python™

int

unlimited precision signed integer

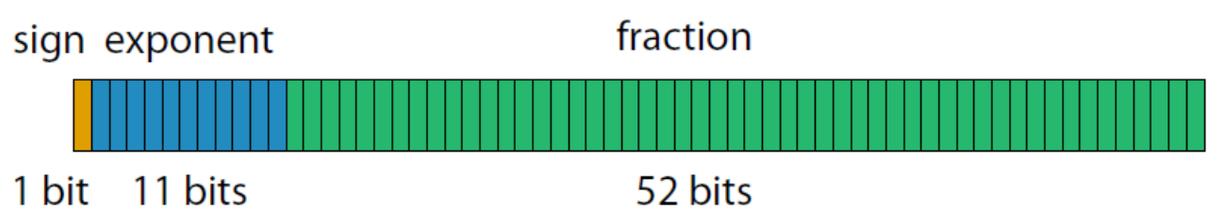
python™

float

IEEE-754 double precision (64-bit)

53 bits of binary precision

15 to 17 bits of decimal precision



What Every Computer Scientist Should Know About Floating-Point Arithmetic

D

Note – This document is an edited reprint of the paper *What Every Computer Scientist Should Know About Floating-Point Arithmetic*, by David Goldberg, published in the March, 1991 issue of Computing Surveys. Copyright 1991, Association for Computing Machinery, Inc., reprinted by permission.

This appendix has the following organization:

David Goldberg
Journal ACM Computing Surveys (CSUR)
Volume 23 Issue 1, March 1991
Pages 5-48

1/18/2018

python™

The standard library module

decimal

containing the class

Decimal

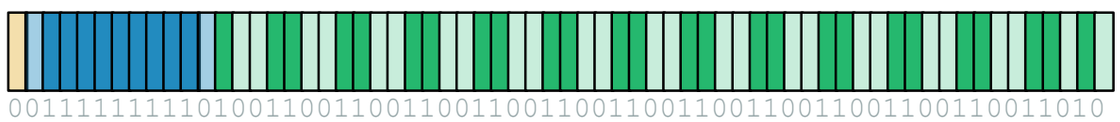
decimal floating point

configurable (although finite) precision

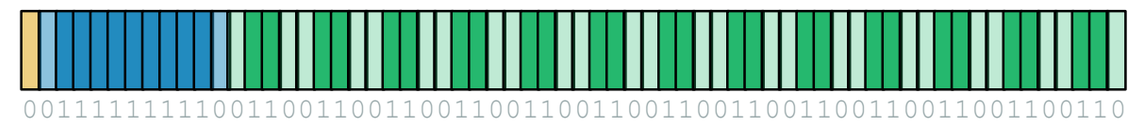
defaults to 28 digits of decimal precision

Decimal(0.8) - Decimal(0.7)

0.8



0.7



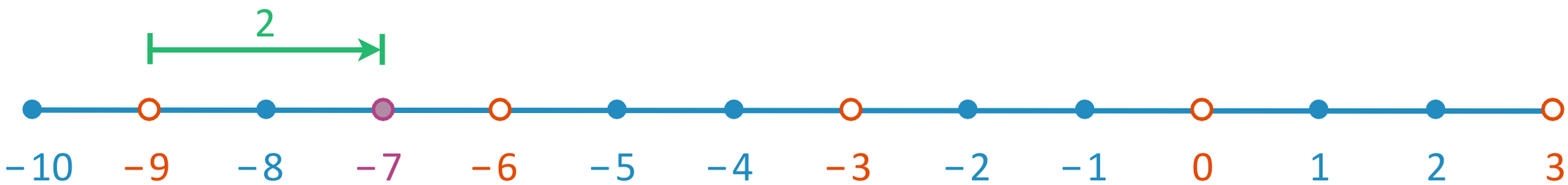
0.8000000000000000444089209850062616169452667236328125

0.6999999999999999555910790149937383830547332763671875

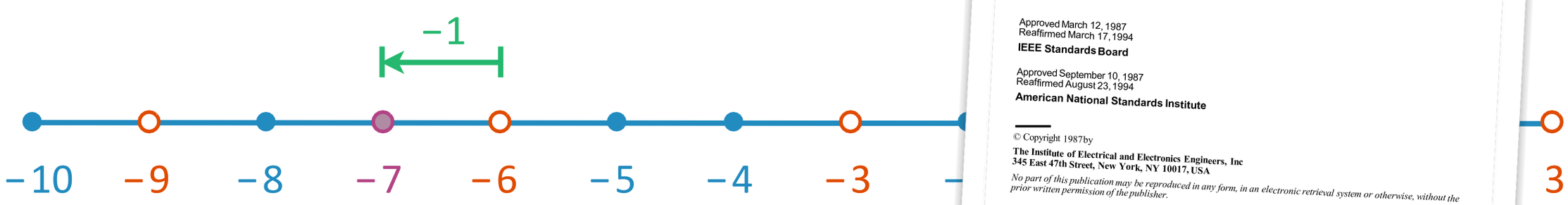
0.1000000000000000888178419700

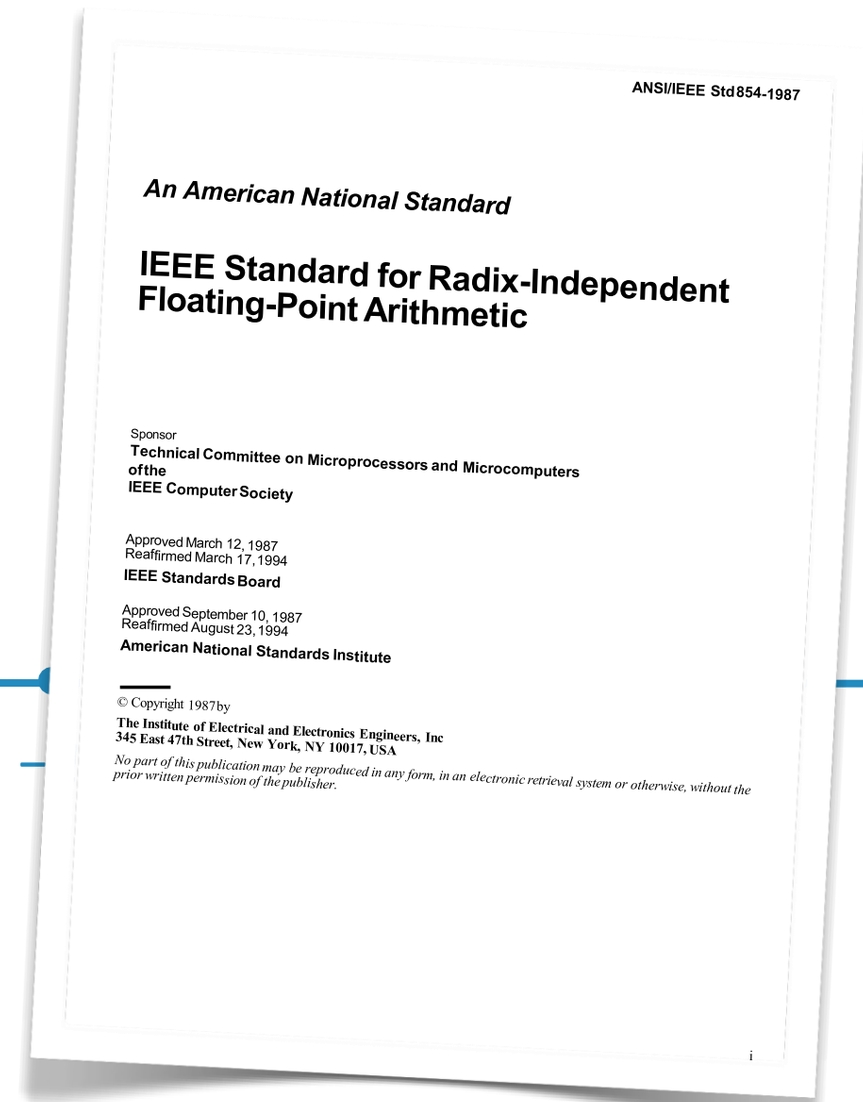
always **quote** literal fractional values

```
>>> (-7) % 3
2
```




```
>>> Decimal(-7) % Decimal(3)
Decimal('-1')
```





ANSI/IEEE Std 854-1987

An American National Standard

IEEE Standard for Radix-Independent Floating-Point Arithmetic

Sponsor
Technical Committee on Microprocessors and Microcomputers of the IEEE Computer Society

Approved March 12, 1987
Reaffirmed March 17, 1994
IEEE Standards Board

Approved September 10, 1987
Reaffirmed August 23, 1994
American National Standards Institute

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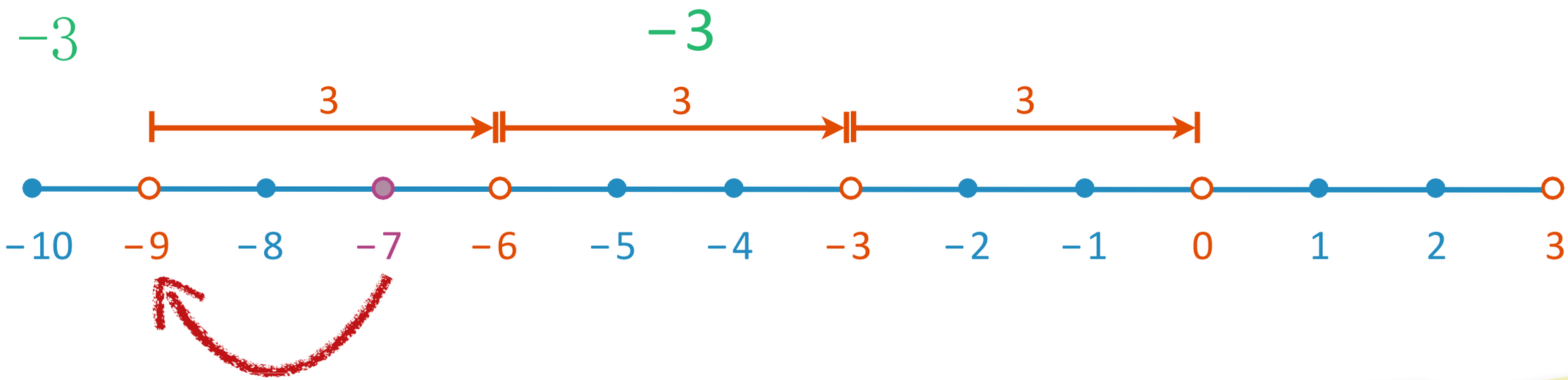
i

This important
identity is preserved

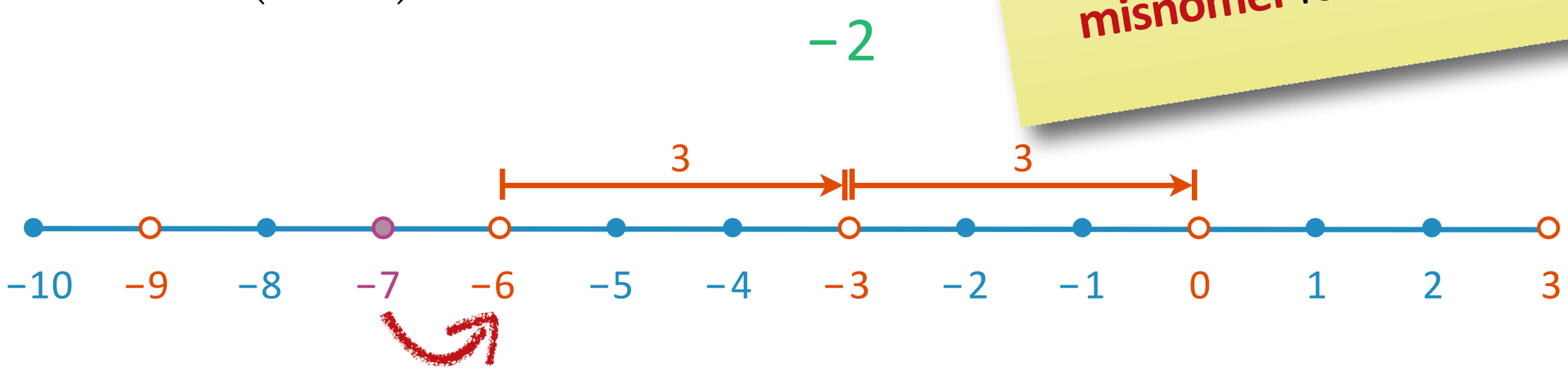
```
x == (x // y) * y + x % y
```

so integer division and modulus
are consistent

```
>>> (-7) // 3
-3
```




```
>>> Decimal(-7) // Decimal(3)
Decimal('-2')
```



The **floor division** operator // is a **misnomer** for Decimal

python™

The standard library module

fractions

containing the class

Fraction

for rational numbers

denominator **cannot** be **zero**

numerator

$2/3$

denominator

$4/5$

python™

The built-in type

complex

for complex numbers

python™

The built-in function

abs()

gives the distance from zero

python™

The built-in function

round()

performs decimal rounding for all scalar number types

`round()` can show **surprising** behaviour with `float` values which can't be represented **exactly** in binary.

python™

Number base conversions

`bin()`
base 2

`oct()`
base 8

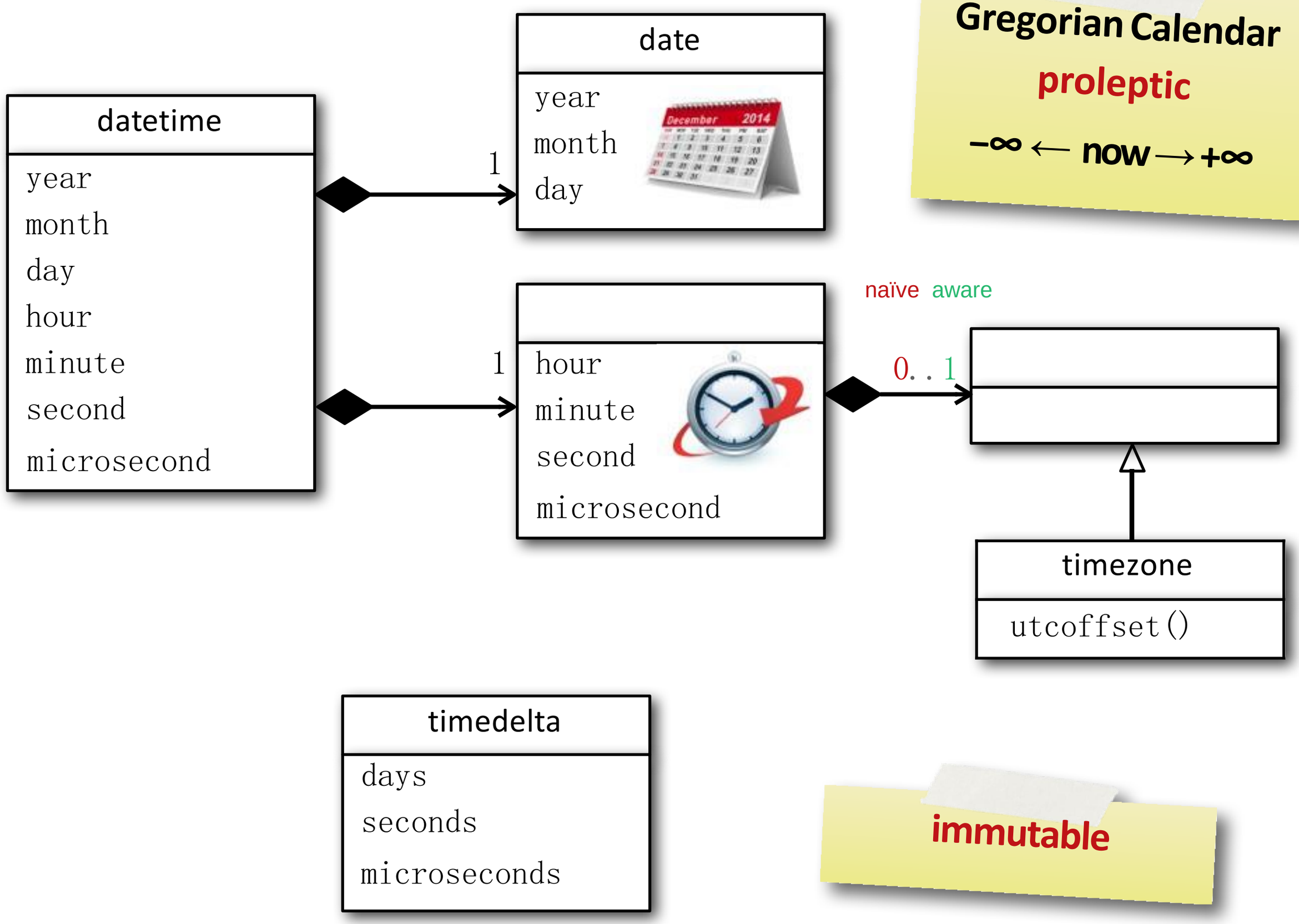
`hex()`
base 16

`int(x, base)`
bases 2 to 36

python™

The standard library module

datetime


datetime
year
month
day
hour
minute
second
microsecond
1
date
year
month
day
December 2014
1
hour
minute
second
microsecond
naïve aware
0..1
timezone
utcoffset()
timedelta
days
seconds
microseconds
Gregorian Calendar
proleptic
−∞ ← now → +∞
immutable

strftime()

string-format-time

strptime()

string-parse-time

year: 1-9999
month: 1-12
day: 1-31

weekday()

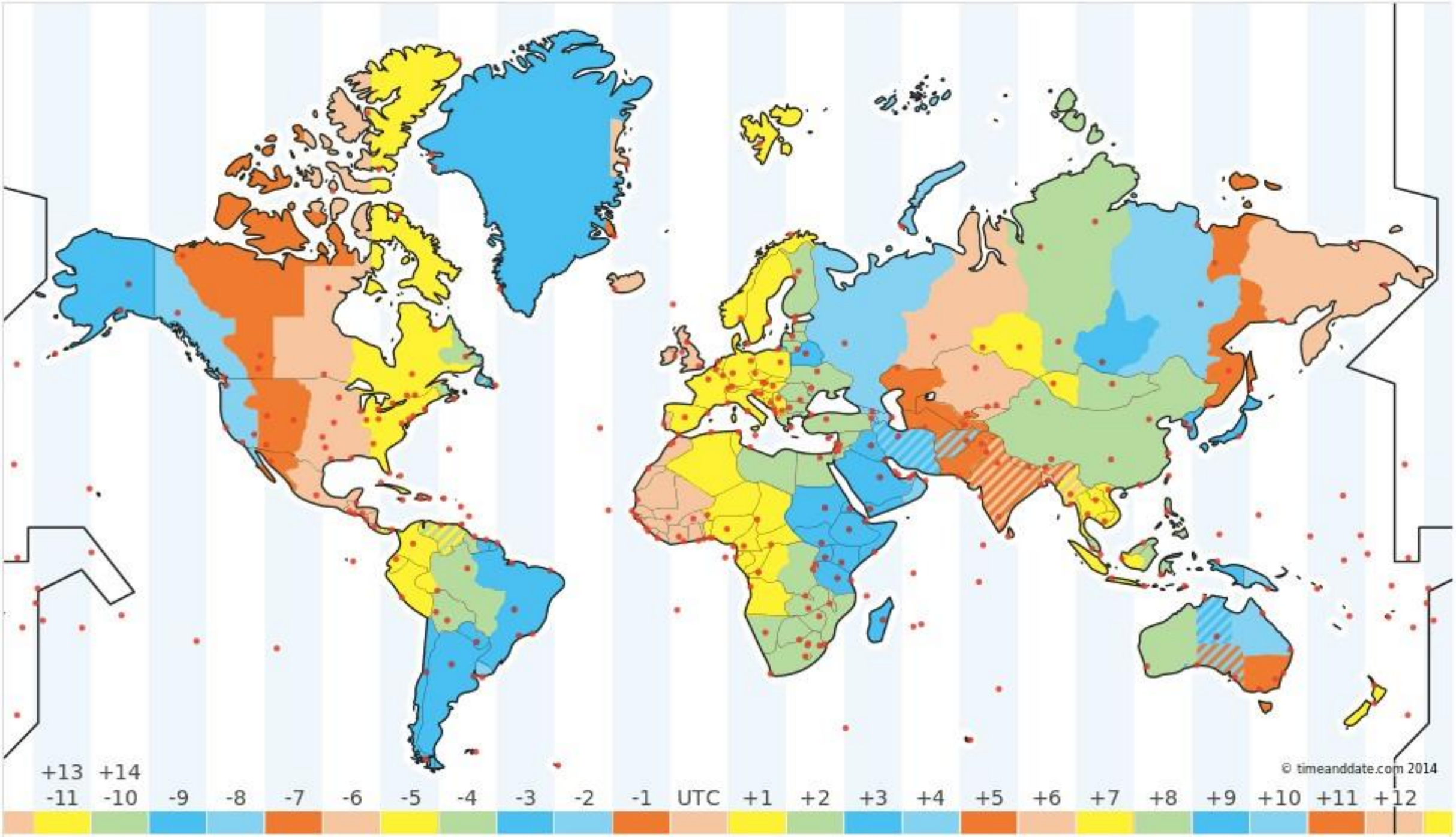
0 Monday
1 Tuesday
2 Wednesday
3 Thursday
4 Friday
5 Saturday
6 Sunday

isoweekday()

1 Monday
2 Tuesday
3 Wednesday
4 Thursday
5 Friday
6 Saturday
7 Sunday

ISO 8601:2004

Representation of dates and times



timeanddate.com

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pytz 2013.9

World timezone definitions, modern and historical

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Package Documentation

```
pytz - World Timezone Definitions for Python
============================================

:Author: Stuart Bishop <stuart@stuartbishop.net>

Introduction
~~~~~~~~~~~~

pytz brings the Olson tz database into Python. This library allows
accurate and cross platform timezone calculations using Python 2.4
or higher. It also solves the issue of ambiguous times at the end
of daylight savings, which you can read more about in the Python
Library Reference (``datetime.tzinfo``).

Almost all of the Olson timezones are supported.

.. note::

    This library differs from the documented Python API for
    tzinfo implementations; if you want to create local wallclock
    times you need to use the ``localize()`` method documented in this
    document. In addition, if you perform date arithmetic on local
    times that cross DST boundaries, the result may be in an incorrect
    timezone (ie. subtract 1 minute from 2002-10-27 1:00 EST and you get
    2002-10-27 0:59 EST instead of the correct 2002-10-27 1:59 EDT). A
    ``normalize()`` method is provided to correct this. Unfortunately these
    issues cannot be resolved without modifying the Python datetime
    implementation (see PEP-431).
```

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python-dateutil 2.2

Extensions to the standard Python datetime module

Download
python-dateutil-2.2.tar.gz

The dateutil module provides powerful extensions to the datetime module available in the Python standard library.

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File	Type	Py Version	Uploaded on	Size
python-dateutil-2.2.tar.gz (md5)	Source		2013-11-01	253KB

Downloads (All Versions):
25326 downloads in the last day
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Author: Tomi Pievilaeinen
Home Page: http://labix.org/python-dateutil
License: Simplified BSD
Requires six
Categories

- Development Status :: 5 - Production/Stable
- Intended Audience :: Developers
- License :: OSI Approved :: BSD License
- Programming Language :: Python
- Programming Language :: Python :: 2
- Programming Language :: Python :: 2.6
- Programming Language :: Python :: 2.7

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pytz 2013.9

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Numeric and Scalar Types

```
int
float
sys.float_info
```

```
complex("3+4j")
```

```
from decimal import Decimal
£ $ ¥
Decimal % → 0
int, float % → -∞
```

```
abs(-5)
round(0.6)
bin(100)
oct(100)
hex(100)
int("100", base=5)
```

```
from fractions import Fraction
f = Fraction("2/3")
```

```
from datetime import (date, time)
from datetime import datetime as Datetime
from datetime import timedelta
from datetime import (tzinfo, timezone)
```