# 十分钟搞定pandas

by zhuolin | posted: 2015年4月19日 5 Comments

转载: http://pandas.pydata.org/pandas-docs/stable/10min.html
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## 10 Minutes to pandas

This is a short introduction to pandas, geared mainly for new users. You can see more complex recipes in the Cookbook

## 10分钟搞定pandas

这是关于pandas的简短介绍, 主要面向新用户. 可以参阅Cookbook了解更复杂的使用方法.

Customarily, we import as follows
习惯上,我们做以下导入

View Code PYTHON

```
In [1]: import pandas as pd
In [2]: import numpy as np
In [3]: import matplotlib.pyplot as plt
```

### Object Creation

创建对象

See the Data Structure Intro section 查看 数据结构简介 Creating a **Series** by passing a list of values, letting pandas create a default integer index
使用传递的值列表序列创建序列, 让pandas创建默认整数索引

View Code PYTHON

```
In [4]: s = pd.Series([1,3,5,np.nan,6,8])
In [5]: s
Out[5]:
0    1
1    3
2    5
3  NaN
4    6
5    8
dtype: float64
```

Creating a **DataFrame** by passing a numpy array, with a datetime index and labeled columns.
使用传递的numpy数组创建数据帧,并使用日期索引和标记列.

View Code PYTHON

```
In [6]: dates = pd.date_range('20130101',periods=6)
In [7]: dates
Out[7]:
<class 'pandas.tseries.index.DatetimeIndex'>
[2013-01-01, ..., 2013-01-06]
Length: 6, Freq: D, Timezone: None

In [8]: df = pd.DataFrame(np.random.randn(6,4),index=dates,columns=list('ABCD'))
In [9]: df
```

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```
Out[9]:
                   A       B       C       D
2013-01-01  0.469112 -0.282863 -1.509059 -1.135632
2013-01-02  1.212112 -0.173215  0.119209 -1.044236
2013-01-03 -0.861849 -2.104569 -0.494929  1.071804
2013-01-04  0.721555 -0.706771 -1.039575  0.271860
2013-01-05 -0.424972  0.567020  0.276232 -1.087401
2013-01-06 -0.673690  0.113648 -1.478427  0.524988
```

Creating a **DataFrame** by passing a dict of objects that can be converted to series-like.
使用传递的可转换序列的字典对象创建数据帧.

View Code PYTHON

```
In [10]: df2 = pd.DataFrame({ 'A' : 1.,
    ....:                     'B' : pd.Timestamp('20130102'),
    ....:                     'C' : pd.Series(1,index=list(range(4)),dtype='float32'),
    ....:                     'D' : np.array([3] * 4,dtype='int32'),
    ....:                     'E' : pd.Categorical(["test","train","test","train"]),
    ....:                     'F' : 'foo' })
    ....:
In [11]: df2
Out[11]:
   A          B  C  D      E    F
0  1 2013-01-02  1  3   test  foo
1  1 2013-01-02  1  3  train  foo
2  1 2013-01-02  1  3   test  foo
3  1 2013-01-02  1  3  train  foo
```

Having specific dtypes
所有明确类型

View Code PYTHON

```
In [12]: df2.dtypes
Out[12]:
A          float64
B    datetime64[ns]
C          float32
D            int32
E         category
F           object
dtype: object
```

If you’re using IPython, tab completion for column names (as well as public attributes) is automatically enabled. Here’s a subset of the attributes that will be completed:
如果你这个正在使用IPython，标签补全列名（以及公共属性）将自动启用。这里是将要完成的属性的子集：

View Code PYTHON

```
In [13]: df2.<TAB>
df2.A                  df2.boxplot
df2.abs                df2.C
df2.add                df2.clip
df2.add_prefix         df2.clip_lower
df2.add_suffix         df2.clip_upper
df2.align              df2.columns
df2.all                df2.combine
df2.any                df2.combineAdd
df2.append             df2.combine_first
df2.apply              df2.combineMult
df2.applymap           df2.compound
df2.as_blocks          df2.consolidate
df2.asfreq             df2.convert_objects
df2.as_matrix          df2.copy
df2.astype             df2.corr
df2.at                 df2.corrwith
df2.at_time            df2.count
df2.axes               df2.cov
df2.B                  df2.cummax
```

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```
df2.between_time      df2.cummin
df2.bfill             df2.cumprod
df2.blocks            df2.cumsum
df2.bool              df2.D
```

As you can see, the columns **A**, **B**, **C**, and **D** are automatically tab completed. **E** is there as well; the rest of the attributes have been truncated for brevity.
如你所见, 列 **A**, **B**, **C**, 和 **D** 也是自动完成标签. **E** 也是可用的; 为了简便起见,后面的属性显示被截断.

### Viewing Data

### 查看数据

See the Basics section
参阅基础部分
See the top & bottom rows of the frame
查看帧顶部和底部行

View Code PYTHON

```
In [14]: df.head()
Out[14]:
                   A         B         C         D
2013-01-01  0.469112 -0.282863 -1.509059 -1.135632
2013-01-02  1.212112 -0.173215  0.119209 -1.044236
2013-01-03 -0.861849 -2.104569 -0.494929  1.071804
2013-01-04  0.721555 -0.706771 -1.039575  0.271860
2013-01-05 -0.424972  0.567020  0.276232 -1.087401

In [15]: df.tail(3)
Out[15]:
                   A         B         C         D
2013-01-04  0.721555 -0.706771 -1.039575  0.271860
2013-01-05 -0.424972  0.567020  0.276232 -1.087401
2013-01-06 -0.673690  0.113648 -1.478427  0.524988
```

Display the index,columns, and the underlying numpy data
显示索引,列,和底层numpy数据

View Code PYTHON

```
In [16]: df.index
Out[16]:
<class 'pandas.tseries.index.DatetimeIndex'>
[2013-01-01, ..., 2013-01-06]
Length: 6, Freq: D, Timezone: None

In [17]: df.columns
Out[17]: Index([u'A', u'B', u'C', u'D'], dtype='object')

In [18]: df.values
Out[18]:
array([[ 0.4691, -0.2829, -1.5091, -1.1356],
       [ 1.2121, -0.1732,  0.1192, -1.0442],
       [-0.8618, -2.1046, -0.4949,  1.0718],
       [ 0.7216, -0.7068, -1.0396,  0.2719],
       [-0.425 ,  0.567 ,  0.2762, -1.0874],
       [-0.6737,  0.1136, -1.4784,  0.525 ]])
```

Describe shows a quick statistic summary of your data
描述显示数据快速统计摘要

View Code PYTHON

```
In [19]: df.describe()
Out[19]:
              A         B         C         D
count  6.000000  6.000000  6.000000  6.000000
mean   0.073711 -0.431125 -0.687758 -0.233103
std    0.843157  0.922818  0.779887  0.973118
min   -0.861849 -2.104569 -1.509059 -1.135632
```

```
25%  -0.611510 -0.600794 -1.368714 -1.076610
50%   0.022070 -0.228039 -0.767252 -0.386188
75%   0.658444  0.041933 -0.034326  0.461706
max   1.212112  0.567020  0.276232  1.071804
</a>
```

Transposing your data

转置数据

View Code PYTHON

```
In [20]: df.T
Out[20]:
   2013-01-01  2013-01-02  2013-01-03  2013-01-04  2013-01-05  2013-01-06
A    0.469112    1.212112   -0.861849    0.721555   -0.424972   -0.673690
B   -0.282863   -0.173215   -2.104569   -0.706771    0.567020    0.113648
C   -1.509059    0.119209   -0.494929   -1.039575    0.276232   -1.478427
D   -1.135632   -1.044236    1.071804    0.271860   -1.087401    0.524988
```

Sorting by an axis

按轴排序

View Code PYTHON

```
In [21]: df.sort_index(axis=1, ascending=False)
Out[21]:
                   D         C         B         A
2013-01-01 -1.135632 -1.509059 -0.282863  0.469112
2013-01-02 -1.044236  0.119209 -0.173215  1.212112
2013-01-03  1.071804 -0.494929 -2.104569 -0.861849
2013-01-04  0.271860 -1.039575 -0.706771  0.721555
2013-01-05 -1.087401  0.276232  0.567020 -0.424972
2013-01-06  0.524988 -1.478427  0.113648 -0.673690
```

Sorting by values

按值排序

View Code PYTHON

```
In [22]: df.sort(columns='B')
Out[22]:
                   A         B         C         D
2013-01-03 -0.861849 -2.104569 -0.494929  1.071804
2013-01-04  0.721555 -0.706771 -1.039575  0.271860
2013-01-01  0.469112 -0.282863 -1.509059 -1.135632
2013-01-02  1.212112 -0.173215  0.119209 -1.044236
2013-01-06 -0.673690  0.113648 -1.478427  0.524988
2013-01-05 -0.424972  0.567020  0.276232 -1.087401
```

## Selection

选择器

> ***Note:*** *While standard Python / Numpy expressions for selecting and setting are intuitive and come in handy for interactive work, for production code, we recommend the optimized pandas data access methods, .at, .iat, .loc, .iloc and .ix.*

> *注释: 标准Python / Numpy表达式可以完成这些互动工作, 但在生产代码中, 我们推荐使用优化的pandas数据访问方法, .at, .iat, .loc, .iloc 和 .ix.*

See the indexing documentation Indexing and Selecing Data and MultiIndex / Advanced Indexing
参阅索引文档 索引和选择数据 and 多索引/高级索引

### Getting

读取

Selecting a single column, which yields a **Series**, equivalent to df.**A**

选择单列, 这会产生一个序列, 等价df.**A**

View Code PYTHON

```
In [23]: df['A']
Out[23]:
2013-01-01    0.469112
2013-01-02    1.212112
2013-01-03   -0.861849
2013-01-04    0.721555
2013-01-05   -0.424972
2013-01-06   -0.673690
Freq: D, Name: A, dtype: float64
```

Selecting via **[]**, which slices the rows.

使用**[]**选择行片断

View Code PYTHON

```
In [24]: df[0:3]
Out[24]:
                   A         B         C         D
2013-01-01  0.469112 -0.282863 -1.509059 -1.135632
2013-01-02  1.212112 -0.173215  0.119209 -1.044236
2013-01-03 -0.861849 -2.104569 -0.494929  1.071804

In [25]: df['20130102':'20130104']
Out[25]:
                   A         B         C         D
2013-01-02  1.212112 -0.173215  0.119209 -1.044236
2013-01-03 -0.861849 -2.104569 -0.494929  1.071804
2013-01-04  0.721555 -0.706771 -1.039575  0.271860
```

**Selection by Label**

使用标签选择

See more in Selection by Label

更多信息请参阅按标签选择

For getting a cross section using a label

使用标签获取横截面

View Code PYTHON

```
In [26]: df.loc[dates[0]]
Out[26]:
A    0.469112
B   -0.282863
C   -1.509059
D   -1.135632
Name: 2013-01-01 00:00:00, dtype: float64
```

Selecting on a multi-axis by label

使用标签选择多轴

View Code PYTHON

```
In [27]: df.loc[:,['A','B']]
Out[27]:
                   A         B
2013-01-01  0.469112 -0.282863
2013-01-02  1.212112 -0.173215
2013-01-03 -0.861849 -2.104569
2013-01-04  0.721555 -0.706771
2013-01-05 -0.424972  0.567020
2013-01-06 -0.673690  0.113648
```

Showing label slicing, both endpoints are **included**

显示标签切片, 包含两个端点

View Code PYTHON

```
In [28]: df.loc['20130102':'20130104',['A','B']]
Out[28]:
                   A         B
2013-01-02  1.212112 -0.173215
2013-01-03 -0.861849 -2.104569
2013-01-04  0.721555 -0.706771
```

Reduction in the dimensions of the returned object

降低返回对象维度

View Code PYTHON

```
In [29]: df.loc['20130102',['A','B']]
Out[29]:
A    1.212112
B   -0.173215
Name: 2013-01-02 00:00:00, dtype: float64
```

For getting a scalar value

获取标量值

View Code PYTHON

```
In [30]: df.loc[dates[0],'A']
Out[30]: 0.46911229990718628
```

For getting fast access to a scalar (equiv to the prior method)

快速访问并获取标量数据 (等价上面的方法)

View Code PYTHON

```
In [31]: df.at[dates[0],'A']
Out[31]: 0.46911229990718628
```

**Selection by Position**

按位置选择

See more in Selection by Position

更多信息请参阅按位置参阅

Select via the position of the passed integers

传递整数选择位置

View Code PYTHON

```
In [32]: df.iloc[3]
Out[32]:
A    0.721555
B   -0.706771
C   -1.039575
D    0.271860
Name: 2013-01-04 00:00:00, dtype: float64
```

By integer slices, acting similar to numpy/python

使用整数片断,效果类似numpy/python

View Code PYTHON

```
In [33]: df.iloc[3:5,0:2]
Out[33]:
                   A         B
2013-01-04  0.721555 -0.706771
2013-01-05 -0.424972  0.567020
```

By lists of integer position locations, similar to the numpy/python style

使用整数偏移定位列表,效果类似 numpy/python 样式

View Code PYTHON

```
In [34]: df.iloc[[1,2,4],[0,2]]
Out[34]:
                   A         C
2013-01-02  1.212112  0.119209
2013-01-03 -0.861849 -0.494929
2013-01-05 -0.424972  0.276232
```

For slicing rows explicitly

显式行切片

View Code PYTHON

```
In [35]: df.iloc[1:3,:]
Out[35]:
                   A         B         C         D
2013-01-02  1.212112 -0.173215  0.119209 -1.044236
2013-01-03 -0.861849 -2.104569 -0.494929  1.071804
```

For slicing columns explicitly

显式列切片

View Code PYTHON

```
In [36]: df.iloc[:,1:3]
Out[36]:
                   B         C
2013-01-01 -0.282863 -1.509059
2013-01-02 -0.173215  0.119209
2013-01-03 -2.104569 -0.494929
2013-01-04 -0.706771 -1.039575
2013-01-05  0.567020  0.276232
2013-01-06  0.113648 -1.478427
```

For getting a value explicitly

显式获取一个值

View Code PYTHON

```
In [37]: df.iloc[1,1]
Out[37]: -0.17321464905330861
```

For getting fast access to a scalar (equiv to the prior method)

快速访问一个标量（等同上个方法）

View Code PYTHON

```
In [38]: df.iat[1,1]
Out[38]: -0.17321464905330861
```

**Boolean Indexing**

布尔索引

Using a single column's values to select data.

使用单个列的值选择数据.

View Code PYTHON

```
In [39]: df[df.A > 0]
Out[39]:
                   A         B         C         D
2013-01-01  0.469112 -0.282863 -1.509059 -1.135632
2013-01-02  1.212112 -0.173215  0.119209 -1.044236
2013-01-04  0.721555 -0.706771 -1.039575  0.271860
```

A **where** operation for getting.

**where** 操作.

View Code PYTHON

```
In [40]: df[df > 0]
Out[40]:
                   A       B       C       D
2013-01-01  0.469112     NaN     NaN     NaN
2013-01-02  1.212112     NaN 0.119209     NaN
2013-01-03     NaN     NaN     NaN 1.071804
2013-01-04  0.721555     NaN     NaN 0.271860
2013-01-05     NaN 0.567020 0.276232     NaN
2013-01-06     NaN 0.113648     NaN 0.524988
```

Using the **isin()** method for filtering:

使用 **isin()** 筛选：

View Code PYTHON

```
In [41]: df2 = df.copy()
In [42]: df2['E']=['one', 'one','two','three','four','three']

In [43]: df2
Out[43]:
                   A       B       C       D     E
2013-01-01  0.469112 -0.282863 -1.509059 -1.135632   one
2013-01-02  1.212112 -0.173215  0.119209 -1.044236   one
2013-01-03 -0.861849 -2.104569 -0.494929  1.071804   two
2013-01-04  0.721555 -0.706771 -1.039575  0.271860 three
2013-01-05 -0.424972  0.567020  0.276232 -1.087401  four
2013-01-06 -0.673690  0.113648 -1.478427  0.524988 three

In [44]: df2[df2['E'].isin(['two','four'])]
Out[44]:
                   A       B       C       D     E
2013-01-03 -0.861849 -2.104569 -0.494929  1.071804   two
2013-01-05 -0.424972  0.567020  0.276232 -1.087401  four
```

**Setting**

**赋值**

Setting a new column automatically aligns the data by the indexes

赋值一个新列，通过索引自动对齐数据

View Code PYTHON

```
In [45]: s1 = pd.Series([1,2,3,4,5,6],index=pd.date_range('20130102',periods=6))
In [46]: s1
Out[46]:
2013-01-02    1
2013-01-03    2
2013-01-04    3
2013-01-05    4
2013-01-06    5
2013-01-07    6
Freq: D, dtype: int64

In [47]: df['F'] = s1
```

Setting values by label

按标签赋值

View Code PYTHON

```
In [48]: df.at[dates[0],'A'] = 0
```

Setting values by position

按位置赋值

View Code PYTHON

```
In [49]: df.iat[0,1] = 0
```

Setting by assigning with a numpy array
通过numpy数组分配赋值

View Code PYTHON

```
In [50]: df.loc[:,'D'] = np.array([5] * len(df))
```

The result of the prior setting operations
之前的操作结果

View Code PYTHON

```
In [51]: df
Out[51]:
                   A         B         C  D   F
2013-01-01  0.000000  0.000000 -1.509059  5 NaN
2013-01-02  1.212112 -0.173215  0.119209  5   1
2013-01-03 -0.861849 -2.104569 -0.494929  5   2
2013-01-04  0.721555 -0.706771 -1.039575  5   3
2013-01-05 -0.424972  0.567020  0.276232  5   4
2013-01-06 -0.673690  0.113648 -1.478427  5   5
```

A **where** operation with setting.
**where** 操作赋值.

View Code PYTHON

```
In [52]: df2 = df.copy()
In [53]: df2[df2 > 0] = -df2
In [54]: df2
Out[54]:
                   A         B         C  D   F
2013-01-01  0.000000  0.000000 -1.509059 -5 NaN
2013-01-02 -1.212112 -0.173215 -0.119209 -5  -1
2013-01-03 -0.861849 -2.104569 -0.494929 -5  -2
2013-01-04 -0.721555 -0.706771 -1.039575 -5  -3
2013-01-05 -0.424972 -0.567020 -0.276232 -5  -4
2013-01-06 -0.673690 -0.113648 -1.478427 -5  -5
```

**Missing Data**

丢失的数据

pandas primarily uses the value **np.nan** to represent missing data. It is by default not included in computations. See the Missing Data section
pandas主要使用**np.nan**替换丢失的数据. 默认情况下它并不包含在计算中. 请参阅 Missing Data section

Reindexing allows you to change/add/delete the index on a specified axis. This returns a copy of the data.
重建索引允许更改/添加/删除指定轴索引,并返回数据副本.

View Code PYTHON

```
In [55]: df1 = df.reindex(index=dates[0:4],columns=list(df.columns) + ['E'])
In [56]: df1.loc[dates[0]:dates[1],'E'] = 1
In [57]: df1
Out[57]:
                   A         B         C  D   F   E
2013-01-01  0.000000  0.000000 -1.509059  5 NaN   1
2013-01-02  1.212112 -0.173215  0.119209  5   1   1
2013-01-03 -0.861849 -2.104569 -0.494929  5   2 NaN
2013-01-04  0.721555 -0.706771 -1.039575  5   3 NaN
```

To drop any rows that have missing data.

删除任何有丢失数据的行.

View Code PYTHON

```
In [58]: df1.dropna(how='any')
Out[58]:
                   A       B       C  D  F  E
2013-01-02  1.212112 -0.173215  0.119209  5  1  1
```

Filling missing data

填充丢失数据

View Code PYTHON

```
In [59]: df1.fillna(value=5)
Out[59]:
                   A       B       C  D  F  E
2013-01-01  0.000000  0.000000 -1.509059  5  5  1
2013-01-02  1.212112 -0.173215  0.119209  5  1  1
2013-01-03 -0.861849 -2.104569 -0.494929  5  2  5
2013-01-04  0.721555 -0.706771 -1.039575  5  3  5
```

To get the boolean mask where values are **nan**

获取值是否**nan**的布尔标记

View Code PYTHON

```
In [60]: pd.isnull(df1)
Out[60]:
                A      B      C      D      F      E
2013-01-01  False  False  False  False   True  False
2013-01-02  False  False  False  False  False  False
2013-01-03  False  False  False  False  False   True
2013-01-04  False  False  False  False  False   True
```

## Operations

运算

See the Basic section on Binary Ops

参阅二元运算基础

### Stats

统计

Operations in general exclude missing data.

计算时一般不包括丢失的数据

Performing a descriptive statistic

执行描述性统计

View Code PYTHON

```
In [61]: df.mean()
Out[61]:
A   -0.004474
B   -0.383981
C   -0.687758
D    5.000000
F    3.000000
dtype: float64
```

Same operation on the other axis

在其他轴做相同的运算

View Code PYTHON

```
In [62]: df.mean(1)
Out[62]:
2013-01-01    0.872735
```

```
2013-01-02    1.431621
2013-01-03    0.707731
2013-01-04    1.395042
2013-01-05    1.883656
2013-01-06    1.592306
Freq: D, dtype: float64
```

Operating with objects that have different dimensionality and need alignment. In addition, pandas automatically broadcasts along the specified dimension.
用于运算的对象有不同的维度并需要对齐.除此之外，pandas会自动沿着指定维度计算.

View Code PYTHON

```
In [63]: s = pd.Series([1,3,5,np.nan,6,8],index=dates).shift(2)
In [64]: s
Out[64]:
2013-01-01   NaN
2013-01-02   NaN
2013-01-03     1
2013-01-04     3
2013-01-05     5
2013-01-06   NaN
Freq: D, dtype: float64

In [65]: df.sub(s,axis='index')
Out[65]:
                   A         B         C   D   F
2013-01-01       NaN       NaN       NaN NaN NaN
2013-01-02       NaN       NaN       NaN NaN NaN
2013-01-03 -1.861849 -3.104569 -1.494929   4   1
2013-01-04 -2.278445 -3.706771 -4.039575   2   0
2013-01-05 -5.424972 -4.432980 -4.723768   0  -1
2013-01-06       NaN       NaN       NaN NaN NaN
```

**Apply**

Applying functions to the data
在数据上使用函数

View Code PYTHON

```
In [66]: df.apply(np.cumsum)
Out[66]:
                   A         B         C   D   F
2013-01-01  0.000000  0.000000 -1.509059   5 NaN
2013-01-02  1.212112 -0.173215 -1.389850  10   1
2013-01-03  0.350263 -2.277784 -1.884779  15   3
2013-01-04  1.071818 -2.984555 -2.924354  20   6
2013-01-05  0.646846 -2.417535 -2.648122  25  10
2013-01-06 -0.026844 -2.303886 -4.126549  30  15

In [67]: df.apply(lambda x: x.max() - x.min())
Out[67]:
A    2.073961
B    2.671590
C    1.785291
D    0.000000
F    4.000000
dtype: float64
```

**Histogramming**

直方图

See more at Histogramming and Discretization
请参阅 直方图和离散化

View Code PYTHON

```
In [68]: s = pd.Series(np.random.randint(0,7,size=10))
In [69]: s
Out[69]:
```

```
0  4
1  2
2  1
3  2
4  6
5  4
6  4
7  6
8  4
9  4
dtype: int32

In [70]: s.value_counts()
Out[70]:
4  5
6  2
2  2
1  1
dtype: int64
```

**String Methods**

**字符串方法**

Series is equipped with a set of string processing methods in the str attribute that make it easy to operate on each element of the array, as in the code snippet below. Note that pattern-matching in str generally uses regular expressions by default (and in some cases always uses them). See more at Vectorized String Methods.

序列可以使用一些字符串处理方法很轻易操作数据组中的每个元素,比如以下代码片断。 注意字符匹配方法默认情况下通常使用正则表达式（并且大多数时候都如此）. 更多信息请参阅字符串向量方法.

View Code PYTHON

```
In [71]: s = pd.Series(['A', 'B', 'C', 'Aaba', 'Baca', np.nan, 'CABA', 'dog', 'cat'])
In [72]: s.str.lower()
Out[72]:
0     a
1     b
2     c
3  aaba
4  baca
5   NaN
6  caba
7   dog
8   cat
dtype: object
```

**Merge**

**合并**

**Concat**

**连接**

pandas provides various facilities for easily combining together Series, DataFrame, and Panel objects with various kinds of set logic for the indexes and relational algebra functionality in the case of join / merge-type operations.

pandas提供各种工具以简便合并序列,数据桢,和组合对象, 在连接/合并类型操作中使用多种类型索引和相关数学函数.

See the Merging section
请参阅合并部分

Concatenating pandas objects together
把pandas对象连接到一起

View Code PYTHON

```
In [73]: df = pd.DataFrame(np.random.randn(10, 4))
In [74]: df
Out[74]:
```

```
        0       1       2       3
0 -0.548702  1.467327 -1.015962 -0.483075
1  1.637550 -1.217659 -0.291519 -1.745505
2 -0.263952  0.991460 -0.919069  0.266046
3 -0.709661  1.669052  1.037882 -1.705775
4 -0.919854 -0.042379  1.247642 -0.009920
5  0.290213  0.495767  0.362949  1.548106
6 -1.131345 -0.089329  0.337863 -0.945867
7 -0.932132  1.956030  0.017587 -0.016692
8 -0.575247  0.254161 -1.143704  0.215897
9  1.193555 -0.077118 -0.408530 -0.862495

# break it into pieces
In [75]: pieces = [df[:3], df[3:7], df[7:]]
In [76]: pd.concat(pieces)
Out[76]:
        0       1       2       3
0 -0.548702  1.467327 -1.015962 -0.483075
1  1.637550 -1.217659 -0.291519 -1.745505
2 -0.263952  0.991460 -0.919069  0.266046
3 -0.709661  1.669052  1.037882 -1.705775
4 -0.919854 -0.042379  1.247642 -0.009920
5  0.290213  0.495767  0.362949  1.548106
6 -1.131345 -0.089329  0.337863 -0.945867
7 -0.932132  1.956030  0.017587 -0.016692
8 -0.575247  0.254161 -1.143704  0.215897
9  1.193555 -0.077118 -0.408530 -0.862495
```

**Join**

连接

SQL style merges. See the Database style joining

SQL样式合并. 请参阅 数据库style联接

View Code PYTHON

```
In [77]: left = pd.DataFrame({'key': ['foo', 'foo'], 'lval': [1, 2]})
In [78]: right = pd.DataFrame({'key': ['foo', 'foo'], 'rval': [4, 5]})
In [79]: left
Out[79]:
  key  lval
0  foo     1
1  foo     2

In [80]: right
Out[80]:
  key  rval
0  foo     4
1  foo     5

In [81]: pd.merge(left, right, on='key')
Out[81]:
  key  lval  rval
0  foo     1     4
1  foo     1     5
2  foo     2     4
3  foo     2     5
```

**Append**

添加

Append rows to a dataframe. See the Appending

添加行到数据增. 参阅 添加

View Code PYTHON

```
In [82]: df = pd.DataFrame(np.random.randn(8, 4), columns=['A','B','C','D'])
In [83]: df
Out[83]:
        A       B       C       D
0  1.346061  1.511763  1.627081 -0.990582
1 -0.441652  1.211526  0.268520  0.024580
```

```
2 -1.577585  0.396823 -0.105381 -0.532532
3  1.453749  1.208843 -0.080952 -0.264610
4 -0.727965 -0.589346  0.339969 -0.693205
5 -0.339355  0.593616  0.884345  1.591431
6  0.141809  0.220390  0.435589  0.192451
7 -0.096701  0.803351  1.715071 -0.708758

In [84]: s = df.iloc[3]
In [85]: df.append(s, ignore_index=True)
Out[85]:
         A        B        C        D
0  1.346061  1.511763  1.627081 -0.990582
1 -0.441652  1.211526  0.268520  0.024580
2 -1.577585  0.396823 -0.105381 -0.532532
3  1.453749  1.208843 -0.080952 -0.264610
4 -0.727965 -0.589346  0.339969 -0.693205
5 -0.339355  0.593616  0.884345  1.591431
6  0.141809  0.220390  0.435589  0.192451
7 -0.096701  0.803351  1.715071 -0.708758
8  1.453749  1.208843 -0.080952 -0.264610
```

## Grouping

分组

By “group by” we are referring to a process involving one or more of the following steps

- Splitting the data into groups based on some criteria
- Applying a function to each group independently
- Combining the results into a data structure

对于“group by”指的是以下一个或多个处理

- 将数据按某些标准分割为不同的组
- 在每个独立组上应用函数
- 组合结果为一个数据结构

See the Grouping section
请参阅 分组部分

View Code PYTHON

```
In [86]: df = pd.DataFrame({'A' : ['foo', 'bar', 'foo', 'bar',
   ....:                           'foo', 'bar', 'foo', 'foo'],
   ....:                    'B' : ['one', 'one', 'two', 'three',
   ....:                           'two', 'two', 'one', 'three'],
   ....:                    'C' : np.random.randn(8),
   ....:                    'D' : np.random.randn(8)})
   ....:
In [87]: df
Out[87]:
     A      B         C         D
0  foo    one -1.202872 -0.055224
1  bar    one -1.814470  2.395985
2  foo    two  1.018601  1.552825
3  bar  three -0.595447  0.166599
4  foo    two  1.395433  0.047609
5  bar    two -0.392670 -0.136473
6  foo    one  0.007207 -0.561757
7  foo  three  1.928123 -1.623033
```

Grouping and then applying a function sum to the resulting groups.
分组然后应用函数统计总和存放到结果组

View Code PYTHON

```
In [88]: df.groupby('A').sum()
Out[88]:
            C       D
A
bar -2.802588  2.42611
foo  3.146492 -0.63958
```

Grouping by multiple columns forms a hierarchical index, which we then apply the function.
按多列分组为层次索引,然后应用函数

View Code PYTHON

```
In [89]: df.groupby(['A','B']).sum()
Out[89]:
                C        D
A   B
bar one   -1.814470  2.395985
    three -0.595447  0.166599
    two   -0.392670 -0.136473
foo one   -1.195665 -0.616981
    three  1.928123 -1.623033
    two    2.414034  1.600434
```

### Reshaping

### 重塑

See the sections on Hierarchical Indexing and Reshaping.
请参阅章节 分层索引 和 重塑.

### Stack

### 堆叠

View Code PYTHON

```
In [90]: tuples = list(zip(*[['bar', 'bar', 'baz', 'baz',
   ....:                      'foo', 'foo', 'qux', 'qux'],
   ....:                     ['one', 'two', 'one', 'two',
   ....:                      'one', 'two', 'one', 'two']]))
   ....:
In [91]: index = pd.MultiIndex.from_tuples(tuples, names=['first', 'second'])
In [92]: df = pd.DataFrame(np.random.randn(8, 2), index=index, columns=['A', 'B'])
In [93]: df2 = df[:4]
In [94]: df2
Out[94]:
                     A         B
first second
bar   one     0.029399 -0.542108
      two     0.282696 -0.087302
baz   one    -1.575170  1.771208
      two     0.816482  1.100230
```

The **stack** function “compresses” a level in the DataFrame’s columns.
堆叠 函数 “压缩” 数据桢的列一个级别.

View Code PYTHON

```
In [95]: stacked = df2.stack()
In [96]: stacked
Out[96]:
first  second
bar    one     A    0.029399
                B   -0.542108
       two     A    0.282696
                B   -0.087302
baz    one     A   -1.575170
                B    1.771208
       two     A    0.816482
                B    1.100230
dtype: float64
```

With a “stacked” DataFrame or Series (having a **MultiIndex** as the **index**), the inverse operation of **stack** is **unstack**, which by default unstacks the **last level**:

被“堆叠”数据桢或序列(有多个索引作为索引), 其堆叠的反向操作是未堆栈, 上面的数据默认反堆叠到上一级别:

View Code PYTHON

```
In [97]: stacked.unstack()
```

```
Out[97]:
                A        B
first second
bar   one     0.029399 -0.542108
      two     0.282696 -0.087302
baz   one    -1.575170  1.771208
      two     0.816482  1.100230

In [98]: stacked.unstack(1)
Out[98]:
second        one       two
first
bar   A  0.029399  0.282696
      B -0.542108 -0.087302
baz   A -1.575170  0.816482
      B  1.771208  1.100230

In [99]: stacked.unstack(0)
Out[99]:
first         bar       baz
second
one    A  0.029399 -1.575170
       B -0.542108  1.771208
two    A  0.282696  0.816482
       B -0.087302  1.100230
```

**Pivot Tables**

数据透视表

See the section on Pivot Tables.

查看数据透视表.

View Code PYTHON

```
In [100]: df = pd.DataFrame({'A' : ['one', 'one', 'two', 'three'] * 3,
   .....:                    'B' : ['A', 'B', 'C'] * 4,
   .....:                    'C' : ['foo', 'foo', 'foo', 'bar', 'bar', 'bar'] * 2,
   .....:                    'D' : np.random.randn(12),
   .....:                    'E' : np.random.randn(12)})
   .....:
In [101]: df
Out[101]:
       A  B    C         D         E
0    one  A  foo  1.418757 -0.179666
1    one  B  foo -1.879024  1.291836
2    two  C  foo  0.536826 -0.009614
3  three  A  bar  1.006160  0.392149
4    one  B  bar -0.029716  0.264599
5    one  C  bar -1.146178 -0.057409
6    two  A  foo  0.100900 -1.425638
7  three  B  foo -1.035018  1.024098
8    one  C  foo  0.314665 -0.106062
9    one  A  bar -0.773723  1.824375
10   two  B  bar -1.170653  0.595974
11 three  C  bar  0.648740  1.167115
```

We can produce pivot tables from this data very easily:

我们可以从此数据非常容易的产生数据透视表:

View Code PYTHON

```
In [102]: pd.pivot_table(df, values='D', index=['A', 'B'], columns=['C'])
Out[102]:
C           bar       foo
A     B
one   A -0.773723  1.418757
      B -0.029716 -1.879024
      C -1.146178  0.314665
three A  1.006160       NaN
      B       NaN -1.035018
      C  0.648740       NaN
two   A       NaN  0.100900
      B -1.170653       NaN
```

```
C     NaN  0.536826
```

### Time Series

时间序列

pandas has simple, powerful, and efficient functionality for performing resampling operations during frequency conversion (e.g., converting secondly data into 5-minutely data). This is extremely common in, but not limited to, financial applications. See the Time Series section

pandas有易用,强大且高效的函数用于高频数据重采样转换操作(例如,转换秒数据到5分钟数据), 这是很普遍的情况，但并不局限于金融应用, 请参阅时间序列章节

View Code PYTHON

```
In [103]: rng = pd.date_range('1/1/2012', periods=100, freq='S')
In [104]: ts = pd.Series(np.random.randint(0, 500, len(rng)), index=rng)
In [105]: ts.resample('5Min', how='sum')
Out[105]:
2012-01-01    25083
Freq: 5T, dtype: int32
```

Time zone representation

时区表示

View Code PYTHON

```
In [106]: rng = pd.date_range('3/6/2012 00:00', periods=5, freq='D')
In [107]: ts = pd.Series(np.random.randn(len(rng)), rng)
In [108]: ts
Out[108]:
2012-03-06    0.464000
2012-03-07    0.227371
2012-03-08   -0.496922
2012-03-09    0.306389
2012-03-10   -2.290613
Freq: D, dtype: float64

In [109]: ts_utc = ts.tz_localize('UTC')
In [110]: ts_utc
Out[110]:
2012-03-06 00:00:00+00:00    0.464000
2012-03-07 00:00:00+00:00    0.227371
2012-03-08 00:00:00+00:00   -0.496922
2012-03-09 00:00:00+00:00    0.306389
2012-03-10 00:00:00+00:00   -2.290613
Freq: D, dtype: float64
```

Convert to another time zone

转换到其它时区

View Code PYTHON

```
In [111]: ts_utc.tz_convert('US/Eastern')
Out[111]:
2012-03-05 19:00:00-05:00    0.464000
2012-03-06 19:00:00-05:00    0.227371
2012-03-07 19:00:00-05:00   -0.496922
2012-03-08 19:00:00-05:00    0.306389
2012-03-09 19:00:00-05:00   -2.290613
Freq: D, dtype: float64
```

Converting between time span representations

转换不同的时间跨度

View Code PYTHON

```
In [112]: rng = pd.date_range('1/1/2012', periods=5, freq='M')
In [113]: ts = pd.Series(np.random.randn(len(rng)), index=rng)
```

```
In [114]: ts
Out[114]:
2012-01-31   -1.134623
2012-02-29   -1.561819
2012-03-31   -0.260838
2012-04-30    0.281957
2012-05-31    1.523962
Freq: M, dtype: float64

In [115]: ps = ts.to_period()
In [116]: ps
Out[116]:
2012-01   -1.134623
2012-02   -1.561819
2012-03   -0.260838
2012-04    0.281957
2012-05    1.523962
Freq: M, dtype: float64

In [117]: ps.to_timestamp()
Out[117]:
2012-01-01   -1.134623
2012-02-01   -1.561819
2012-03-01   -0.260838
2012-04-01    0.281957
2012-05-01    1.523962
Freq: MS, dtype: float64
```

Converting between period and timestamp enables some convenient arithmetic functions to be used. In the following example, we convert a quarterly frequency with year ending in November to 9am of the end of the month following the quarter end:
转换时段并且使用一些运算函数, 下例中, 我们转换年报11月到季度结束每日上午9点数据

View Code PYTHON

```
In [118]: prng = pd.period_range('1990Q1', '2000Q4', freq='Q-NOV')
In [119]: ts = pd.Series(np.random.randn(len(prng)), prng)
In [120]: ts.index = (prng.asfreq('M', 'e') + 1).asfreq('H', 's') + 9
In [121]: ts.head()
Out[121]:
1990-03-01 09:00   -0.902937
1990-06-01 09:00    0.068159
1990-09-01 09:00   -0.057873
1990-12-01 09:00   -0.368204
1991-03-01 09:00   -1.144073
Freq: H, dtype: float64
```

## Categoricals

分类

Since version 0.15, pandas can include categorical data in a **DataFrame**. For full docs, see the categorical introduction and the API documentation.
自版本0.15起, pandas可以在数据桢中包含分类. 完整的文档, 请查看分类介绍 and the API文档.

View Code PYTHON

```
In [122]: df = pd.DataFrame({"id":[1,2,3,4,5,6], "raw_grade":['a', 'b', 'b', 'a', 'a', 'e']})
```

Convert the raw grades to a categorical data type.
转换原始类别为分类数据类型.

View Code PYTHON

```
In [123]: df["grade"] = df["raw_grade"].astype("category")
In [124]: df["grade"]
Out[124]:
0    a
1    b
2    b
3    a
```

```
4   a
5   e
Name: grade, dtype: category
Categories (3, object): [a, b, e]
```

Rename the categories to more meaningful names (assigning to **Series.cat.categories** is inplace!)
重命令分类为更有意义的名称 (分配到**Series.cat.categories**对应位置!)

View Code PYTHON

```
In [125]: df["grade"].cat.categories = ["very good", "good", "very bad"]
```

Reorder the categories and simultaneously add the missing categories (methods under **Series .cat** return a new **Series** per default).
Reorder the categories and simultaneously add the missing categories (methods under **Series .cat** return a new **Series** per default).
重排顺分类,同时添加缺少的分类(序列 **.cat**方法下返回新默认序列)

View Code PYTHON

```
In [126]: df["grade"] = df["grade"].cat.set_categories(["very bad", "bad", "medium", "good", "very good"])
In [127]: df["grade"]
Out[127]:
0   very good
1        good
2        good
3   very good
4   very good
5    very bad
Name: grade, dtype: category
Categories (5, object): [very bad, bad, medium, good, very good]
```

Sorting is per order in the categories, not lexical order.
排列分类中的顺序,不是按词汇排列.

View Code PYTHON

```
In [128]: df.sort("grade")
Out[128]:
  id raw_grade      grade
5  6         e   very bad
1  2         b       good
2  3         b       good
0  1         a  very good
3  4         a  very good
4  5         a  very good
```

Grouping by a categorical column shows also empty categories.
类别列分组,并且也显示空类别.

View Code PYTHON

```
In [129]: df.groupby("grade").size()
Out[129]:
grade
very bad     1
bad        NaN
medium     NaN
good         2
very good    3
dtype: float64
```

**Plotting**

绘图

Plotting docs.
绘图文档.

View Code PYTHON

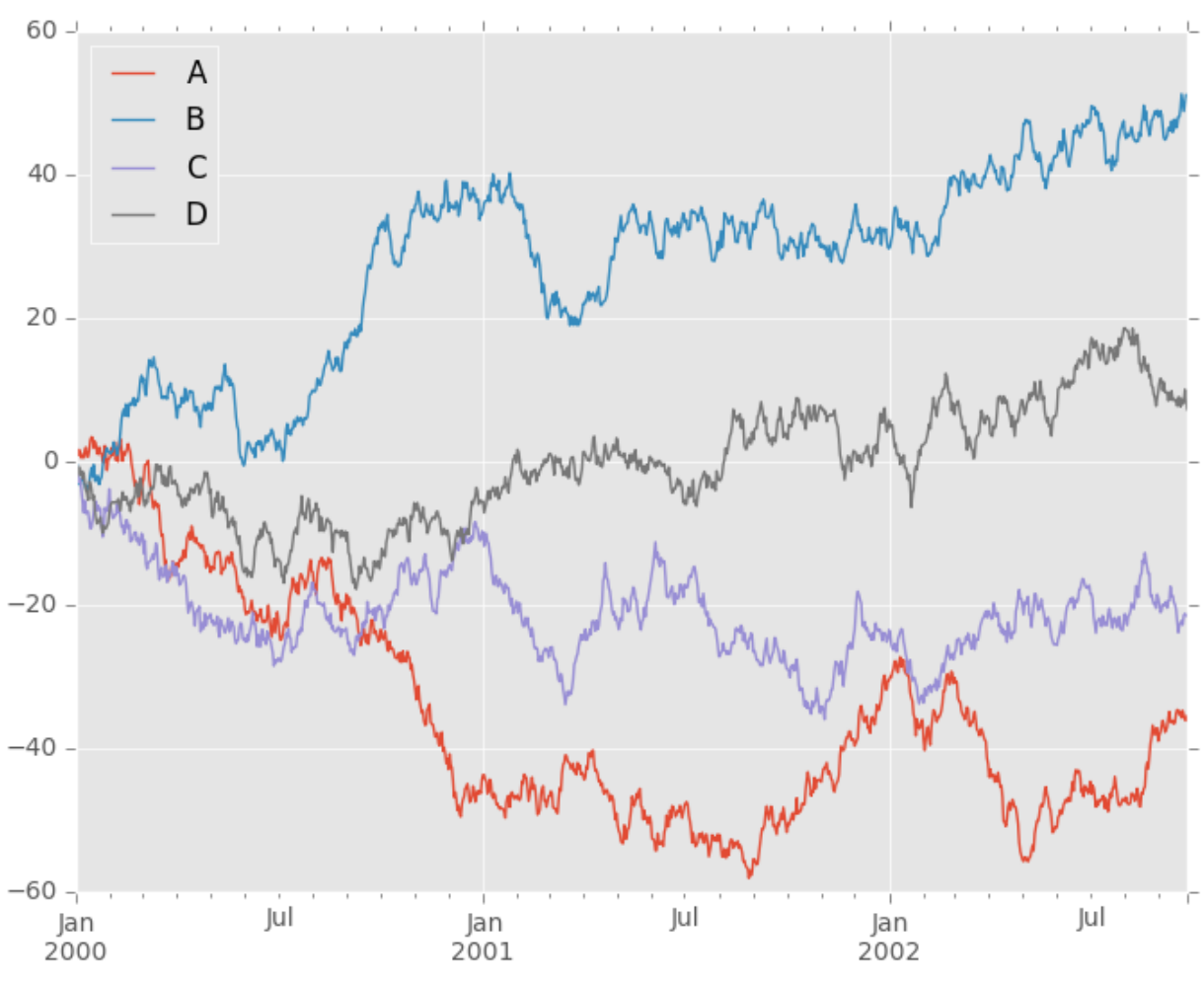
```
In [130]: ts = pd.Series(np.random.randn(1000), index=pd.date_range('1/1/2000', periods=1000))
In [131]: ts = ts.cumsum()
In [132]: ts.plot()
Out[132]: <matplotlib.axes._subplots.AxesSubplot at 0xb02091ac>
```


On DataFrame, plot is a convenience to plot all of the columns with labels:

在数据桢中,可以很方便的绘制带标签列:

View Code PYTHON

```
In [133]: df = pd.DataFrame(np.random.randn(1000, 4), index=ts.index,
   .....:                   columns=['A', 'B', 'C', 'D'])
   .....:
In [134]: df = df.cumsum()
In [135]: plt.figure(); df.plot(); plt.legend(loc='best')
Out[135]: <matplotlib.legend.Legend at 0xb01c9cac>
```



**Getting Data In/Out**

**获取数据输入/输出**

**CSV**

Writing to a csv file

写入csv文件

View Code PYTHON

```
In [136]: df.to_csv('foo.csv')
```

Reading from a csv file

读取csv文件

View Code PYTHON

```
In [137]: pd.read_csv('foo.csv')
Out[137]:
    Unnamed: 0         A         B         C         D
0   2000-01-01  0.266457 -0.399641 -0.219582  1.186860
1   2000-01-02 -1.170732 -0.345873  1.653061 -0.282953
2   2000-01-03 -1.734933  0.530468  2.060811 -0.515536
3   2000-01-04 -1.555121  1.452620  0.239859 -1.156896
4   2000-01-05  0.578117  0.511371  0.103552 -2.428202
5   2000-01-06  0.478344  0.449933 -0.741620 -1.962409
6   2000-01-07  1.235339 -0.091757 -1.543861 -1.084753
..         ...       ...       ...       ...       ...
993 2002-09-20 -10.628548 -9.153563 -7.883146 28.313940
994 2002-09-21 -10.390377 -8.727491 -6.399645 30.914107
995 2002-09-22  -8.985362 -8.485624 -4.669462 31.367740
996 2002-09-23  -9.558560 -8.781216 -4.499815 30.518439
997 2002-09-24  -9.902058 -9.340490 -4.386639 30.105593
998 2002-09-25 -10.216020 -9.480682 -3.933802 29.758560
999 2002-09-26 -11.856774 -10.671012 -3.216025 29.369368

[1000 rows x 5 columns]
```

**HDF5**

Reading and writing to HDFStores

读写HDF存储

Writing to a HDF5 Store

写入HDF5存储

View Code PYTHON

```
In [138]: df.to_hdf('foo.h5','df')
```

Reading from a HDF5 Store

读取HDF5存储

View Code PYTHON

```
In [139]: pd.read_hdf('foo.h5','df')
Out[139]:
                   A         B         C         D
2000-01-01  0.266457 -0.399641 -0.219582  1.186860
2000-01-02 -1.170732 -0.345873  1.653061 -0.282953
2000-01-03 -1.734933  0.530468  2.060811 -0.515536
2000-01-04 -1.555121  1.452620  0.239859 -1.156896
2000-01-05  0.578117  0.511371  0.103552 -2.428202
2000-01-06  0.478344  0.449933 -0.741620 -1.962409
2000-01-07  1.235339 -0.091757 -1.543861 -1.084753
...              ...       ...       ...       ...
2002-09-20 -10.628548 -9.153563 -7.883146 28.313940
2002-09-21 -10.390377 -8.727491 -6.399645 30.914107
2002-09-22  -8.985362 -8.485624 -4.669462 31.367740
2002-09-23  -9.558560 -8.781216 -4.499815 30.518439
2002-09-24  -9.902058 -9.340490 -4.386639 30.105593
2002-09-25 -10.216020 -9.480682 -3.933802 29.758560
```

```
2002-09-26 -11.856774 -10.671012 -3.216025  29.369368

[1000 rows x 4 columns]
```

**Excel**

Reading and writing to MS Excel
读写MS Excel
Writing to an excel file
写入excel文件

View Code PYTHON

```
In [140]: df.to_excel('foo.xlsx', sheet_name='Sheet1')
```

Reading from an excel file
读取excel文件

View Code PYTHON

```
In [141]: pd.read_excel('foo.xlsx', 'Sheet1', index_col=None, na_values=['NA'])
Out[141]:
                   A         B         C         D
2000-01-01  0.266457 -0.399641 -0.219582  1.186860
2000-01-02 -1.170732 -0.345873  1.653061 -0.282953
2000-01-03 -1.734933  0.530468  2.060811 -0.515536
2000-01-04 -1.555121  1.452620  0.239859 -1.156896
2000-01-05  0.578117  0.511371  0.103552 -2.428202
2000-01-06  0.478344  0.449933 -0.741620 -1.962409
2000-01-07  1.235339 -0.091757 -1.543861 -1.084753
...              ...       ...       ...       ...
2002-09-20 -10.628548 -9.153563 -7.883146  28.313940
2002-09-21 -10.390377 -8.727491 -6.399645  30.914107
2002-09-22  -8.985362 -8.485624 -4.669462  31.367740
2002-09-23  -9.558560 -8.781216 -4.499815  30.518439
2002-09-24  -9.902058 -9.340490 -4.386639  30.105593
2002-09-25 -10.216020 -9.480682 -3.933802  29.758560
2002-09-26 -11.856774 -10.671012 -3.216025  29.369368

[1000 rows x 4 columns]
```

**Gotchas**

陷阱

If you are trying an operation and you see an exception like:
如果尝试这样操作可能会看到像这样的异常:

View Code PYTHON

```
>>> if pd.Series([False, True, False]):
    print("I was true")
Traceback
    ...
ValueError: The truth value of an array is ambiguous. Use a.empty, a.any() or a.all().
```

See Comparisons for an explanation and what to do.
查看对照获取解释和怎么做的帮助
也可以查看陷阱.

pandas 文档

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mark！支持卓林哥！

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