: int64

df.iloc[:2] # the first 2 rows
#     0   1
# a  11  22
# b  33  44

df[::-1]    # reverse order of rows
#     0   1
# c  55  66
# b  33  44
# a  11  22
```

```
df.iloc[:, 1]  # the 1st column
# Out[15]:
# a    22
# b    44
# c    66
# Name: 1, dtype: int64
```

。

```
import pandas as pd
import numpy as np
np.random.seed(5)
df = pd.DataFrame(np.random.randint(100, size=(5, 5)), columns = list("ABCDE"),
                  index = ["R" + str(i) for i in range(5)])

# Out:
#      A   B   C   D   E
# R0  99  78  61  16  73
# R1   8  62  27  30  80
# R2   7  76  15  53  80
# R3  27  44  77  75  65
# R4  47  30  84  86  18
```

R0R2

```
df.loc['R0':'R2']
# Out:
#      A   B   C   D   E
# R0   9  41  62   1  82
# R1  16  78   5  58   0
# R2  80   4  36  51  27
```

locilociloc

```
df.loc['R0':'R2'] # rows labelled R0, R1, R2
# Out:
#      A   B   C   D   E
# R0   9  41  62   1  82
# R1  16  78   5  58   0
# R2  80   4  36  51  27
```

```
# df.iloc[0:2] # rows indexed by 0, 1
#      A   B   C   D   E
# R0  99  78  61  16  73
# R1   8  62  27  30  80
```

CE

```
df.loc[:, 'C':'E']
# Out:
#      C   D   E
# R0  62   1  82
# R1   5  58   0
# R2  36  51  27
# R3  68  38  83
# R4   7  30  62
```

```
import pandas as pd
import numpy as np
np.random.seed(5)
df = pd.DataFrame(np.random.randint(100, size=(5, 5)), columns = list("ABCDE"),
                  index = ["R" + str(i) for i in range(5)])


df
Out[12]:
     A   B   C   D   E
R0  99  78  61  16  73
R1   8  62  27  30  80
R2   7  76  15  53  80
R3  27  44  77  75  65
R4  47  30  84  86  18
```

```
df.ix[1:3, 'C':'E']
Out[19]:
     C   D   E
R1   5  58   0
R2  36  51  27
```

.ix

```
df.index = np.arange(5, 10)

df
Out[22]:
    A   B   C   D   E
5   9  41  62   1  82
6  16  78   5  58   0
7  80   4  36  51  27
8  31   2  68  38  83
9  19  18   7  30  62

#same call returns an empty DataFrame because now the index is integer
df.ix[1:3, 'C':'E']
Out[24]:
Empty DataFrame
Columns: [C, D, E]
Index: []
```

。

```
import pandas as pd
import numpy as np
np.random.seed(5)
df = pd.DataFrame(np.random.randint(100, size=(5, 5)), columns = list("ABCDE"),
                  index = ["R" + str(i) for i in range(5)])
print (df)
#      A   B   C   D   E
# R0  99  78  61  16  73
# R1   8  62  27  30  80
# R2   7  76  15  53  80
# R3  27  44  77  75  65
# R4  47  30  84  86  18
```

```
mask = df['A'] > 10
print (mask)
# R0     True
# R1    False
# R2    False
# R3     True
# R4     True
# Name: A, dtype: bool

print (df[mask])
#      A   B   C   D   E
# R0  99  78  61  16  73
# R3  27  44  77  75  65
# R4  47  30  84  86  18

print (df.ix[mask, 'C'])
# R0    61
# R3    77
# R4    84
# Name: C, dtype: int32

print(df.ix[mask, ['C', 'D']])
#      C   D
# R0  61  16
# R3  77  75
# R4  84  86
```

pandas 。

“”RegEx

DF

```
In [39]: df = pd.DataFrame(np.random.randint(0, 10, size=(5, 6)),
columns=['a10','a20','a25','b','c','d'])

In [40]: df
Out[40]:
   a10  a20  a25  b  c  d
0    2    3    7  5  4  7
```

```
1    3    1    5  7  2  6
2    7    4    9  0  8  7
3    5    8    8  9  6  8
4    8    1    0  4  4  9
```

'a'

```
In [41]: df.filter(like='a')
Out[41]:
   a10  a20  a25
0    2    3    7
1    3    1    5
2    7    4    9
3    5    8    8
4    8    1    0
```

RegEx(b|c|d) - bcd

```
In [42]: df.filter(regex='(b|c|d)')
Out[42]:
   b  c  d
0  5  4  7
1  7  2  6
2  0  8  7
3  9  6  8
4  4  4  9
```

a/RegEx

```
In [43]: df.ix[:, ~df.columns.str.contains('^a')]
Out[43]:
   b  c  d
0  5  4  7
1  7  2  6
2  0  8  7
3  9  6  8
4  4  4  9
```

`.query`/

```
import pandas as pd
```

DF

```
df = pd.DataFrame(np.random.randint(0,10,size=(10, 3)), columns=list('ABC'))

In [16]: print(df)
```

```
   A  B  C
0  4  1  4
1  0  2  0
2  7  8  8
3  2  1  9
4  7  3  8
5  4  0  7
6  1  5  5
7  6  7  8
8  6  7  3
9  6  4  5
```

A > 2B < 5

```
In [18]: df.query('A > 2 and B < 5')
Out[18]:
   A  B  C
0  4  1  4
4  7  3  8
5  4  0  7
9  6  4  5
```

.query()

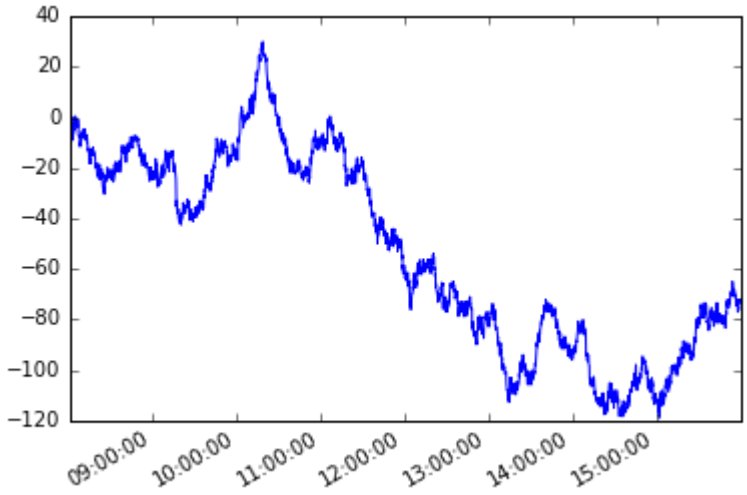
```
In [23]: B_filter = [1,7]

In [24]: df.query('B == @B_filter')
Out[24]:
   A  B  C
0  4  1  4
3  2  1  9
7  6  7  8
8  6  7  3

In [25]: df.query('@B_filter in B')
Out[25]:
   A  B  C
0  4  1  4
```

◦ ◦

s◦

```
#starting python community conventions
import numpy    as np
import pandas   as pd

# n is number of observations
n = 5000

day = pd.to_datetime(['2013-02-06'])
# irregular seconds spanning 28800 seconds (8 hours)
seconds = np.random.rand(n) * 28800 * pd.Timedelta(1, 's')
# start at 8 am
start = pd.offsets.Hour(8)
# irregular timeseries
```

```
tidx = day + start + seconds
tidx = tidx.sort_values()

s = pd.Series(np.random.randn(n), tidx, name='A').cumsum()
s.plot();
```



◦ x ◦

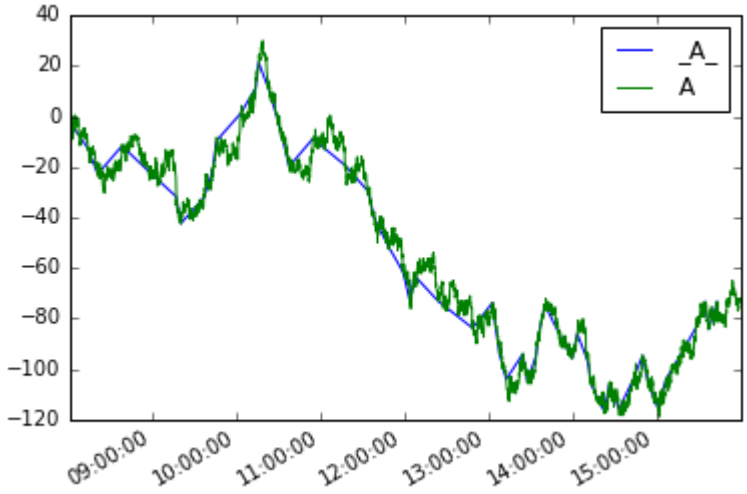
python。

```
def mover(s, move_size=10):
    """Given a reference, find next value with
    an absolute difference >= move_size"""
    ref = None
    for i, v in s.iteritems():
        if ref is None or (abs(ref - v) >= move_size):
            yield i, v
            ref = v
```

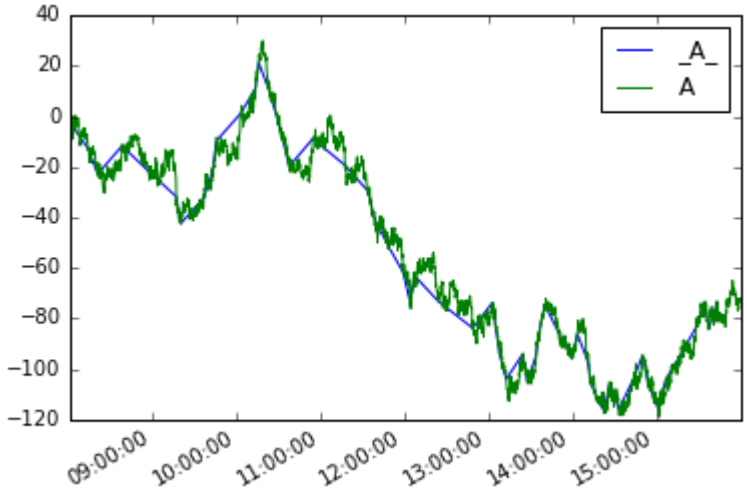
moves

```
moves = pd.Series({i:v for i, v in mover(s, move_size=10)},
                  name='_{}_'.format(s.name))
```

```
moves.plot(legend=True)
s.plot(legend=True)
```



```
def mover_df(df, col, move_size=2):
    ref = None
    for i, row in df.iterrows():
        if ref is None or (abs(ref - row.loc[col]) >= move_size):
            yield row
            ref = row.loc[col]

df = s.to_frame()
moves_df = pd.concat(mover_df(df, 'A', 10), axis=1).T

moves_df.A.plot(label='_A_', legend=True)
df.A.plot(legend=True)
```



nn

headtail

n`DataFrame.head([n])`

```
df.head(n)
```

n`DataFrame.tail([n])`

```
df.tail(n)
```

n5。

`head` / `tail`

```
df[:10]  # same as df.head(10)
df[-10:] # same as df.tail(10)
```

```
df = pd.DataFrame({'col_1':['A','B','A','B','C'], 'col_2':[3,4,3,5,6]})
df
# Output:
#   col_1  col_2
# 0     A      3
# 1     B      4
# 2     A      3
# 3     B      5
# 4     C      6
```

col_1`Series.unique()`

```
df['col_1'].unique()
# Output:
# array(['A', 'B', 'C'], dtype=object)
```

Series.unique。

col_1 SQL*col_2* `DataFrame.drop_duplicates()`

```
df.drop_duplicates()
#   col_1  col_2
# 0     A      3
# 1     B      4
# 3     B      5
# 4     C      6
```

。

```
df = pd.DataFrame({'col_1':['A','B','A','B','C'], 'col_2':[3,4,3,5,6],
'col_3':[0,0.1,0.2,0.3,0.4]})
df
# Output:
#   col_1  col_2  col_3
# 0     A      3    0.0
# 1     B      4    0.1
# 2     A      3    0.2
# 3     B      5    0.3
# 4     C      6    0.4

df.drop_duplicates()
#   col_1  col_2  col_3
# 0     A      3    0.0
# 1     B      4    0.1
# 2     A      3    0.2
```

```
# 3     B      5    0.3
# 4     C      6    0.4
```

```
df = pd.DataFrame({'col_1':['A','B','A','B','C'], 'col_2':[3,4,3,5,6],
'col_3':[0,0.1,0.2,0.3,0.4]})
df.drop_duplicates(['col_1','col_2'])
# Output:
#   col_1  col_2  col_3
# 0     A      3    0.0
# 1     B      4    0.1
# 3     B      5    0.3
# 4     C      6    0.4

# skip last column
# df.drop_duplicates(['col_1','col_2'])[['col_1','col_2']]
#   col_1  col_2
# 0     A      3
# 1     B      4
# 3     B      5
# 4     C      6
```

pandas“” 。

NaNNoneNaT

pd.NaT NaN pd.NaT None

```
df = pd.DataFrame([[0,1,2,3],
                   [None,5,None,pd.NaT],
                   [8,None,10,None],
                   [11,12,13,pd.NaT]],columns=list('ABCD'))
df
# Output:
#      A   B   C     D
# 0    0   1   2     3
# 1  NaN   5 NaN   NaT
# 2    8 NaN  10  None
# 3   11  12  13   NaT
```

DataFrame.dropna

```
df.dropna()
# Output:
#    A  B  C  D
# 0  0  1  2  3
```

subset

```
df.dropna(subset=['C'])
# Output:
#      A   B   C     D
# 0    0   1   2     3
# 2    8 NaN  10  None
# 3   11  12  13   NaT
```

inplace = Trueinplace = True

。

https://riptutorial.com/zh-TW/pandas/topic/1751/

33:

`ffillbfill`

Examples

```
In [11]: df = pd.DataFrame([[1, 2, None, 3], [4, None, 5, 6],
                            [7, 8, 9, 10], [None, None, None, None]])

Out[11]:
     0    1    2     3
0  1.0  2.0  NaN   3.0
1  4.0  NaN  5.0   6.0
2  7.0  8.0  9.0  10.0
3  NaN  NaN  NaN   NaN
```

```
In [12]: df.fillna(0)
Out[12]:
     0    1    2     3
0  1.0  2.0  0.0   3.0
1  4.0  0.0  5.0   6.0
2  7.0  8.0  9.0  10.0
3  0.0  0.0  0.0   0.0
```

DataFrame。 `inplace` `df.fillna(0, inplace=True)` `df = df.fillna(0)`

```
In [13]: df.fillna(method='pad')  # this is equivalent to both method='ffill' and .ffill()
Out[13]:
     0    1    2     3
0  1.0  2.0  NaN   3.0
1  4.0  2.0  5.0   6.0
2  7.0  8.0  9.0  10.0
3  7.0  8.0  9.0  10.0
```

```
In [14]: df.fillna(method='bfill')  # this is equivalent to .bfill()
Out[14]:
     0    1    2     3
0  1.0  2.0  5.0   3.0
1  4.0  8.0  5.0   6.0
2  7.0  8.0  9.0  10.0
3  NaN  NaN  NaN   NaN
```

DataFrame

```
In [15]: df2 = pd.DataFrame(np.arange(100, 116).reshape(4, 4))
         df2
Out[15]:
     0    1    2    3
0  100  101  102  103
1  104  105  106  107
```

```
2  108  109  110  111
3  112  113  114  115

In [16]: df.fillna(df2) #  takes the corresponding cells in df2 to fill df
Out[16]:
       0      1      2      3
0    1.0    2.0  102.0    3.0
1    4.0  105.0    5.0    6.0
2    7.0    8.0    9.0   10.0
3  112.0  113.0  114.0  115.0
```

`None` python`NaN` '

```
In [11]: df = pd.DataFrame([[1, 2, None, 3], [4, None, 5, 6],
                            [7, 8, 9, 10], [None, None, None, None]])

Out[11]:
     0    1    2     3
0  1.0  2.0  NaN   3.0
1  4.0  NaN  5.0   6.0
2  7.0  8.0  9.0  10.0
3  NaN  NaN  NaN   NaN
```

```
In [12]: df.dropna()
Out[12]:
     0    1    2     3
2  7.0  8.0  9.0  10.0
```

DataFrame。 `inplace` `df.dropna(inplace=True)` `df = df.dropna()`

```
In [13]: df.dropna(how='all')
Out[13]:
     0    1    2     3
0  1.0  2.0  NaN   3.0
1  4.0  NaN  5.0   6.0
2  7.0  8.0  9.0  10.0
```

3

```
In [14]: df.dropna(axis=1, thresh=3)
Out[14]:
     0     3
0  1.0   3.0
1  4.0   6.0
2  7.0  10.0
3  NaN   NaN
```

```
import pandas as pd
import numpy as np

df = pd.DataFrame({'A':[1,2,np.nan,3,np.nan],
                   'B':[1.2,7,3,0,8]})
```

```
df['C'] = df.A.interpolate()
df['D'] = df.A.interpolate(method='spline', order=1)

print (df)
     A    B    C         D
0  1.0  1.2  1.0  1.000000
1  2.0  7.0  2.0  2.000000
2  NaN  3.0  2.5  2.428571
3  3.0  0.0  3.0  3.000000
4  NaN  8.0  3.0  3.714286
```

NaN`isnull()notnull()`。

```
In [1]: import numpy as np
In [2]: import pandas as pd
In [3]: ser = pd.Series([1, 2, np.nan, 4])
In [4]: pd.isnull(ser)
Out[4]:
0    False
1    False
2     True
3    False
dtype: bool
```

`np.nan == np.nan`Falsenp.nan

```
In [5]: ser == np.nan
Out[5]:
0    False
1    False
2    False
3    False
dtype: bool
```

SeriesDataFrames。

```
In [6]: ser.isnull()
Out[6]:
0    False
1    False
2     True
3    False
dtype: bool
```

DataFrames

```
In [7]: df = pd.DataFrame({'A': [1, np.nan, 3], 'B': [np.nan, 5, 6]})
In [8]: print(df)
Out[8]:
     A    B
0  1.0  NaN
1  NaN  5.0
2  3.0  6.0

In [9]: df.isnull()  # If the value is NaN, returns True.
Out[9]:
```

```
       A      B
0  False   True
1   True  False
2  False  False

In [10]: df.notnull()  # Opposite of .isnull(). If the value is not NaN, returns True.
Out[10]:
       A      B
0   True  False
1  False   True
2   True   True
```

https://riptutorial.com/zh-TW/pandas/topic/1896/

34:

Examples

`get_dummies`

```
>>> df = pd.DataFrame({'Name':['John Smith', 'Mary Brown'],
                       'Gender':['M', 'F'], 'Smoker':['Y', 'N']})
>>> print(df)
```

```
  Gender        Name Smoker
0      M  John Smith      Y
1      F  Mary Brown      N
```

```
>>> df_with_dummies = pd.get_dummies(df, columns=['Gender', 'Smoker'])
>>> print(df_with_dummies)
```

```
         Name  Gender_F  Gender_M  Smoker_N  Smoker_Y
0  John Smith       0.0       1.0       0.0       1.0
1  Mary Brown       1.0       0.0       1.0       0.0
```

https://riptutorial.com/zh-TW/pandas/topic/5999/

35:

Examples

DataFrame

```
df = pd.DataFrame(np.random.randn(1000, 3), columns=['a', 'b', 'c'])
```

```
>>> df.corr()
          a         b         c
a  1.000000  0.018602  0.038098
b  0.018602  1.000000 -0.014245
c  0.038098 -0.014245  1.000000
```

Pearson 。 1。

`pd.DataFrame.correlation`method。 `pearson` 。 Spearman

```
>>> df.corr(method='spearman')
          a         b         c
a  1.000000  0.007744  0.037209
b  0.007744  1.000000 -0.011823
c  0.037209 -0.011823  1.000000
```

https://riptutorial.com/zh-TW/pandas/topic/5620/

36:

Examples

```
import pandas as pd

df = pd.DataFrame({'eggs': [1,2,4,8,], 'chickens': [0,1,2,4,]})

df

#    chickens  eggs
# 0         0     1
# 1         1     2
# 2         2     4
# 3         4     8

df.shift()

#    chickens  eggs
# 0       NaN   NaN
# 1       0.0   1.0
# 2       1.0   2.0
# 3       2.0   4.0

df.shift(-2)

#    chickens  eggs
# 0       2.0   4.0
# 1       4.0   8.0
# 2       NaN   NaN
# 3       NaN   NaN

df['eggs'].shift(1) - df['chickens']

# 0    NaN
# 1    0.0
# 2    0.0
# 3    0.0
```

`.shift()`periods ◦ 1 ◦

https://riptutorial.com/zh-TW/pandas/topic/7554/

37: Google BigQueryIO

Examples

BigQuery

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

BigQueryBigQuery。

```
In [2]: data = pd.read_gbq('''SELECT title, id, num_characters
   ...:                       FROM [publicdata:samples.wikipedia]
   ...:                       LIMIT 5'''
   ...:                     , project_id='<your-project-id>')
```

```
Your browser has been opened to visit:

    https://accounts.google.com/o/oauth2/v2/auth...[looong url cutted]

If your browser is on a different machine then exit and re-run this
application with the command-line parameter

  --noauth_local_webserver
```

- pandas

```
Authentication successful.
Requesting query... ok.
Query running...
Query done.
Processed: 13.8 Gb

Retrieving results...
Got 5 rows.

Total time taken 1.5 s.
Finished at 2016-08-23 11:26:03.
```

```
In [3]: data
Out[3]:
               title       id  num_characters
0       Fusidic acid   935328            1112
1     Clark Air Base   426241            8257
2  Watergate scandal    52382           25790
3               2005    35984           75813
4               .BLP  2664340            1659
```

pandasjson`bigquery_credentials.dat`

```
In [9]: pd.read_gbq('SELECT count(1) cnt FROM [publicdata:samples.wikipedia]'
```

```
                  , project_id='<your-project-id>')
Requesting query... ok.
[rest of output cutted]

Out[9]:
         cnt
0  313797035
```

BigQuery

jsonpandas

```
In [5]: pd.read_gbq('''SELECT corpus, sum(word_count) words
                       FROM [bigquery-public-data:samples.shakespeare]
                       GROUP BY corpus
                       ORDER BY words desc
                       LIMIT 5'''
                    , project_id='<your-project-id>'
                    , private_key='<private key json contents or file path>')
Requesting query... ok.
[rest of output cutted]

Out[5]:
           corpus  words
0          hamlet  32446
1  kingrichardiii  31868
2      coriolanus  29535
3       cymbeline  29231
4    2kinghenryiv  28241
```

Google BigQueryIO https://riptutorial.com/zh-TW/pandas/topic/5610/google-bigqueryio

38:

Examples

pivot

```
import pandas as pd
import numpy as np

df = pd.DataFrame({'Name':['Mary', 'Josh','Jon','Lucy', 'Jane', 'Sue'],
                   'Age':[34, 37, 29, 40, 29, 31],
                   'City':['Boston','New York', 'Chicago', 'Los Angeles', 'Chicago',
'Boston'],
                   'Position':['Manager','Programmer','Manager','Manager','Programmer',
'Programmer']},
                    columns=['Name','Position','City','Age'])

print (df)
   Name    Position         City  Age
0  Mary     Manager       Boston   34
1  Josh  Programmer     New York   37
2   Jon     Manager      Chicago   29
3  Lucy     Manager  Los Angeles   40
4  Jane  Programmer      Chicago   29
5   Sue  Programmer       Boston   31

print (df.pivot(index='Position', columns='City', values='Age'))
City        Boston  Chicago  Los Angeles  New York
Position
Manager       34.0     29.0         40.0       NaN
Programmer    31.0     29.0          NaN      37.0
```

NaN

```
#pivoting by numbers - column Age
print (df.pivot(index='Position', columns='City', values='Age')
         .reset_index()
         .rename_axis(None, axis=1)
         .fillna(0))

     Position  Boston  Chicago  Los Angeles  New York
0     Manager    34.0     29.0         40.0       0.0
1  Programmer    31.0     29.0          0.0      37.0


#pivoting by strings - column Name
print (df.pivot(index='Position', columns='City', values='Name'))

City       Boston Chicago Los Angeles New York
Position
Manager      Mary     Jon        Lucy     None
Programmer    Sue    Jane        None     Josh
```

```
import pandas as pd
import numpy as np
```

```
df = pd.DataFrame({'Name':['Mary', 'Jon','Lucy', 'Jane', 'Sue', 'Mary', 'Lucy'],
                   'Age':[35, 37, 40, 29, 31, 26, 28],
                   'City':['Boston', 'Chicago', 'Los Angeles', 'Chicago', 'Boston', 'Boston',
'Chicago'],
                   'Position':['Manager','Manager','Manager','Programmer',
'Programmer','Manager','Manager'],
                    'Sex':['Female','Male','Female','Female', 'Female','Female','Female']},
                    columns=['Name','Position','City','Age','Sex'])

print (df)
   Name    Position         City  Age  Sex
0  Mary     Manager       Boston   35  Female
1   Jon     Manager      Chicago   37  Male
2  Lucy     Manager  Los Angeles   40  Female
3  Jane  Programmer      Chicago   29  Female
4   Sue  Programmer       Boston   31  Female
5  Mary     Manager       Boston   26  Female
6  Lucy     Manager      Chicago   28  Female
```

pivot

```
print (df.pivot(index='Position', columns='City', values='Age'))
```

ValueError

pivot_table

```
#default aggfunc is np.mean
print (df.pivot_table(index='Position', columns='City', values='Age'))
City        Boston  Chicago  Los Angeles
Position
Manager       30.5     32.5         40.0
Programmer    31.0     29.0          NaN

print (df.pivot_table(index='Position', columns='City', values='Age', aggfunc=np.mean))
City        Boston  Chicago  Los Angeles
Position
Manager       30.5     32.5         40.0
Programmer    31.0     29.0          NaN
```

agg

```
print (df.pivot_table(index='Position', columns='City', values='Age', aggfunc=sum))
City        Boston  Chicago  Los Angeles
Position
Manager       61.0     65.0         40.0
Programmer    31.0     29.0          NaN

#lost data !!!
print (df.pivot_table(index='Position', columns='City', values='Age', aggfunc='first'))
City        Boston  Chicago  Los Angeles
Position
Manager       35.0     37.0         40.0
Programmer    31.0     29.0          NaN
```

string

```
print (df.pivot_table(index='Position', columns='City', values='Name'))
```

DataError

aggragating

```
print (df.pivot_table(index='Position', columns='City', values='Name', aggfunc='first'))
City       Boston Chicago Los Angeles
Position
Manager      Mary     Jon        Lucy
Programmer    Sue    Jane        None

print (df.pivot_table(index='Position', columns='City', values='Name', aggfunc='last'))
City       Boston Chicago Los Angeles
Position
Manager      Mary    Lucy        Lucy
Programmer    Sue    Jane        None

print (df.pivot_table(index='Position', columns='City', values='Name', aggfunc='sum'))
City          Boston  Chicago Los Angeles
Position
Manager     MaryMary  JonLucy        Lucy
Programmer       Sue     Jane        None

print (df.pivot_table(index='Position', columns='City', values='Name', aggfunc=', '.join))
City            Boston    Chicago Los Angeles
Position
Manager     Mary, Mary  Jon, Lucy        Lucy
Programmer         Sue       Jane        None

print (df.pivot_table(index='Position', columns='City', values='Name', aggfunc=', '.join,
fill_value='-')
         .reset_index()
         .rename_axis(None, axis=1))
     Position      Boston    Chicago Los Angeles
0     Manager  Mary, Mary  Jon, Lucy        Lucy
1  Programmer         Sue       Jane           -
```

。

```
print (df.pivot_table(index='Position', columns=['City','Sex'], values='Age',
aggfunc='first'))

City       Boston Chicago       Los Angeles
Sex        Female  Female  Male      Female
Position
Manager      35.0    28.0  37.0        40.0
Programmer   31.0    29.0   NaN         NaN
```

。

```
print (df.pivot_table(index=['Position','Sex'], columns='City', values='Age',
aggfunc='first'))

City               Boston  Chicago  Los Angeles
Position   Sex
Manager    Female    35.0     28.0         40.0
```

```
           Male       NaN     37.0          NaN
Programmer Female    31.0     29.0          NaN
```

```
In [23]: import numpy as np

In [24]: df.pivot_table(index='Position', values='Age', aggfunc=[np.mean, np.std])
Out[24]:
                mean       std
Position
Manager     34.333333  5.507571
Programmer  32.333333  4.163332
```

```
In [35]: df['Random'] = np.random.random(6)
In [36]: df
Out[36]:
   Name    Position         City  Age    Random
0  Mary     Manager       Boston   34  0.678577
1  Josh  Programmer     New York   37  0.973168
2   Jon     Manager      Chicago   29  0.146668
3  Lucy     Manager  Los Angeles   40  0.150120
4  Jane  Programmer      Chicago   29  0.112769
5   Sue  Programmer       Boston   31  0.185198

For example, find the mean age, and standard deviation of random by Position:

In [37]: df.pivot_table(index='Position', aggfunc={'Age': np.mean, 'Random': np.std})
Out[37]:
                 Age    Random
Position
Manager     34.333333  0.306106
Programmer  32.333333  0.477219
```

```
In [38]: df.pivot_table(index='Position', aggfunc={'Age': np.mean, 'Random': [np.mean,
np.std]})]
Out[38]:
                 Age    Random
                mean      mean       std
Position
Manager     34.333333  0.325122  0.306106
Programmer  32.333333  0.423712  0.477219
```

```
import pandas as pd
import numpy as np

np.random.seed(0)
tuples = list(zip(*[['bar', 'bar', 'foo', 'foo', 'qux', 'qux'],
                    ['one', 'two', 'one', 'two','one', 'two']]))

idx = pd.MultiIndex.from_tuples(tuples, names=['first', 'second'])
df = pd.DataFrame(np.random.randn(6, 2), index=idx, columns=['A', 'B'])
print (df)
                     A         B
first second
bar   one     1.764052  0.400157
      two     0.978738  2.240893
foo   one     1.867558 -0.977278
      two     0.950088 -0.151357
```

```
qux   one    -0.103219  0.410599
      two     0.144044  1.454274
```

```
print (df.stack())
first  second
bar    one     A    1.764052
               B    0.400157
       two     A    0.978738
               B    2.240893
foo    one     A    1.867558
               B   -0.977278
       two     A    0.950088
               B   -0.151357
qux    one     A   -0.103219
               B    0.410599
       two     A    0.144044
               B    1.454274
dtype: float64

#reset index, rename column name
print (df.stack().reset_index(name='val2').rename(columns={'level_2': 'val1'}))
   first second val1      val2
0    bar    one    A  1.764052
1    bar    one    B  0.400157
2    bar    two    A  0.978738
3    bar    two    B  2.240893
4    foo    one    A  1.867558
5    foo    one    B -0.977278
6    foo    two    A  0.950088
7    foo    two    B -0.151357
8    qux    one    A -0.103219
9    qux    one    B  0.410599
10   qux    two    A  0.144044
11   qux    two    B  1.454274
```

```
print (df.unstack())
               A                   B
second       one       two       one       two
first
bar     1.764052  0.978738  0.400157  2.240893
foo     1.867558  0.950088 -0.977278 -0.151357
qux    -0.103219  0.144044  0.410599  1.454274
```

rename_axis pandas 0.18.0

```
#reset index, remove columns names
df1 = df.unstack().reset_index().rename_axis((None,None), axis=1)
#reset MultiIndex in columns with list comprehension
df1.columns = ['_'.join(col).strip('_') for col in df1.columns]
print (df1)
  first     A_one     A_two     B_one     B_two
0   bar  1.764052  0.978738  0.400157  2.240893
1   foo  1.867558  0.950088 -0.977278 -0.151357
2   qux -0.103219  0.144044  0.410599  1.454274
```

0.18.0

```
#reset index
df1 = df.unstack().reset_index()
#remove columns names
df1.columns.names = (None, None)
#reset MultiIndex in columns with list comprehension
df1.columns = ['_'.join(col).strip('_') for col in df1.columns]
print (df1)
  first     A_one     A_two     B_one     B_two
0   bar  1.764052  0.978738  0.400157  2.240893
1   foo  1.867558  0.950088 -0.977278 -0.151357
2   qux -0.103219  0.144044  0.410599  1.454274
```

```
import pandas as pd
df = pd.DataFrame({'Sex': ['M', 'M', 'F', 'M', 'F', 'F', 'M', 'M', 'F', 'F'],
                'Age': [20, 19, 17, 35, 22, 22, 12, 15, 17, 22],
                'Heart Disease': ['Y', 'N', 'Y', 'N', 'N', 'Y', 'N', 'Y', 'N', 'Y']})

df

  Age Heart Disease Sex
0   20             Y   M
1   19             N   M
2   17             Y   F
3   35             N   M
4   22             N   F
5   22             Y   F
6   12             N   M
7   15             Y   M
8   17             N   F
9   22             Y   F

pd.crosstab(df['Sex'], df['Heart Disease'])

Hearth Disease  N  Y
Sex
F               2  3
M               3  2
```

```
pd.crosstab(df.Sex, df.Age)

Age  12  15  17  19  20  22  35
Sex
F     0   0   2   0   0   3   0
M     1   1   0   1   1   0   1
```

DF

```
pd.crosstab(df.Sex, df.Age).T

Sex  F  M
Age
12   0  1
15   0  1
17   2  0
19   0  1
20   0  1
22   3  0
35   0  1
```

```
pd.crosstab(df['Sex'], df['Heart Disease'], margins=True)

Heart Disease  N  Y  All
Sex
F              2  3    5
M              3  2    5
All            5  5   10
```

```
pd.crosstab(df['Sex'], df['Age'], margins=True).T


Sex  F  M  All
Age
12   0  1    1
15   0  1    1
17   2  0    2
19   0  1    1
20   0  1    1
22   3  0    3
35   0  1    1
All  5  5   10
```

```
pd.crosstab(df["Sex"],df['Heart Disease']).apply(lambda r: r/len(df), axis=1)

Heart Disease    N    Y
Sex
F              0.2  0.3
M              0.3  0.2
```

100

```
df2 = pd.crosstab(df["Age"],df['Sex'], margins=True ).apply(lambda r: r/len(df)*100, axis=1)

df2

Sex     F     M    All
Age
12    0.0  10.0   10.0
15    0.0  10.0   10.0
17   20.0   0.0   20.0
19    0.0  10.0   10.0
20    0.0  10.0   10.0
22   30.0   0.0   30.0
35    0.0  10.0   10.0
All  50.0  50.0  100.0
```

DF

```
df2[["F","M"]]

Sex     F     M
Age
12    0.0  10.0
15    0.0  10.0
17   20.0   0.0
19    0.0  10.0
```

```
20    0.0  10.0
22   30.0   0.0
35    0.0  10.0
All  50.0  50.0
```

```
>>> df
   ID  Year  Jan_salary  Feb_salary  Mar_salary
0   1  2016        4500        4200        4700
1   2  2016        3800        3600        4400
2   3  2016        5500        5200        5300

>>> melted_df = pd.melt(df,id_vars=['ID','Year'],
                        value_vars=['Jan_salary','Feb_salary','Mar_salary'],
                        var_name='month',value_name='salary')

>>> melted_df
   ID  Year       month  salary
0   1  2016  Jan_salary    4500
1   2  2016  Jan_salary    3800
2   3  2016  Jan_salary    5500
3   1  2016  Feb_salary    4200
4   2  2016  Feb_salary    3600
5   3  2016  Feb_salary    5200
6   1  2016  Mar_salary    4700
7   2  2016  Mar_salary    4400
8   3  2016  Mar_salary    5300

>>> melted_['month'] = melted_['month'].str.replace('_salary','')

>>> import calendar
>>> def mapper(month_abbr):
...     # from http://stackoverflow.com/a/3418092/42346
...     d = {v: str(k).zfill(2) for k,v in enumerate(calendar.month_abbr)}
...     return d[month_abbr]

>>> melted_df['month'] = melted_df['month'].apply(mapper)
>>> melted_df
   ID  Year month  salary
0   1  2016    01    4500
1   2  2016    01    3800
2   3  2016    01    5500
3   1  2016    02    4200
4   2  2016    02    3600
5   3  2016    02    5200
6   1  2016    03    4700
7   2  2016    03    4400
8   3  2016    03    5300
```

CSV

```
import pandas as pd

df = pd.DataFrame([{'var1': 'a,b,c', 'var2': 1, 'var3': 'XX'},
                   {'var1': 'd,e,f,x,y', 'var2': 2, 'var3': 'ZZ'}])

print(df)

reshaped = \
```

```
(df.set_index(df.columns.drop('var1',1).tolist())
   .var1.str.split(',', expand=True)
   .stack()
   .reset_index()
   .rename(columns={0:'var1'})
   .loc[:, df.columns]
)

print(reshaped)
```

```
        var1  var2 var3
0      a,b,c     1   XX
1  d,e,f,x,y     2   ZZ

  var1  var2 var3
0    a     1   XX
1    b     1   XX
2    c     1   XX
3    d     2   ZZ
4    e     2   ZZ
5    f     2   ZZ
6    x     2   ZZ
7    y     2   ZZ
```

https://riptutorial.com/zh-TW/pandas/topic/1463/

39:

Examples

```
import pandas as pd
import numpy as np

np.random.seed(0)
rng = pd.date_range('2015-02-24', periods=10, freq='T')
df = pd.DataFrame({'Val' : np.random.randn(len(rng))}, index=rng)
print (df)
                         Val
2015-02-24 00:00:00  1.764052
2015-02-24 00:01:00  0.400157
2015-02-24 00:02:00  0.978738
2015-02-24 00:03:00  2.240893
2015-02-24 00:04:00  1.867558
2015-02-24 00:05:00 -0.977278
2015-02-24 00:06:00  0.950088
2015-02-24 00:07:00 -0.151357
2015-02-24 00:08:00 -0.103219
2015-02-24 00:09:00  0.410599
```

```
#downsampling with aggregating sum
print (df.resample('5Min').sum())
                         Val
2015-02-24 00:00:00  7.251399
2015-02-24 00:05:00  0.128833

#5Min is same as 5T
print (df.resample('5T').sum())
                         Val
2015-02-24 00:00:00  7.251399
2015-02-24 00:05:00  0.128833

#upsampling and fill NaN values method forward filling
print (df.resample('30S').ffill())
                         Val
2015-02-24 00:00:00  1.764052
2015-02-24 00:00:30  1.764052
2015-02-24 00:01:00  0.400157
2015-02-24 00:01:30  0.400157
2015-02-24 00:02:00  0.978738
2015-02-24 00:02:30  0.978738
2015-02-24 00:03:00  2.240893
2015-02-24 00:03:30  2.240893
2015-02-24 00:04:00  1.867558
2015-02-24 00:04:30  1.867558
2015-02-24 00:05:00 -0.977278
2015-02-24 00:05:30 -0.977278
2015-02-24 00:06:00  0.950088
2015-02-24 00:06:30  0.950088
2015-02-24 00:07:00 -0.151357
2015-02-24 00:07:30 -0.151357
2015-02-24 00:08:00 -0.103219
2015-02-24 00:08:30 -0.103219
2015-02-24 00:09:00  0.410599
```

https://riptutorial.com/zh-TW/pandas/topic/2164/

40:

Examples

0BASeries.duplicatedDataFrame.ixSeries.mask

```
In [224]: df = pd.DataFrame({'A':[1,2,3,3,2],
     ...:                    'B':[1,7,3,0,8]})

In [225]: mask = df.A.duplicated(keep=False)

In [226]: mask
Out[226]:
0    False
1     True
2     True
3     True
4     True
Name: A, dtype: bool

In [227]: df.ix[mask, 'B'] = 0

In [228]: df['C'] = df.A.mask(mask, 0)

In [229]: df
Out[229]:
   A  B  C
0  1  1  1
1  2  0  0
2  3  0  0
3  3  0  0
4  2  0  0
```

~

```
In [230]: df['C'] = df.A.mask(~mask, 0)

In [231]: df
Out[231]:
   A  B  C
0  1  1  0
1  2  0  2
2  3  0  3
3  3  0  3
4  2  0  2
```

drop_duplicates

```
In [216]: df = pd.DataFrame({'A':[1,2,3,3,2],
     ...:                    'B':[1,7,3,0,8]})

In [217]: df
Out[217]:
   A  B
```

```
0  1  1
1  2  7
2  3  3
3  3  0
4  2  8

# keep only the last value
In [218]: df.drop_duplicates(subset=['A'], keep='last')
Out[218]:
   A  B
0  1  1
3  3  0
4  2  8

# keep only the first value, default value
In [219]: df.drop_duplicates(subset=['A'], keep='first')
Out[219]:
   A  B
0  1  1
1  2  7
2  3  3

# drop all duplicated values
In [220]: df.drop_duplicates(subset=['A'], keep=False)
Out[220]:
   A  B
0  1  1
```

```
In [221]: df = pd.DataFrame({'A':[1,2,3,3,2],
     ...:                    'B':[1,7,3,0,8]})

In [222]: df.drop_duplicates(subset=['A'], inplace=True)

In [223]: df
Out[223]:
   A  B
0  1  1
1  2  7
2  3  3
```

```
In [1]: id_numbers = pd.Series([111, 112, 112, 114, 115, 118, 114, 118, 112])
In [2]: id_numbers.nunique()
Out[2]: 5
```

```
In [3]: id_numbers.unique()
Out[3]: array([111, 112, 114, 115, 118], dtype=int64)

In [4]: df = pd.DataFrame({'Group': list('ABAABABAAB'),
                           'ID': [1, 1, 2, 3, 3, 2, 1, 2, 1, 3]})

In [5]: df
Out[5]:
  Group  ID
0     A   1
1     B   1
2     A   2
3     A   3
4     B   3
```

```
5     A   2
6     B   1
7     A   2
8     A   1
9     B   3
```

```
In [6]: df.groupby('Group')['ID'].nunique()
Out[6]:
Group
A    3
B    2
Name: ID, dtype: int64
```

```
In [7]: df.groupby('Group')['ID'].unique()
Out[7]:
Group
A    [1, 2, 3]
B       [1, 3]
Name: ID, dtype: object
```

◦

```
In [15]: df = pd.DataFrame({"A":[1,1,2,3,1,1],"B":[5,4,3,4,6,7]})

In [21]: df
Out[21]:
   A  B
0  1  5
1  1  4
2  2  3
3  3  4
4  1  6
5  1  7
```

AB

```
In [22]: df["A"].unique()
Out[22]: array([1, 2, 3])

In [23]: df["B"].unique()
Out[23]: array([5, 4, 3, 6, 7])
```

A `unique()`

```
In [24]: pd.unique(df['A']).tolist()
Out[24]: [1, 2, 3]
```

◦ 'B"A'1◦

◦ 4'4'6'B'

```
In [24]: df.loc['4', 'B'] = 4
Out[24]:
```

```
   A  B
0  1  5
1  1  4
2  2  3
3  3  4
4  1  4
5  1  7
```

```
In [25]: pd.unique(df[df['A'] == 1 ]['B']).tolist()
Out[25]: [5, 4, 7]
```

DataFrame

```
df['A'] == 1
```

A1TrueFalse。DataFrame'B'DataFrame

unique。“B”“A”1

```
In [26]: df[df['A'] == 1]['B'].tolist()
Out[26]: [5, 4, 4, 7]
```

https://riptutorial.com/zh-TW/pandas/topic/2082/

41: DataFrame

Examples

DataFrame

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

In [2]: df = pd.DataFrame(columns = ['A', 'B', 'C'])

In [3]: df
Out[3]:
Empty DataFrame
Columns: [A, B, C]
Index: []
```

```
In [4]: df.loc[0, 'A'] = 1

In [5]: df
Out[5]:
   A    B    C
0  1  NaN  NaN
```

```
In [6]: df.loc[1] = [2, 3, 4]

In [7]: df
Out[7]:
   A    B    C
0  1  NaN  NaN
1  2    3    4
```

```
In [8]: df.loc[2] = {'A': 3, 'C': 9, 'B': 9}

In [9]: df
Out[9]:
   A    B    C
0  1  NaN  NaN
1  2    3    4
2  3    9    9
```

.loc []。

```
In [17]: df.loc[1] = [5, 6, 7]

In [18]: df
Out[18]:
   A    B    C
0  1  NaN  NaN
1  5    6    7
2  3    9    9
```

```
In [19]: df.loc[0, 'B'] = 8

In [20]: df
Out[20]:
   A  B    C
0  1  8  NaN
1  5  6    7
2  3  9    9
```

DataFrameDataFrame

DataFrame

```
In [7]: df1
Out[7]:
    A   B
0  a1  b1
1  a2  b2

In [8]: df2
Out[8]:
    B   C
0  b1  c1
```

DataFrame。 appendDataFrame。DataFrame。DataFrame

```
In [9]: df1.append(df2)
Out[9]:
     A   B    C
0   a1  b1  NaN
1   a2  b2  NaN
0  NaN  b1   c1
```

0。PandasDataFrame

```
In [10]: df1.append(df2, ignore_index = True)
Out[10]:
     A   B    C
0   a1  b1  NaN
1   a2  b2  NaN
2  NaN  b1   c1
```

DataFrame https://riptutorial.com/zh-TW/pandas/topic/6456/dataframe

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