Time Series

Time Series

What is Time Series?

Anything that is observed or measured at many points in time leads to a time series.

Example for time series:

Financial sectors
Economics
Ecology
Environmental Behavior
Neuroscience and physics etc.

Time Series

How To Mark And Refer Time Series Data?

- Timestamps, specific instants in time
- Fixed periods, such as the month Dec 2018 or the full year 2018
- Intervals of time, indicated by a start and end timestamp. Periods can be thought of as special cases of intervals
- Experiment or elapsed time; each timestamp is a measure of time relative to a particular start time.

Time Series

How To Handle Data And Time In Python?

Python provides standard library that includes date and time series.

- ‘datetime’ : it stores both the date and time down to the microsecond.
- ‘timedelta’ : it represents the temporal difference between two datetime objects.
- ‘time’ : it stores time of day as hours, minutes, seconds and microseconds
- ‘date’ : it store calendar date (year, month, day) using the Gregorian calendar.
- ‘calendar’ : it displays dates and days of calendar for a specific month
- ‘days’ : it displays number of days in timedelta object.

Time Series

How To Convert String Form Of Date And Time Into Datetime Format?

We can format datetime objects and pandas Timestamp objects as strings using ‘str’ or the ‘strftime’ method, passing a format specification.

```
date_time = datetime(2019, 12, 20)
```

```
str(date_time)
‘2019-12-20 00:00:00’

Or
date_time.strftime('%Y-%m-%d')
‘2019-12-20’
```

`datetime.strptime()`

Reverse Operation

Time Series

Datetime Format Specifications (ISO C89 Compatible)

%Y	Four-digit year
%y	Two-digit year
%m	Two-digit month [01, 12]
%d	Two-digit day [01, 31]
%H	Hour (24-hour clock) [00, 23]
%I	Hour (12-hour clock) [01, 12]
%M	Two-digit minute [00, 59]
%S	Second [00, 61] (seconds 60, 61 account for leap seconds)
%w	Weekday as integer [0 (Sunday), 6]
%U	Week number of the year [00, 53]; Sunday is considered the first day of the week, and days before the first Sunday of the year are “week 0”
%W	Week number of the year [00, 53]; Monday is considered the first day of the week, and days before the first Monday of the year are “week 0”
%z	UTC time zone offset as +HHMM or -HHMM; empty if time zone naive
%F	Shortcut for %Y-%m-%d (e.g., 2019-12-20)
%D	Shortcut for %m/%d/%y (e.g., 12/20/19)

Time Series

How Pandas Handles Date and Time Series?

The pandas provides ‘to_datetime’ method that is used to parse different kinds of date representations in general.

‘datetime’ objects also have a number of locale-specific formatting options for systems in other countries or languages.

Locale-specific date formatting

Type	Description
%a	Abbreviated weekday name
%A	Full weekday name
%b	Abbreviated month name
%B	Full month name
%c	Full date and time (e.g., ‘Tue 01 May 2012 04:20:57 PM’)
%p	Locale equivalent of AM or PM
%x	Locale-appropriate formatted date
%X	Locale-appropriate time (e.g., ’04:24:12 PM’)

Time Series

How To Handle Common Date Formats ?

The pandas utilizes a third-party package named ‘dateutil’.

It is capable of parsing most human-intelligible date representations.

Note: NaT (Not a Time) is pandas’s null value for timestamp data.

Time Series

How Date Ranges, Frequencies, and Shifting works in pandas?

- The pandas provides `'date_range'` to create a date or time periods between the two timestamps
- By default, `date_range` generates daily timestamps
- `'date_range'` by default preserves the time (if any) of the start or end timestamp
- We can use `'resample'` to convert sample time series into a fixed daily frequency
- Frequencies in pandas are composed of a base frequency and a multiplier
- Base frequencies are typically referred to by a string alias, like 'D' for day or 'H' for hourly
- 'shift' : "shifting" refers to moving data backward and forward through time

Time Series

How Date Ranges, Frequencies, and Shifting works in pandas?

Alias	Offset type
D	Day
B	Business Day
H	Hour
T or min	Minute
S	Second
L or ms	Milli
U	Micro
M	MonthEnd
BM	BusinessMonthEnd
MS	MonthBegin
BMS	BusinessMonthBegin
W-MON, W-TUE, ...	Week

Time Series

How Date Ranges, Frequencies, and Shifting works in pandas?

Alias	Offset type
WOM-1MON, WOM-2MON, ...	WeekOfMonth
Q-JAN, Q-FEB, ...	QuarterEnd
BQ-JAN, BQ-FEB, ...	BusinessQuarterEnd
QS-JAN, QS-FEB, ...	QuarterBegin
BQS-JAN, BQS-FEB, ...	BusinessQuarterBegin
A-JAN, A-FEB, ...	YearEnd
BA-JAN, BA-FEB, ...	BusinessYearEnd
AS-JAN, AS-FEB, ...	YearBegin
BAS-JAN, BAS-FEB, ...	BusinessYearBegin

Time Series

How to Handle Time Zone in pandas?

- Time zones in time series
  - Little bit unpleasant to work with
  - Uses third party package ‘pytz’
- Coordinated universal time or ‘UTC’
  - Universally accepted and and is the current international standard
  - By default timestamps are stored in ‘UTC’ format

Time Series

Other Important Topics Of Time Series In Pandas

Periods and Period Arithmetic

- 'Period'
- 'period_range'

Period Frequency Conversion

- 'asfreq'

Converting Timestamps to Periods and back

- 'to_period
- 'to_timestamp'