**The Python Standard Library**

While The Python Language Reference describes the exact syntax and semantics of the Python language, this library reference manual describes the standard library that is distributed with Python. It also describes some of the optional components that are commonly included in Python distributions.

Python’s standard library is very extensive, offering a wide range of facilities as indicated by the long table of contents listed below. The library contains built-in modules (written in C) that provide access to system functionality such as file I/O that would otherwise be inaccessible to Python programmers, as well as modules written in Python that provide standardized solutions for many problems that occur in everyday programming. Some of these modules are explicitly designed to encourage and enhance the portability of Python programs by abstracting away platform-specifics into platform-neutral APIs.

The Python installers for the Windows platform usually include the entire standard library and often also include many additional components. For Unix-like operating systems Python is normally provided as a collection of packages, so it may be necessary to use the packaging tools provided with the operating system to obtain some or all of the optional components.

In addition to the standard library, there is an active collection of hundreds of thousands of components (from individual programs and modules to packages and entire application development frameworks), available from the Python Package Index.

Introduction

Notes on availability

Built-in Functions

Built-in Constants

Constants added by the site module

Built-in Types

Truth Value Testing

Boolean Operations — and, or, not

Comparisons

Numeric Types — int, float, complex

Boolean Type - bool

Iterator Types

Sequence Types — list, tuple, range

Text Sequence Type — str

Binary Sequence Types — bytes, bytearray, memoryview

Set Types — set, frozenset

Mapping Types — dict

Context Manager Types

Type Annotation Types — Generic Alias, Union

Other Built-in Types

Special Attributes

Integer string conversion length limitation

Built-in Exceptions

Exception context

Inheriting from built-in exceptions

Base classes

Concrete exceptions

Warnings

Exception groups

Exception hierarchy

Text Processing Services

string — Common string operations

re — Regular expression operations

difflib — Helpers for computing deltas

textwrap — Text wrapping and filling

unicodedata — Unicode Database

stringprep — Internet String Preparation

readline — GNU readline interface

rlcompleter — Completion function for GNU readline

Binary Data Services

struct — Interpret bytes as packed binary data

codecs — Codec registry and base classes

Data Types

datetime — Basic date and time types

zoneinfo — IANA time zone support

calendar — General calendar-related functions

collections — Container datatypes

collections.abc — Abstract Base Classes for Containers

heapq — Heap queue algorithm

bisect — Array bisection algorithm

array — Efficient arrays of numeric values

weakref — Weak references

types — Dynamic type creation and names for built-in types

copy — Shallow and deep copy operations

pprint — Data pretty printer

reprlib — Alternate repr() implementation

enum — Support for enumerations

graphlib — Functionality to operate with graph-like structures

Numeric and Mathematical Modules

numbers — Numeric abstract base classes

math — Mathematical functions

cmath — Mathematical functions for complex numbers

decimal — Decimal fixed-point and floating-point arithmetic

fractions — Rational numbers

random — Generate pseudo-random numbers

statistics — Mathematical statistics functions

Functional Programming Modules

itertools — Functions creating iterators for efficient looping

functools — Higher-order functions and operations on callable objects

operator — Standard operators as functions

File and Directory Access

pathlib — Object-oriented filesystem paths

os.path — Common pathname manipulations

stat — Interpreting stat() results

filecmp — File and Directory Comparisons

tempfile — Generate temporary files and directories

glob — Unix style pathname pattern expansion

fnmatch — Unix filename pattern matching

linecache — Random access to text lines

shutil — High-level file operations

Data Persistence

pickle — Python object serialization

copyreg — Register pickle support functions

shelve — Python object persistence

marshal — Internal Python object serialization

dbm — Interfaces to Unix “databases”

sqlite3 — DB-API 2.0 interface for SQLite databases

Data Compression and Archiving

zlib — Compression compatible with gzip

gzip — Support for gzip files

bz2 — Support for bzip2 compression

lzma — Compression using the LZMA algorithm

zipfile — Work with ZIP archives

tarfile — Read and write tar archive files

File Formats

csv — CSV File Reading and Writing

configparser — Configuration file parser

tomllib — Parse TOML files

netrc — netrc file processing

plistlib — Generate and parse Apple .plist files

Cryptographic Services

hashlib — Secure hashes and message digests

hmac — Keyed-Hashing for Message Authentication

secrets — Generate secure random numbers for managing secrets

Generic Operating System Services

os — Miscellaneous operating system interfaces

io — Core tools for working with streams

time — Time access and conversions

logging — Logging facility for Python

logging.config — Logging configuration

logging.handlers — Logging handlers

platform — Access to underlying platform’s identifying data

errno — Standard errno system symbols

ctypes — A foreign function library for Python

Command Line Interface Libraries

argparse — Parser for command-line options, arguments and subcommands

optparse — Parser for command line options

getpass — Portable password input

fileinput — Iterate over lines from multiple input streams

curses — Terminal handling for character-cell displays

curses.textpad — Text input widget for curses programs

curses.ascii — Utilities for ASCII characters

curses.panel — A panel stack extension for curses

Concurrent Execution

threading — Thread-based parallelism

multiprocessing — Process-based parallelism

multiprocessing.shared\_memory — Shared memory for direct access across processes

The concurrent package

concurrent.futures — Launching parallel tasks

subprocess — Subprocess management

sched — Event scheduler

queue — A synchronized queue class

contextvars — Context Variables

\_thread — Low-level threading API

Networking and Interprocess Communication

asyncio — Asynchronous I/O

socket — Low-level networking interface

ssl — TLS/SSL wrapper for socket objects

select — Waiting for I/O completion

selectors — High-level I/O multiplexing

signal — Set handlers for asynchronous events

mmap — Memory-mapped file support

Internet Data Handling

email — An email and MIME handling package

json — JSON encoder and decoder

mailbox — Manipulate mailboxes in various formats

mimetypes — Map filenames to MIME types

base64 — Base16, Base32, Base64, Base85 Data Encodings

binascii — Convert between binary and ASCII

quopri — Encode and decode MIME quoted-printable data

Structured Markup Processing Tools

html — HyperText Markup Language support

html.parser — Simple HTML and XHTML parser

html.entities — Definitions of HTML general entities

XML Processing Modules

xml.etree.ElementTree — The ElementTree XML API

xml.dom — The Document Object Model API

xml.dom.minidom — Minimal DOM implementation

xml.dom.pulldom — Support for building partial DOM trees

xml.sax — Support for SAX2 parsers

xml.sax.handler — Base classes for SAX handlers

xml.sax.saxutils — SAX Utilities

xml.sax.xmlreader — Interface for XML parsers

xml.parsers.expat — Fast XML parsing using Expat

Internet Protocols and Support

webbrowser — Convenient web-browser controller

wsgiref — WSGI Utilities and Reference Implementation

urllib — URL handling modules

urllib.request — Extensible library for opening URLs

urllib.response — Response classes used by urllib

urllib.parse — Parse URLs into components

urllib.error — Exception classes raised by urllib.request

urllib.robotparser — Parser for robots.txt

http — HTTP modules

http.client — HTTP protocol client

ftplib — FTP protocol client

poplib — POP3 protocol client

imaplib — IMAP4 protocol client

smtplib — SMTP protocol client

uuid — UUID objects according to RFC 4122

socketserver — A framework for network servers

http.server — HTTP servers

http.cookies — HTTP state management

http.cookiejar — Cookie handling for HTTP clients

xmlrpc — XMLRPC server and client modules

xmlrpc.client — XML-RPC client access

xmlrpc.server — Basic XML-RPC servers

ipaddress — IPv4/IPv6 manipulation library

Multimedia Services

wave — Read and write WAV files

colorsys — Conversions between color systems

Internationalization

gettext — Multilingual internationalization services

locale — Internationalization services

Program Frameworks

turtle — Turtle graphics

cmd — Support for line-oriented command interpreters

shlex — Simple lexical analysis

Graphical User Interfaces with Tk

tkinter — Python interface to Tcl/Tk

tkinter.colorchooser — Color choosing dialog

tkinter.font — Tkinter font wrapper

Tkinter Dialogs

tkinter.messagebox — Tkinter message prompts

tkinter.scrolledtext — Scrolled Text Widget

tkinter.dnd — Drag and drop support

tkinter.ttk — Tk themed widgets

IDLE — Python editor and shell

Development Tools

typing — Support for type hints

pydoc — Documentation generator and online help system

Python Development Mode

doctest — Test interactive Python examples

unittest — Unit testing framework

unittest.mock — mock object library

unittest.mock — getting started

test — Regression tests package for Python

test.support — Utilities for the Python test suite

test.support.socket\_helper — Utilities for socket tests

test.support.script\_helper — Utilities for the Python execution tests

test.support.bytecode\_helper — Support tools for testing correct bytecode generation

test.support.threading\_helper — Utilities for threading tests

test.support.os\_helper — Utilities for os tests

test.support.import\_helper — Utilities for import tests

test.support.warnings\_helper — Utilities for warnings tests

Debugging and Profiling

Audit events table

bdb — Debugger framework

faulthandler — Dump the Python traceback

pdb — The Python Debugger

The Python Profilers

timeit — Measure execution time of small code snippets

trace — Trace or track Python statement execution

tracemalloc — Trace memory allocations

Software Packaging and Distribution

ensurepip — Bootstrapping the pip installer

venv — Creation of virtual environments

zipapp — Manage executable Python zip archives

Python Runtime Services

sys — System-specific parameters and functions

sys.monitoring — Execution event monitoring

sysconfig — Provide access to Python’s configuration information

builtins — Built-in objects

\_\_main\_\_ — Top-level code environment

warnings — Warning control

dataclasses — Data Classes

contextlib — Utilities for with-statement contexts

abc — Abstract Base Classes

atexit — Exit handlers

traceback — Print or retrieve a stack traceback

\_\_future\_\_ — Future statement definitions

gc — Garbage Collector interface

inspect — Inspect live objects

site — Site-specific configuration hook

Custom Python Interpreters

code — Interpreter base classes

codeop — Compile Python code

Importing Modules

zipimport — Import modules from Zip archives

pkgutil — Package extension utility

modulefinder — Find modules used by a script

runpy — Locating and executing Python modules

importlib — The implementation of import

importlib.resources – Package resource reading, opening and access

importlib.resources.abc – Abstract base classes for resources

importlib.metadata – Accessing package metadata

The initialization of the sys.path module search path

Python Language Services

ast — Abstract Syntax Trees

symtable — Access to the compiler’s symbol tables

token — Constants used with Python parse trees

keyword — Testing for Python keywords

tokenize — Tokenizer for Python source

tabnanny — Detection of ambiguous indentation

pyclbr — Python module browser support

py\_compile — Compile Python source files

compileall — Byte-compile Python libraries

dis — Disassembler for Python bytecode

pickletools — Tools for pickle developers

MS Windows Specific Services

msvcrt — Useful routines from the MS VC++ runtime

winreg — Windows registry access

winsound — Sound-playing interface for Windows

Unix Specific Services

posix — The most common POSIX system calls

pwd — The password database

grp — The group database

termios — POSIX style tty control

tty — Terminal control functions

pty — Pseudo-terminal utilities

fcntl — The fcntl and ioctl system calls

resource — Resource usage information

syslog — Unix syslog library routines

Modules command-line interface (CLI)

Superseded Modules

getopt — C-style parser for command line options

Removed Modules

Security Considerations

# This is another heading

## Part 2

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