Python Setup and Usage

Yayım 3.13.7

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İçindekiler

1 Command line and environment **3**
- 1.1 Command line . . . 3
  - 1.1.1 Interface options . . . 3
  - 1.1.2 Generic options . . . 5
  - 1.1.3 Miscellaneous options . . . 6
  - 1.1.4 Controlling color . . . 10
  - 1.1.5 Options you shouldn't use . . . 10
- 1.2 Environment variables . . . 10
  - 1.2.1 Debug-mode variables . . . 17

2 Using Python on Unix platforms **19**
- 2.1 Getting and installing the latest version of Python . . . 19
  - 2.1.1 On Linux . . . 19
  - 2.1.2 On FreeBSD and OpenBSD . . . 20
- 2.2 Building Python . . . 20
- 2.3 Python-related paths and files . . . 20
- 2.4 Miscellaneous . . . 21
- 2.5 Custom OpenSSL . . . 21

3 Configure Python **23**
- 3.1 Build Requirements . . . 23
- 3.2 Generated files . . . 24
  - 3.2.1 configure script . . . 24
- 3.3 Configure Options . . . 24
  - 3.3.1 General Options . . . 24
  - 3.3.2 C compiler options . . . 27
  - 3.3.3 Linker options . . . 28
  - 3.3.4 Options for third-party dependencies . . . 28
  - 3.3.5 WebAssembly Options . . . 29
  - 3.3.6 Install Options . . . 29
  - 3.3.7 Performance options . . . 30
  - 3.3.8 Python Debug Build . . . 31
  - 3.3.9 Debug options . . . 32
  - 3.3.10 Linker options . . . 33
  - 3.3.11 Libraries options . . . 33
  - 3.3.12 Security Options . . . 34
  - 3.3.13 macOS Options . . . 35
  - 3.3.14 iOS Options . . . 36
  - 3.3.15 Cross Compiling Options . . . 36
- 3.4 Python Build System . . . 36
  - 3.4.1 Main files of the build system . . . 36

3.4.2 Main build steps . . . 37
3.4.3 Main Makefile targets . . . 37
3.4.4 C extensions . . . 38
3.5 Compiler and linker flags . . . 38
3.5.1 Preprocessor flags . . . 39
3.5.2 Compiler flags . . . 39
3.5.3 Linker flags . . . 40

4 Using Python on Windows **43**
4.1 The full installer . . . 43
4.1.1 Installation steps . . . 43
4.1.2 Removing the MAX_PATH Limitation . . . 44
4.1.3 Installing Without UI . . . 45
4.1.4 Installing Without Downloading . . . 47
4.1.5 Modifying an install . . . 47
4.1.6 Installing Free-threaded Binaries . . . 48
4.2 The Microsoft Store package . . . 48
4.2.1 Known issues . . . 49
4.3 The nuget.org packages . . . 50
4.3.1 Free-threaded packages . . . 50
4.4 The embeddable package . . . 51
4.4.1 Python Application . . . 51
4.4.2 Embedding Python . . . 51
4.5 Alternative bundles . . . 52
4.6 Configuring Python . . . 52
4.6.1 Excursus: Setting environment variables . . . 52
4.6.2 Finding the Python executable . . . 53
4.7 UTF-8 mode . . . 53
4.8 Python Launcher for Windows . . . 54
4.8.1 Getting started . . . 54
4.8.2 Shebang Lines . . . 55
4.8.3 Arguments in shebang lines . . . 56
4.8.4 Customization . . . 57
4.8.5 Diagnostics . . . 58
4.8.6 Dry Run . . . 58
4.8.7 Install on demand . . . 58
4.8.8 Return codes . . . 58
4.9 Finding modules . . . 58
4.10 Additional modules . . . 60
4.10.1 PyWin32 . . . 60
4.10.2 cx_Freeze . . . 60
4.11 Compiling Python on Windows . . . 60
4.12 Other Platforms . . . 60

5 Using Python on macOS **61**
5.1 Using Python for macOS from `python.org` . . . 61
5.1.1 Installation steps . . . 61
5.1.2 How to run a Python script . . . 69
5.2 Alternative Distributions . . . 69
5.3 Installing Additional Python Packages . . . 69
5.4 GUI Programming . . . 69
5.5 Advanced Topics . . . 70
5.5.1 Installing Free-threaded Binaries . . . 70
5.5.2 Installing using the command line . . . 72
5.5.3 Distributing Python Applications . . . 73
5.5.4 App Store Compliance . . . 73
5.6 Other Resources . . . 73

6 Using Python on Android **75**
6.1 Adding Python to an Android app . . . 75
6.2 Building a Python package for Android . . . 76

7 Using Python on iOS **77**
7.1 Python at runtime on iOS . . . 77
7.1.1 iOS version compatibility . . . 77
7.1.2 Platform identification . . . 77
7.1.3 Standard library availability . . . 78
7.1.4 Binary extension modules . . . 78
7.1.5 Compiler stub binaries . . . 78
7.2 Installing Python on iOS . . . 79
7.2.1 Tools for building iOS apps . . . 79
7.2.2 Adding Python to an iOS project . . . 79
7.2.3 Testing a Python package . . . 82
7.3 App Store Compliance . . . 82

8 Editors and IDEs **83**
8.1 IDLE — Python editor and shell . . . 83
8.2 Other Editors and IDEs . . . 83

A Sözlük **85**

B About this documentation **103**
B.1 Contributors to the Python documentation . . . 103

C Tarihçe ve Lisans **105**
C.1 Yazılımın tarihçesi . . . 105
C.2 Python'a erişmek veya başka bir şekilde kullanmak için şartlar ve koşullar . . . 106
C.2.1 PYTHON SOFTWARE FOUNDATION LICENSE VERSION 2 . . . 106
C.2.2 PYTHON 2.0 İÇİN BEOPEN.COM LİSANS SÖZLEŞMESİ . . . 107
C.2.3 PYTHON 1.6.1 İÇİN CNRI LİSANS ANLAŞMASI . . . 108
C.2.4 0.9.0 ARASI 1.2 PYTHON İÇİN CWI LİSANS SÖZLEŞMESİ . . . 109
C.2.5 ZERO-CLAUSE BSD LICENSE FOR CODE IN THE PYTHON DOCUMENTATION . . . 109
C.3 Tüzel Yazılımlar için Lisanslar ve Onaylar . . . 109
C.3.1 Mersenne Twister'ı . . . 109
C.3.2 Soketler . . . 110
C.3.3 Asenkron soket hizmetleri . . . 111
C.3.4 Çerez yönetimi . . . 111
C.3.5 Çalıştırma izleme . . . 112
C.3.6 UUencode ve UUdecode fonksiyonları . . . 112
C.3.7 XML Uzaktan Yordam Çağrıları . . . 113
C.3.8 test_epoll . . . 113
C.3.9 kqueue seçin . . . 114
C.3.10 SipHash24 . . . 114
C.3.11 strtod ve dtoa . . . 115
C.3.12 OpenSSL . . . 115
C.3.13 expat . . . 119
C.3.14 libffi . . . 119
C.3.15 zlib . . . 120
C.3.16 cfuhash . . . 120
C.3.17 libmpdec . . . 121
C.3.18 W3C C14N test paketi . . . 121
C.3.19 mimalloc . . . 122
C.3.20 asyncio . . . 122
C.3.21 Global Unbounded Sequences (GUS) . . . 123

D Telif Hakkı **125**

Dizin 127

This part of the documentation is devoted to general information on the setup of the Python environment on different platforms, the invocation of the interpreter and things that make working with Python easier.

BÖLÜM 1

Command line and environment

The CPython interpreter scans the command line and the environment for various settings.

CPython uygulama ayrıntısı: Other implementations' command line schemes may differ. See implementations for further resources.

1.1 Command line

When invoking Python, you may specify any of these options:

```
python [-bBdEhiIOPqRsSuvVWx?] [-c command | -m module-name | script | - ] [args]
```

The most common use case is, of course, a simple invocation of a script:

```
python myscript.py
```

1.1.1 Interface options

The interpreter interface resembles that of the UNIX shell, but provides some additional methods of invocation:

- When called with standard input connected to a tty device, it prompts for commands and executes them until an EOF (an end-of-file character, you can produce that with `Ctrl-D` on UNIX or `Ctrl-Z, Enter` on Windows) is read. For more on interactive mode, see tut-interac.
- When called with a file name argument or with a file as standard input, it reads and executes a script from that file.
- When called with a directory name argument, it reads and executes an appropriately named script from that directory.
- When called with `-c command`, it executes the Python statement(s) given as *command*. Here *command* may contain multiple statements separated by newlines. Leading whitespace is significant in Python statements!
- When called with `-m module-name`, the given module is located on the Python module path and executed as a script.

In non-interactive mode, the entire input is parsed before it is executed.

An interface option terminates the list of options consumed by the interpreter, all consecutive arguments will end up in `sys.argv` – note that the first element, subscript zero (`sys.argv[0]`), is a string reflecting the program's source.

-c <command>

Execute the Python code in *command*. *command* can be one or more statements separated by newlines, with significant leading whitespace as in normal module code.

If this option is given, the first element of `sys.argv` will be `"-c"` and the current directory will be added to the start of `sys.path` (allowing modules in that directory to be imported as top level modules).

Raises an auditing event `cpython.run_command` with argument `command`.

-m <module-name>

Search `sys.path` for the named module and execute its contents as the `__main__` module.

Since the argument is a *module* name, you must not give a file extension (`.py`). The module name should be a valid absolute Python module name, but the implementation may not always enforce this (e.g. it may allow you to use a name that includes a hyphen).

Package names (including namespace packages) are also permitted. When a package name is supplied instead of a normal module, the interpreter will execute `<pkg>.__main__` as the main module. This behaviour is deliberately similar to the handling of directories and zipfiles that are passed to the interpreter as the script argument.

Not

This option cannot be used with built-in modules and extension modules written in C, since they do not have Python module files. However, it can still be used for precompiled modules, even if the original source file is not available.

If this option is given, the first element of `sys.argv` will be the full path to the module file (while the module file is being located, the first element will be set to `"-m"`). As with the *-c* option, the current directory will be added to the start of `sys.path`.

-I option can be used to run the script in isolated mode where `sys.path` contains neither the current directory nor the user's site-packages directory. All `PYTHON*` environment variables are ignored, too.

Many standard library modules contain code that is invoked on their execution as a script. An example is the `timeit` module:

```
python -m timeit -s "setup here" "benchmarked code here"
python -m timeit -h # for details
```

Raises an auditing event `cpython.run_module` with argument `module-name`.

Ayrıca bakınız

runpy.run_module()
Equivalent functionality directly available to Python code

PEP 338 – Executing modules as scripts

3.1 sürümünde değişti: Supply the package name to run a `__main__` submodule.

3.4 sürümünde değişti: namespace packages are also supported

-

Read commands from standard input (`sys.stdin`). If standard input is a terminal, *-i* is implied.

If this option is given, the first element of `sys.argv` will be `"-"` and the current directory will be added to the start of `sys.path`.

Raises an auditing event `cpython.run_stdin` with no arguments.

<script>

Execute the Python code contained in *script*, which must be a filesystem path (absolute or relative) referring to either a Python file, a directory containing a `__main__.py` file, or a zipfile containing a `__main__.py` file.

If this option is given, the first element of `sys.argv` will be the script name as given on the command line.

If the script name refers directly to a Python file, the directory containing that file is added to the start of `sys.path`, and the file is executed as the `__main__` module.

If the script name refers to a directory or zipfile, the script name is added to the start of `sys.path` and the `__main__.py` file in that location is executed as the `__main__` module.

`-I` option can be used to run the script in isolated mode where `sys.path` contains neither the script's directory nor the user's site-packages directory. All `PYTHON*` environment variables are ignored, too.

Raises an auditing event `cpython.run_file` with argument `filename`.

Ayrıca bakınız

runpy.run_path()
Equivalent functionality directly available to Python code

If no interface option is given, `-i` is implied, `sys.argv[0]` is an empty string (`""`) and the current directory will be added to the start of `sys.path`. Also, tab-completion and history editing is automatically enabled, if available on your platform (see rlcompleter-config).

Ayrıca bakınız

tut-invoking

3.4 sürümünde değişti: Automatic enabling of tab-completion and history editing.

1.1.2 Generic options

-?

-h

--help

Print a short description of all command line options and corresponding environment variables and exit.

--help-env

Print a short description of Python-specific environment variables and exit.

Added in version 3.11.

--help-xoptions

Print a description of implementation-specific `-X` options and exit.

Added in version 3.11.

--help-all

Print complete usage information and exit.

Added in version 3.11.

-V

--version

Print the Python version number and exit. Example output could be:

```
Python 3.8.0b2+
```

When given twice, print more information about the build, like:

```
Python 3.8.0b2+ (3.8:0c076caaa8, Apr 20 2019, 21:55:00)
[GCC 6.2.0 20161005]
```

Added in version 3.6: The `-VV` option.

1.1.3 Miscellaneous options

-b

Issue a warning when converting `bytes` or `bytearray` to `str` without specifying encoding or comparing `bytes` or `bytearray` with `str` or `bytes` with `int`. Issue an error when the option is given twice (`-bb`).

3.5 sürümünde değişti: Affects also comparisons of `bytes` with `int`.

-B

If given, Python won't try to write `.pyc` files on the import of source modules. See also *PYTHONDONTWRITEBYTECODE*.

--check-hash-based-pycs `default|always|never`

Control the validation behavior of hash-based `.pyc` files. See pyc-invalidation. When set to `default`, checked and unchecked hash-based bytecode cache files are validated according to their default semantics. When set to `always`, all hash-based `.pyc` files, whether checked or unchecked, are validated against their corresponding source file. When set to `never`, hash-based `.pyc` files are not validated against their corresponding source files.

The semantics of timestamp-based `.pyc` files are unaffected by this option.

-d

Turn on parser debugging output (for expert only). See also the *PYTHONDEBUG* environment variable.

This option requires a *debug build of Python*, otherwise it's ignored.

-E

Ignore all `PYTHON*` environment variables, e.g. *PYTHONPATH* and *PYTHONHOME*, that might be set.

See also the *-P* and *-I* (isolated) options.

-i

Enter interactive mode after execution.

Using the *-i* option will enter interactive mode in any of the following circumstances:

- When a script is passed as first argument
- When the *-c* option is used
- When the *-m* option is used

Interactive mode will start even when `sys.stdin` does not appear to be a terminal. The *PYTHONSTARTUP* file is not read.

This can be useful to inspect global variables or a stack trace when a script raises an exception. See also *PYTHONINSPECT*.

-I

Run Python in isolated mode. This also implies *-E*, *-P* and *-s* options.

In isolated mode `sys.path` contains neither the script's directory nor the user's site-packages directory. All `PYTHON*` environment variables are ignored, too. Further restrictions may be imposed to prevent the user from injecting malicious code.

Added in version 3.4.

-O

Remove assert statements and any code conditional on the value of `__debug__`. Augment the filename for compiled (*bytecode*) files by adding `.opt-1` before the `.pyc` extension (see **PEP 488**). See also *PYTHONOPTIMIZE*.

3.5 sürümünde değişti: Modify `.pyc` filenames according to **PEP 488**.

-OO

Do *-O* and also discard docstrings. Augment the filename for compiled (*bytecode*) files by adding `.opt-2` before the `.pyc` extension (see **PEP 488**).

3.5 sürümünde değişti: Modify `.pyc` filenames according to **PEP 488**.

-P

Don't prepend a potentially unsafe path to `sys.path`:

- `python -m module` command line: Don't prepend the current working directory.
- `python script.py` command line: Don't prepend the script's directory. If it's a symbolic link, resolve symbolic links.
- `python -c code` and `python` (REPL) command lines: Don't prepend an empty string, which means the current working directory.

See also the *PYTHONSAFEPATH* environment variable, and *-E* and *-I* (isolated) options.

Added in version 3.11.

-q

Don't display the copyright and version messages even in interactive mode.

Added in version 3.2.

-R

Turn on hash randomization. This option only has an effect if the *PYTHONHASHSEED* environment variable is set to anything other than `random`, since hash randomization is enabled by default.

On previous versions of Python, this option turns on hash randomization, so that the `__hash__()` values of str and bytes objects are "salted" with an unpredictable random value. Although they remain constant within an individual Python process, they are not predictable between repeated invocations of Python.

Hash randomization is intended to provide protection against a denial-of-service caused by carefully chosen inputs that exploit the worst case performance of a dict construction, $O(n^2)$ complexity. See http://ocert.org/advisories/ocert-2011-003.html for details.

PYTHONHASHSEED allows you to set a fixed value for the hash seed secret.

Added in version 3.2.3.

3.7 sürümünde değişti: The option is no longer ignored.

-s

Don't add the `user site-packages directory` to `sys.path`.

See also *PYTHONNOUSERSITE*.

Ayrıca bakınız

PEP 370 – Per user site-packages directory

-S

Disable the import of the module `site` and the site-dependent manipulations of `sys.path` that it entails. Also disable these manipulations if `site` is explicitly imported later (call `site.main()` if you want them to be triggered).

-u

Force the stdout and stderr streams to be unbuffered. This option has no effect on the stdin stream.

See also *PYTHONUNBUFFERED*.

3.7 sürümünde değişti: The text layer of the stdout and stderr streams now is unbuffered.

-v

Print a message each time a module is initialized, showing the place (filename or built-in module) from which it is loaded. When given twice (`-vv`), print a message for each file that is checked for when searching for a module. Also provides information on module cleanup at exit.

3.10 sürümünde değişti: The `site` module reports the site-specific paths and `.pth` files being processed.

See also *PYTHONVERBOSE*.

-W `arg`

Warning control. Python's warning machinery by default prints warning messages to `sys.stderr`.

The simplest settings apply a particular action unconditionally to all warnings emitted by a process (even those that are otherwise ignored by default):

```
-Wdefault  # Warn once per call location
-Werror    # Convert to exceptions
-Walways   # Warn every time
-Wall      # Same as -Walways
-Wmodule   # Warn once per calling module
-Wonce     # Warn once per Python process
-Wignore   # Never warn
```

The action names can be abbreviated as desired and the interpreter will resolve them to the appropriate action name. For example, `-Wi` is the same as `-Wignore`.

The full form of argument is:

```
action:message:category:module:lineno
```

Empty fields match all values; trailing empty fields may be omitted. For example `-W ignore::DeprecationWarning` ignores all DeprecationWarning warnings.

The *action* field is as explained above but only applies to warnings that match the remaining fields.

The *message* field must match the whole warning message; this match is case-insensitive.

The *category* field matches the warning category (ex: `DeprecationWarning`). This must be a class name; the match test whether the actual warning category of the message is a subclass of the specified warning category.

The *module* field matches the (fully qualified) module name; this match is case-sensitive.

The *lineno* field matches the line number, where zero matches all line numbers and is thus equivalent to an omitted line number.

Multiple *-W* options can be given; when a warning matches more than one option, the action for the last matching option is performed. Invalid *-W* options are ignored (though, a warning message is printed about invalid options when the first warning is issued).

Warnings can also be controlled using the *PYTHONWARNINGS* environment variable and from within a Python program using the `warnings` module. For example, the `warnings.filterwarnings()` function can be used to use a regular expression on the warning message.

See warning-filter and describing-warning-filters for more details.

-x

Skip the first line of the source, allowing use of non-Unix forms of `#!cmd`. This is intended for a DOS specific hack only.

-X

Reserved for various implementation-specific options. CPython currently defines the following possible values:

- `-X faulthandler` to enable `faulthandler`. See also *PYTHONFAULTHANDLER*.

  Added in version 3.3.

- `-X showrefcount` to output the total reference count and number of used memory blocks when the program finishes or after each statement in the interactive interpreter. This only works on *debug builds*.

  Added in version 3.4.

- `-X tracemalloc` to start tracing Python memory allocations using the `tracemalloc` module. By default, only the most recent frame is stored in a traceback of a trace. Use `-X tracemalloc =NFRAME` to start tracing with a traceback limit of *NFRAME* frames. See `tracemalloc.start()` and *PYTHONTRACEMALLOC* for more information.

  Added in version 3.4.

- `-X int_max_str_digits` configures the integer string conversion length limitation. See also *PYTHONINTMAXSTRDIGITS*.

  Added in version 3.11.

- `-X importtime` to show how long each import takes. It shows module name, cumulative time (including nested imports) and self time (excluding nested imports). Note that its output may be broken in multi-threaded application. Typical usage is `python3 -X importtime -c 'import asyncio'`. See also *PYTHONPROFILEIMPORTTIME*.

  Added in version 3.7.

- `-X dev`: enable Python Development Mode, introducing additional runtime checks that are too expensive to be enabled by default. See also *PYTHONDEVMODE*.

  Added in version 3.7.

- `-X utf8` enables the Python UTF-8 Mode. `-X utf8 =0` explicitly disables Python UTF-8 Mode (even when it would otherwise activate automatically). See also *PYTHONUTF8*.

  Added in version 3.7.

- `-X pycache_prefix =PATH` enables writing `.pyc` files to a parallel tree rooted at the given directory instead of to the code tree. See also *PYTHONPYCACHEPREFIX*.

  Added in version 3.8.

- `-X warn_default_encoding` issues a `EncodingWarning` when the locale-specific default encoding is used for opening files. See also *PYTHONWARNDEFAULTENCODING*.

  Added in version 3.10.

- `-X no_debug_ranges` disables the inclusion of the tables mapping extra location information (end line, start column offset and end column offset) to every instruction in code objects. This is useful when smaller code objects and pyc files are desired as well as suppressing the extra visual location indicators when the interpreter displays tracebacks. See also *PYTHONNODEBUGRANGES*.

  Added in version 3.11.

- `-X frozen_modules` determines whether or not frozen modules are ignored by the import machinery. A value of `on` means they get imported and `off` means they are ignored. The default is `on` if this is an installed Python (the normal case). If it's under development (running from the source tree) then the default is `off`. Note that the `importlib_bootstrap` and `importlib_bootstrap_external` frozen modules are always used, even if this flag is set to `off`. See also *PYTHON_FROZEN_MODULES*.

  Added in version 3.11.

- `-X perf` enables support for the Linux `perf` profiler. When this option is provided, the `perf` profiler will be able to report Python calls. This option is only available on some platforms and will do nothing if

is not supported on the current system. The default value is "off". See also *PYTHONPERFSUPPORT* and perf_profiling.

Added in version 3.12.

- `-X perf_jit` enables support for the Linux `perf` profiler with DWARF support. When this option is provided, the `perf` profiler will be able to report Python calls using DWARF information. This option is only available on some platforms and will do nothing if is not supported on the current system. The default value is "off". See also *PYTHON_PERF_JIT_SUPPORT* and perf_profiling.

  Added in version 3.13.

- `-X cpu_count =n` overrides `os.cpu_count()`, `os.process_cpu_count()`, and `multiprocessing.cpu_count()`. *n* must be greater than or equal to 1. This option may be useful for users who need to limit CPU resources of a container system. See also *PYTHON_CPU_COUNT*. If *n* is `default`, nothing is overridden.

  Added in version 3.13.

- `-X presite =package.module` specifies a module that should be imported before the `site` module is executed and before the `__main__` module exists. Therefore, the imported module isn't `__main__`. This can be used to execute code early during Python initialization. Python needs to be *built in debug mode* for this option to exist. See also *PYTHON_PRESITE*.

  Added in version 3.13.

- `-X gil =0,1` forces the GIL to be disabled or enabled, respectively. Setting to `0` is only available in builds configured with *--disable-gil*. See also *PYTHON_GIL* and whatsnew313-free-threaded-cpython.

  Added in version 3.13.

It also allows passing arbitrary values and retrieving them through the `sys._xoptions` dictionary.

Added in version 3.2.

3.9 sürümünde değişti: Removed the `-X showalloccount` option.

3.10 sürümünde değişti: Removed the `-X oldparser` option.

1.1.4 Controlling color

The Python interpreter is configured by default to use colors to highlight output in certain situations such as when displaying tracebacks. This behavior can be controlled by setting different environment variables.

Setting the environment variable `TERM` to `dumb` will disable color.

If the `FORCE_COLOR` environment variable is set, then color will be enabled regardless of the value of TERM. This is useful on CI systems which aren't terminals but can still display ANSI escape sequences.

If the `NO_COLOR` environment variable is set, Python will disable all color in the output. This takes precedence over `FORCE_COLOR`.

All these environment variables are used also by other tools to control color output. To control the color output only in the Python interpreter, the *PYTHON_COLORS* environment variable can be used. This variable takes precedence over `NO_COLOR`, which in turn takes precedence over `FORCE_COLOR`.

1.1.5 Options you shouldn't use

`-J`

Reserved for use by Jython.

1.2 Environment variables

These environment variables influence Python's behavior, they are processed before the command-line switches other than -E or -I. It is customary that command-line switches override environmental variables where there is a conflict.

PYTHONHOME

Change the location of the standard Python libraries. By default, the libraries are searched in *prefix*/lib/python*version* and *exec_prefix*/lib/python*version*, where *prefix* and *exec_prefix* are installation-dependent directories, both defaulting to /usr/local.

When *PYTHONHOME* is set to a single directory, its value replaces both *prefix* and *exec_prefix*. To specify different values for these, set *PYTHONHOME* to *prefix*:*exec_prefix*.

PYTHONPATH

Augment the default search path for module files. The format is the same as the shell's PATH: one or more directory pathnames separated by os.pathsep (e.g. colons on Unix or semicolons on Windows). Non-existent directories are silently ignored.

In addition to normal directories, individual *PYTHONPATH* entries may refer to zipfiles containing pure Python modules (in either source or compiled form). Extension modules cannot be imported from zipfiles.

The default search path is installation dependent, but generally begins with *prefix*/lib/python*version* (see *PYTHONHOME* above). It is *always* appended to *PYTHONPATH*.

An additional directory will be inserted in the search path in front of *PYTHONPATH* as described above under *Interface options*. The search path can be manipulated from within a Python program as the variable sys.path.

PYTHONSAFEPATH

If this is set to a non-empty string, don't prepend a potentially unsafe path to sys.path: see the *-P* option for details.

Added in version 3.11.

PYTHONPLATLIBDIR

If this is set to a non-empty string, it overrides the sys.platlibdir value.

Added in version 3.9.

PYTHONSTARTUP

If this is the name of a readable file, the Python commands in that file are executed before the first prompt is displayed in interactive mode. The file is executed in the same namespace where interactive commands are executed so that objects defined or imported in it can be used without qualification in the interactive session. You can also change the prompts sys.ps1 and sys.ps2 and the hook sys.__interactivehook__ in this file.

Raises an auditing event cpython.run_startup with the filename as the argument when called on startup.

PYTHONOPTIMIZE

If this is set to a non-empty string it is equivalent to specifying the *-O* option. If set to an integer, it is equivalent to specifying *-O* multiple times.

PYTHONBREAKPOINT

If this is set, it names a callable using dotted-path notation. The module containing the callable will be imported and then the callable will be run by the default implementation of sys.breakpointhook() which itself is called by built-in breakpoint(). If not set, or set to the empty string, it is equivalent to the value "pdb.set_trace". Setting this to the string "0" causes the default implementation of sys.breakpointhook() to do nothing but return immediately.

Added in version 3.7.

PYTHONDEBUG

If this is set to a non-empty string it is equivalent to specifying the *-d* option. If set to an integer, it is equivalent to specifying *-d* multiple times.

This environment variable requires a *debug build of Python*, otherwise it's ignored.

PYTHONINSPECT

If this is set to a non-empty string it is equivalent to specifying the `-i` option.

This variable can also be modified by Python code using `os.environ` to force inspect mode on program termination.

Raises an auditing event `cpython.run_stdin` with no arguments.

3.12.5 sürümünde değişti: (also 3.11.10, 3.10.15, 3.9.20, and 3.8.20) Emits audit events.

3.13 sürümünde değişti: Uses PyREPL if possible, in which case *PYTHONSTARTUP* is also executed. Emits audit events.

PYTHONUNBUFFERED

If this is set to a non-empty string it is equivalent to specifying the `-u` option.

PYTHONVERBOSE

If this is set to a non-empty string it is equivalent to specifying the `-v` option. If set to an integer, it is equivalent to specifying `-v` multiple times.

PYTHONCASEOK

If this is set, Python ignores case in `import` statements. This only works on Windows and macOS.

PYTHONDONTWRITEBYTECODE

If this is set to a non-empty string, Python won't try to write `.pyc` files on the import of source modules. This is equivalent to specifying the `-B` option.

PYTHONPYCACHEPREFIX

If this is set, Python will write `.pyc` files in a mirror directory tree at this path, instead of in `__pycache__` directories within the source tree. This is equivalent to specifying the `-X pycache_prefix =PATH` option.

Added in version 3.8.

PYTHONHASHSEED

If this variable is not set or set to `random`, a random value is used to seed the hashes of str and bytes objects.

If *PYTHONHASHSEED* is set to an integer value, it is used as a fixed seed for generating the hash() of the types covered by the hash randomization.

Its purpose is to allow repeatable hashing, such as for selftests for the interpreter itself, or to allow a cluster of python processes to share hash values.

The integer must be a decimal number in the range [0,4294967295]. Specifying the value 0 will disable hash randomization.

Added in version 3.2.3.

PYTHONINTMAXSTRDIGITS

If this variable is set to an integer, it is used to configure the interpreter's global integer string conversion length limitation.

Added in version 3.11.

PYTHONIOENCODING

If this is set before running the interpreter, it overrides the encoding used for stdin/stdout/stderr, in the syntax `encodingname:errorhandler`. Both the `encodingname` and the `:errorhandler` parts are optional and have the same meaning as in `str.encode()`.

For stderr, the `:errorhandler` part is ignored; the handler will always be `'backslashreplace'`.

3.4 sürümünde değişti: The `encodingname` part is now optional.

3.6 sürümünde değişti: On Windows, the encoding specified by this variable is ignored for interactive console buffers unless *PYTHONLEGACYWINDOWSSTDIO* is also specified. Files and pipes redirected through the standard streams are not affected.

PYTHONNOUSERSITE

If this is set, Python won't add the `user site-packages directory` to `sys.path`.

> **Ayrıca bakınız**
>
> **PEP 370** – Per user site-packages directory

PYTHONUSERBASE

Defines the `user base directory`, which is used to compute the path of the `user site-packages directory` and installation paths for `python -m pip install --user`.

> **Ayrıca bakınız**
>
> **PEP 370** – Per user site-packages directory

PYTHONEXECUTABLE

If this environment variable is set, `sys.argv[0]` will be set to its value instead of the value got through the C runtime. Only works on macOS.

PYTHONWARNINGS

This is equivalent to the *-W* option. If set to a comma separated string, it is equivalent to specifying *-W* multiple times, with filters later in the list taking precedence over those earlier in the list.

The simplest settings apply a particular action unconditionally to all warnings emitted by a process (even those that are otherwise ignored by default):

```
PYTHONWARNINGS=default  # Warn once per call location
PYTHONWARNINGS=error    # Convert to exceptions
PYTHONWARNINGS=always   # Warn every time
PYTHONWARNINGS=all      # Same as PYTHONWARNINGS =always
PYTHONWARNINGS=module   # Warn once per calling module
PYTHONWARNINGS=once     # Warn once per Python process
PYTHONWARNINGS=ignore   # Never warn
```

See warning-filter and describing-warning-filters for more details.

PYTHONFAULTHANDLER

If this environment variable is set to a non-empty string, `faulthandler.enable()` is called at startup: install a handler for `SIGSEGV`, `SIGFPE`, `SIGABRT`, `SIGBUS` and `SIGILL` signals to dump the Python traceback. This is equivalent to *-X* `faulthandler` option.

Added in version 3.3.

PYTHONTRACEMALLOC

If this environment variable is set to a non-empty string, start tracing Python memory allocations using the `tracemalloc` module. The value of the variable is the maximum number of frames stored in a traceback of a trace. For example, `PYTHONTRACEMALLOC =1` stores only the most recent frame. See the `tracemalloc.start()` function for more information. This is equivalent to setting the *-X* `tracemalloc` option.

Added in version 3.4.

PYTHONPROFILEIMPORTTIME

If this environment variable is set to a non-empty string, Python will show how long each import takes. This is equivalent to setting the *-X* `importtime` option.

Added in version 3.7.

PYTHONASYNCIODEBUG

If this environment variable is set to a non-empty string, enable the debug mode of the `asyncio` module.

Added in version 3.4.

PYTHONMALLOC

Set the Python memory allocators and/or install debug hooks.

Set the family of memory allocators used by Python:

- `default`: use the default memory allocators.
- `malloc`: use the `malloc()` function of the C library for all domains (`PYMEM_DOMAIN_RAW`, `PYMEM_DOMAIN_MEM`, `PYMEM_DOMAIN_OBJ`).
- `pymalloc`: use the pymalloc allocator for `PYMEM_DOMAIN_MEM` and `PYMEM_DOMAIN_OBJ` domains and use the `malloc()` function for the `PYMEM_DOMAIN_RAW` domain.
- `mimalloc`: use the mimalloc allocator for `PYMEM_DOMAIN_MEM` and `PYMEM_DOMAIN_OBJ` domains and use the `malloc()` function for the `PYMEM_DOMAIN_RAW` domain.

Install debug hooks:

- `debug`: install debug hooks on top of the default memory allocators.
- `malloc_debug`: same as `malloc` but also install debug hooks.
- `pymalloc_debug`: same as `pymalloc` but also install debug hooks.
- `mimalloc_debug`: same as `mimalloc` but also install debug hooks.

Added in version 3.6.

3.7 sürümünde değişti: Added the `"default"` allocator.

PYTHONMALLOCSTATS

If set to a non-empty string, Python will print statistics of the pymalloc memory allocator every time a new pymalloc object arena is created, and on shutdown.

This variable is ignored if the *PYTHONMALLOC* environment variable is used to force the `malloc()` allocator of the C library, or if Python is configured without `pymalloc` support.

3.6 sürümünde değişti: This variable can now also be used on Python compiled in release mode. It now has no effect if set to an empty string.

PYTHONLEGACYWINDOWSFSENCODING

If set to a non-empty string, the default *filesystem encoding and error handler* mode will revert to their pre-3.6 values of 'mbcs' and 'replace', respectively. Otherwise, the new defaults 'utf-8' and 'surrogatepass' are used.

This may also be enabled at runtime with `sys._enablelegacywindowsfsencoding()`.

Availability: Windows.

Added in version 3.6: See **PEP 529** for more details.

PYTHONLEGACYWINDOWSSTDIO

If set to a non-empty string, does not use the new console reader and writer. This means that Unicode characters will be encoded according to the active console code page, rather than using utf-8.

This variable is ignored if the standard streams are redirected (to files or pipes) rather than referring to console buffers.

Availability: Windows.

Added in version 3.6.

PYTHONCOERCECLOCALE

If set to the value `0`, causes the main Python command line application to skip coercing the legacy ASCII-based C and POSIX locales to a more capable UTF-8 based alternative.

If this variable is *not* set (or is set to a value other than `0`), the `LC_ALL` locale override environment variable is also not set, and the current locale reported for the `LC_CTYPE` category is either the default `C` locale, or else the explicitly ASCII-based `POSIX` locale, then the Python CLI will attempt to configure the following locales for the `LC_CTYPE` category in the order listed before loading the interpreter runtime:

- `C.UTF-8`
- `C.utf8`
- `UTF-8`

If setting one of these locale categories succeeds, then the `LC_CTYPE` environment variable will also be set accordingly in the current process environment before the Python runtime is initialized. This ensures that in addition to being seen by both the interpreter itself and other locale-aware components running in the same process (such as the GNU `readline` library), the updated setting is also seen in subprocesses (regardless of whether or not those processes are running a Python interpreter), as well as in operations that query the environment rather than the current C locale (such as Python's own `locale.getdefaultlocale()`).

Configuring one of these locales (either explicitly or via the above implicit locale coercion) automatically enables the `surrogateescape` error handler for `sys.stdin` and `sys.stdout` (`sys.stderr` continues to use `backslashreplace` as it does in any other locale). This stream handling behavior can be overridden using *PYTHONIOENCODING* as usual.

For debugging purposes, setting `PYTHONCOERCECLOCALE =warn` will cause Python to emit warning messages on `stderr` if either the locale coercion activates, or else if a locale that *would* have triggered coercion is still active when the Python runtime is initialized.

Also note that even when locale coercion is disabled, or when it fails to find a suitable target locale, *PYTHONUTF8* will still activate by default in legacy ASCII-based locales. Both features must be disabled in order to force the interpreter to use `ASCII` instead of `UTF-8` for system interfaces.

Availability: Unix.

Added in version 3.7: See **PEP 538** for more details.

PYTHONDEVMODE

If this environment variable is set to a non-empty string, enable Python Development Mode, introducing additional runtime checks that are too expensive to be enabled by default. This is equivalent to setting the *-X* `dev` option.

Added in version 3.7.

PYTHONUTF8

If set to `1`, enable the Python UTF-8 Mode.

If set to `0`, disable the Python UTF-8 Mode.

Setting any other non-empty string causes an error during interpreter initialisation.

Added in version 3.7.

PYTHONWARNDEFAULTENCODING

If this environment variable is set to a non-empty string, issue a `EncodingWarning` when the locale-specific default encoding is used.

See io-encoding-warning for details.

Added in version 3.10.

PYTHONNODEBUGRANGES

If this variable is set, it disables the inclusion of the tables mapping extra location information (end line, start column offset and end column offset) to every instruction in code objects. This is useful when smaller code

objects and pyc files are desired as well as suppressing the extra visual location indicators when the interpreter displays tracebacks.

Added in version 3.11.

PYTHONPERFSUPPORT

If this variable is set to a nonzero value, it enables support for the Linux `perf` profiler so Python calls can be detected by it.

If set to `0`, disable Linux `perf` profiler support.

See also the *-X perf* command-line option and perf_profiling.

Added in version 3.12.

PYTHON_PERF_JIT_SUPPORT

If this variable is set to a nonzero value, it enables support for the Linux `perf` profiler so Python calls can be detected by it using DWARF information.

If set to `0`, disable Linux `perf` profiler support.

See also the *-X perf_jit* command-line option and perf_profiling.

Added in version 3.13.

PYTHON_CPU_COUNT

If this variable is set to a positive integer, it overrides the return values of `os.cpu_count()` and `os.process_cpu_count()`.

See also the *-X cpu_count* command-line option.

Added in version 3.13.

PYTHON_FROZEN_MODULES

If this variable is set to `on` or `off`, it determines whether or not frozen modules are ignored by the import machinery. A value of `on` means they get imported and `off` means they are ignored. The default is `on` for non-debug builds (the normal case) and `off` for debug builds. Note that the `importlib_bootstrap` and `importlib_bootstrap_external` frozen modules are always used, even if this flag is set to `off`.

See also the *-X frozen_modules* command-line option.

Added in version 3.13.

PYTHON_COLORS

If this variable is set to `1`, the interpreter will colorize various kinds of output. Setting it to `0` deactivates this behavior. See also *Controlling color*.

Added in version 3.13.

PYTHON_BASIC_REPL

If this variable is set to any value, the interpreter will not attempt to load the Python-based *REPL* that requires `curses` and `readline`, and will instead use the traditional parser-based *REPL*.

Added in version 3.13.

PYTHON_HISTORY

This environment variable can be used to set the location of a `.python_history` file (by default, it is `.python_history` in the user's home directory).

Added in version 3.13.

PYTHON_GIL

If this variable is set to `1`, the global interpreter lock (GIL) will be forced on. Setting it to `0` forces the GIL off (needs Python configured with the *--disable-gil* build option).

See also the *-X gil* command-line option, which takes precedence over this variable, and whatsnew313-free-threaded-cpython.

Added in version 3.13.

PYTHON_JIT

On builds where experimental just-in-time compilation is available, this variable can force the JIT to be disabled (`0`) or enabled (`1`) at interpreter startup.

Added in version 3.13.

1.2.1 Debug-mode variables

PYTHONDUMPREFS

If set, Python will dump objects and reference counts still alive after shutting down the interpreter.

Needs Python configured with the *--with-trace-refs* build option.

PYTHONDUMPREFSFILE

If set, Python will dump objects and reference counts still alive after shutting down the interpreter into a file under the path given as the value to this environment variable.

Needs Python configured with the *--with-trace-refs* build option.

Added in version 3.11.

PYTHON_PRESITE

If this variable is set to a module, that module will be imported early in the interpreter lifecycle, before the `site` module is executed, and before the `__main__` module is created. Therefore, the imported module is not treated as `__main__`.

This can be used to execute code early during Python initialization.

To import a submodule, use `package.module` as the value, like in an import statement.

See also the *-X presite* command-line option, which takes precedence over this variable.

Needs Python configured with the *--with-pydebug* build option.

Added in version 3.13.

BÖLÜM 2

Using Python on Unix platforms

2.1 Getting and installing the latest version of Python

2.1.1 On Linux

Python comes preinstalled on most Linux distributions, and is available as a package on all others. However there are certain features you might want to use that are not available on your distro's package. You can compile the latest version of Python from source.

In the event that the latest version of Python doesn't come preinstalled and isn't in the repositories as well, you can make packages for your own distro. Have a look at the following links:

Ayrıca bakınız

https://www.debian.org/doc/manuals/maint-guide/first.en.html
for Debian users

https://en.opensuse.org/Portal:Packaging
for OpenSuse users

https://docs.fedoraproject.org/en-US/package-maintainers/Packaging_Tutorial_GNU_Hello/
for Fedora users

https://slackbook.org/html/package-management-making-packages.html
for Slackware users

Installing IDLE

In some cases, IDLE might not be included in your Python installation.

- For Debian and Ubuntu users:

```
sudo apt update
sudo apt install idle
```

- For Fedora, RHEL, and CentOS users:

```
sudo dnf install python3-idle
```

- For SUSE and OpenSUSE users:

```
sudo zypper install python3-idle
```

- For Alpine Linux users:

```
sudo apk add python3-idle
```

2.1.2 On FreeBSD and OpenBSD

- FreeBSD users, to add the package use:

```
pkg install python3
```

- OpenBSD users, to add the package use:

```
pkg_add -r python

pkg_add ftp://ftp.openbsd.org/pub/OpenBSD/4.2/packages/<insert your␣
↪architecture here>/python-<version>.tgz
```

For example i386 users get the 2.5.1 version of Python using:

```
pkg_add ftp://ftp.openbsd.org/pub/OpenBSD/4.2/packages/i386/python-2.5.1p2.tgz
```

2.2 Building Python

If you want to compile CPython yourself, first thing you should do is get the source. You can download either the latest release's source or just grab a fresh clone. (If you want to contribute patches, you will need a clone.)

The build process consists of the usual commands:

```
./configure
make
make install
```

Configuration options and caveats for specific Unix platforms are extensively documented in the README.rst file in the root of the Python source tree.

Uyarı

`make install` can overwrite or masquerade the `python3` binary. `make altinstall` is therefore recommended instead of `make install` since it only installs *exec_prefix*`/bin/python`*version*.

2.3 Python-related paths and files

These are subject to difference depending on local installation conventions; *prefix* and *exec_prefix* are installation-dependent and should be interpreted as for GNU software; they may be the same.

For example, on most Linux systems, the default for both is `/usr`.

File/directory	Meaning
exec_prefix/bin/python3	Recommended location of the interpreter.
prefix/lib/python*version*, *exec_prefix*/lib/python*version*	Recommended locations of the directories containing the standard modules.
prefix/include/python*version*, *exec_prefix*/include/python*version*	Recommended locations of the directories containing the include files needed for developing Python extensions and embedding the interpreter.

2.4 Miscellaneous

To easily use Python scripts on Unix, you need to make them executable, e.g. with

```
$ chmod +x script
```

and put an appropriate Shebang line at the top of the script. A good choice is usually

```
#!/usr/bin/env python3
```

which searches for the Python interpreter in the whole `PATH`. However, some Unices may not have the **`env`** command, so you may need to hardcode `/usr/bin/python3` as the interpreter path.

To use shell commands in your Python scripts, look at the `subprocess` module.

2.5 Custom OpenSSL

1. To use your vendor's OpenSSL configuration and system trust store, locate the directory with `openssl.cnf` file or symlink in `/etc`. On most distribution the file is either in `/etc/ssl` or `/etc/pki/tls`. The directory should also contain a `cert.pem` file and/or a `certs` directory.

   ```
   $ find /etc/ -name openssl.cnf -printf "%h\n"
   /etc/ssl
   ```

2. Download, build, and install OpenSSL. Make sure you use `install_sw` and not `install`. The `install_sw` target does not override `openssl.cnf`.

   ```
   $ curl -O https://www.openssl.org/source/openssl-VERSION.tar.gz
   $ tar xzf openssl-VERSION
   $ pushd openssl-VERSION
   $ ./config \
       --prefix=/usr/local/custom-openssl \
       --libdir=lib \
       --openssldir=/etc/ssl
   $ make -j1 depend
   $ make -j8
   $ make install_sw
   $ popd
   ```

3. Build Python with custom OpenSSL (see the configure `--with-openssl` and `--with-openssl-rpath` options)

   ```
   $ pushd python-3.x.x
   $ ./configure -C \
       --with-openssl=/usr/local/custom-openssl \
       --with-openssl-rpath=auto \
       --prefix=/usr/local/python-3.x.x
   ```

(sonraki sayfaya devam)

(önceki sayfadan devam)

```
$ make -j8
$ make altinstall
```

Not

Patch releases of OpenSSL have a backwards compatible ABI. You don't need to recompile Python to update OpenSSL. It's sufficient to replace the custom OpenSSL installation with a newer version.

BÖLÜM 3

Configure Python

3.1 Build Requirements

Features and minimum versions required to build CPython:

- A C11 compiler. Optional C11 features are not required.
- On Windows, Microsoft Visual Studio 2017 or later is required.
- Support for IEEE 754 floating-point numbers and floating-point Not-a-Number (NaN).
- Support for threads.
- OpenSSL 1.1.1 is the minimum version and OpenSSL 3.0.9 is the recommended minimum version for the `ssl` and `hashlib` extension modules.
- SQLite 3.15.2 for the `sqlite3` extension module.
- Tcl/Tk 8.5.12 for the `tkinter` module.
- libmpdec 2.5.0 for the `decimal` module.
- Autoconf 2.71 and aclocal 1.16.5 are required to regenerate the `configure` script.

3.1 sürümünde değişti: Tcl/Tk version 8.3.1 is now required.

3.5 sürümünde değişti: On Windows, Visual Studio 2015 or later is now required. Tcl/Tk version 8.4 is now required.

3.6 sürümünde değişti: Selected C99 features are now required, like `<stdint.h>` and `static inline` functions.

3.7 sürümünde değişti: Thread support and OpenSSL 1.0.2 are now required.

3.10 sürümünde değişti: OpenSSL 1.1.1 is now required. Require SQLite 3.7.15.

3.11 sürümünde değişti: C11 compiler, IEEE 754 and NaN support are now required. On Windows, Visual Studio 2017 or later is required. Tcl/Tk version 8.5.12 is now required for the `tkinter` module.

3.13 sürümünde değişti: Autoconf 2.71, aclocal 1.16.5 and SQLite 3.15.2 are now required.

See also **PEP 7** “Style Guide for C Code” and **PEP 11** “CPython platform support”.

3.2 Generated files

To reduce build dependencies, Python source code contains multiple generated files. Commands to regenerate all generated files:

```
make regen-all
make regen-stdlib-module-names
make regen-limited-abi
make regen-configure
```

The `Makefile.pre.in` file documents generated files, their inputs, and tools used to regenerate them. Search for `regen-*` make targets.

3.2.1 configure script

The `make regen-configure` command regenerates the `aclocal.m4` file and the `configure` script using the `Tools/build/regen-configure.sh` shell script which uses an Ubuntu container to get the same tools versions and have a reproducible output.

The container is optional, the following command can be run locally:

```
autoreconf -ivf -Werror
```

The generated files can change depending on the exact `autoconf-archive`, `aclocal` and `pkg-config` versions.

3.3 Configure Options

List all `configure` script options using:

```
./configure --help
```

See also the `Misc/SpecialBuilds.txt` in the Python source distribution.

3.3.1 General Options

--enable-loadable-sqlite-extensions

Support loadable extensions in the `_sqlite` extension module (default is no) of the `sqlite3` module.

See the `sqlite3.Connection.enable_load_extension()` method of the `sqlite3` module.

Added in version 3.6.

--disable-ipv6

Disable IPv6 support (enabled by default if supported), see the `socket` module.

--enable-big-digits=`[15|30]`

Define the size in bits of Python `int` digits: 15 or 30 bits.

By default, the digit size is 30.

Define the `PYLONG_BITS_IN_DIGIT` to `15` or `30`.

See `sys.int_info.bits_per_digit`.

--with-suffix=`SUFFIX`

Set the Python executable suffix to *SUFFIX*.

The default suffix is `.exe` on Windows and macOS (`python.exe` executable), `.js` on Emscripten node, `.html` on Emscripten browser, `.wasm` on WASI, and an empty string on other platforms (`python` executable).

3.11 sürümünde değişti: The default suffix on WASM platform is one of `.js`, `.html` or `.wasm`.

--with-tzpath=<list of absolute paths separated by pathsep>

Select the default time zone search path for `zoneinfo.TZPATH`. See the Compile-time configuration of the `zoneinfo` module.

Default: `/usr/share/zoneinfo:/usr/lib/zoneinfo:/usr/share/lib/zoneinfo:/etc/zoneinfo`.

See `os.pathsep` path separator.

Added in version 3.9.

--without-decimal-contextvar

Build the `_decimal` extension module using a thread-local context rather than a coroutine-local context (default), see the `decimal` module.

See `decimal.HAVE_CONTEXTVAR` and the `contextvars` module.

Added in version 3.9.

--with-dbmliborder=<list of backend names>

Override order to check db backends for the `dbm` module

A valid value is a colon (`:`) separated string with the backend names:

- `ndbm`;
- `gdbm`;
- `bdb`.

--without-c-locale-coercion

Disable C locale coercion to a UTF-8 based locale (enabled by default).

Don't define the `PY_COERCE_C_LOCALE` macro.

See *`PYTHONCOERCECLOCALE`* and the **PEP 538**.

--without-freelists

Disable all freelists except the empty tuple singleton.

Added in version 3.11.

--with-platlibdir=DIRNAME

Python library directory name (default is `lib`).

Fedora and SuSE use `lib64` on 64-bit platforms.

See `sys.platlibdir`.

Added in version 3.9.

--with-wheel-pkg-dir=PATH

Directory of wheel packages used by the `ensurepip` module (none by default).

Some Linux distribution packaging policies recommend against bundling dependencies. For example, Fedora installs wheel packages in the `/usr/share/python-wheels/` directory and don't install the `ensurepip._bundled` package.

Added in version 3.10.

--with-pkg-config=[check|yes|no]

Whether configure should use **pkg-config** to detect build dependencies.

- `check` (default): **pkg-config** is optional
- `yes`: **pkg-config** is mandatory
- `no`: configure does not use **pkg-config** even when present

Added in version 3.11.

--enable-pystats

Turn on internal Python performance statistics gathering.

By default, statistics gathering is off. Use `python3 -X pystats` command or set `PYTHONSTATS =1` environment variable to turn on statistics gathering at Python startup.

At Python exit, dump statistics if statistics gathering was on and not cleared.

Effects:

- Add *-X pystats* command line option.
- Add `PYTHONSTATS` environment variable.
- Define the `Py_STATS` macro.
- Add functions to the `sys` module:
  - `sys._stats_on()`: Turns on statistics gathering.
  - `sys._stats_off()`: Turns off statistics gathering.
  - `sys._stats_clear()`: Clears the statistics.
  - `sys._stats_dump()`: Dump statistics to file, and clears the statistics.

The statistics will be dumped to a arbitrary (probably unique) file in `/tmp/py_stats/` (Unix) or `C:\temp\py_stats\` (Windows). If that directory does not exist, results will be printed on stderr.

Use `Tools/scripts/summarize_stats.py` to read the stats.

Statistics:

- Opcode:
  - Specialization: success, failure, hit, deferred, miss, deopt, failures;
  - Execution count;
  - Pair count.
- Call:
  - Inlined Python calls;
  - PyEval calls;
  - Frames pushed;
  - Frame object created;
  - Eval calls: vector, generator, legacy, function VECTORCALL, build class, slot, function “ex”, API, method.
- Object:
  - incref and decref;
  - interpreter incref and decref;
  - allocations: all, 512 bytes, 4 kiB, big;
  - free;
  - to/from free lists;
  - dictionary materialized/dematerialized;
  - type cache;
  - optimization attempts;
  - optimization traces created/executed;
  - uops executed.

- Garbage collector:
  - Garbage collections;
  - Objects visited;
  - Objects collected.

Added in version 3.11.

--disable-gil

Enables **experimental** support for running Python without the *global interpreter lock* (GIL): free threading build.

Defines the `Py_GIL_DISABLED` macro and adds `"t"` to `sys.abiflags`.

See whatsnew313-free-threaded-cpython for more detail.

Added in version 3.13.

--enable-experimental-jit=[no|yes|yes-off|interpreter]

Indicate how to integrate the JIT compiler.

- `no` - build the interpreter without the JIT.
- `yes` - build the interpreter with the JIT.
- `yes-off` - build the interpreter with the JIT but disable it by default.
- `interpreter` - build the interpreter without the JIT, but with the tier 2 enabled interpreter.

By convention, `--enable-experimental-jit` is a shorthand for `--enable-experimental-jit =yes`.

> **Not**
>
> When building CPython with JIT enabled, ensure that your system has Python 3.11 or later installed.

Added in version 3.13.

PKG_CONFIG

Path to `pkg-config` utility.

PKG_CONFIG_LIBDIR

PKG_CONFIG_PATH

`pkg-config` options.

3.3.2 C compiler options

CC

C compiler command.

CFLAGS

C compiler flags.

CPP

C preprocessor command.

CPPFLAGS

C preprocessor flags, e.g. *-Iinclude_dir*.

3.3.3 Linker options

LDFLAGS

Linker flags, e.g. `-Llibrary_directory`.

LIBS

Libraries to pass to the linker, e.g. `-llibrary`.

MACHDEP

Name for machine-dependent library files.

3.3.4 Options for third-party dependencies

Added in version 3.11.

BZIP2_CFLAGS

BZIP2_LIBS

C compiler and linker flags to link Python to `libbz2`, used by `bz2` module, overriding `pkg-config`.

CURSES_CFLAGS

CURSES_LIBS

C compiler and linker flags for `libncurses` or `libncursesw`, used by `curses` module, overriding `pkg-config`.

GDBM_CFLAGS

GDBM_LIBS

C compiler and linker flags for `gdbm`.

LIBB2_CFLAGS

LIBB2_LIBS

C compiler and linker flags for `libb2` (BLAKE2), used by `hashlib` module, overriding `pkg-config`.

LIBEDIT_CFLAGS

LIBEDIT_LIBS

C compiler and linker flags for `libedit`, used by `readline` module, overriding `pkg-config`.

LIBFFI_CFLAGS

LIBFFI_LIBS

C compiler and linker flags for `libffi`, used by `ctypes` module, overriding `pkg-config`.

LIBMPDEC_CFLAGS

LIBMPDEC_LIBS

C compiler and linker flags for `libmpdec`, used by `decimal` module, overriding `pkg-config`.

> **Not**
>
> These environment variables have no effect unless `--with-system-libmpdec` is specified.

LIBLZMA_CFLAGS

LIBLZMA_LIBS

C compiler and linker flags for `liblzma`, used by `lzma` module, overriding `pkg-config`.

LIBREADLINE_CFLAGS

LIBREADLINE_LIBS

C compiler and linker flags for `libreadline`, used by `readline` module, overriding `pkg-config`.

LIBSQLITE3_CFLAGS

LIBSQLITE3_LIBS

C compiler and linker flags for `libsqlite3`, used by `sqlite3` module, overriding `pkg-config`.

LIBUUID_CFLAGS

LIBUUID_LIBS

C compiler and linker flags for `libuuid`, used by `uuid` module, overriding `pkg-config`.

PANEL_CFLAGS

PANEL_LIBS

C compiler and linker flags for PANEL, overriding `pkg-config`.

C compiler and linker flags for `libpanel` or `libpanelw`, used by `curses.panel` module, overriding `pkg-config`.

TCLTK_CFLAGS

TCLTK_LIBS

C compiler and linker flags for TCLTK, overriding `pkg-config`.

ZLIB_CFLAGS

ZLIB_LIBS

C compiler and linker flags for `libzlib`, used by `gzip` module, overriding `pkg-config`.

3.3.5 WebAssembly Options

--with-emscripten-target=[browser|node]

Set build flavor for `wasm32-emscripten`.

- `browser` (default): preload minimal stdlib, default MEMFS.
- `node`: NODERAWFS and pthread support.

Added in version 3.11.

--enable-wasm-dynamic-linking

Turn on dynamic linking support for WASM.

Dynamic linking enables `dlopen`. File size of the executable increases due to limited dead code elimination and additional features.

Added in version 3.11.

--enable-wasm-pthreads

Turn on pthreads support for WASM.

Added in version 3.11.

3.3.6 Install Options

--prefix=PREFIX

Install architecture-independent files in PREFIX. On Unix, it defaults to `/usr/local`.

This value can be retrieved at runtime using `sys.prefix`.

As an example, one can use `--prefix ="$HOME/.local/"` to install a Python in its home directory.

--exec-prefix=EPREFIX

Install architecture-dependent files in EPREFIX, defaults to *--prefix*.

This value can be retrieved at runtime using `sys.exec_prefix`.

--disable-test-modules

Don't build nor install test modules, like the `test` package or the `_testcapi` extension module (built and installed by default).

Added in version 3.10.

--with-ensurepip=[upgrade|install|no]

Select the `ensurepip` command run on Python installation:

- `upgrade` (default): run `python -m ensurepip --altinstall --upgrade` command.
- `install`: run `python -m ensurepip --altinstall` command;
- `no`: don't run ensurepip;

Added in version 3.6.

3.3.7 Performance options

Configuring Python using `--enable-optimizations --with-lto` (PGO + LTO) is recommended for best performance. The experimental `--enable-bolt` flag can also be used to improve performance.

--enable-optimizations

Enable Profile Guided Optimization (PGO) using *PROFILE_TASK* (disabled by default).

The C compiler Clang requires `llvm-profdata` program for PGO. On macOS, GCC also requires it: GCC is just an alias to Clang on macOS.

Disable also semantic interposition in libpython if `--enable-shared` and GCC is used: add `-fno-semantic-interposition` to the compiler and linker flags.

> **Not**
>
> During the build, you may encounter compiler warnings about profile data not being available for some source files. These warnings are harmless, as only a subset of the code is exercised during profile data acquisition. To disable these warnings on Clang, manually suppress them by adding `-Wno-profile-instr-unprofiled` to *CFLAGS*.

Added in version 3.6.

3.10 sürümünde değişti: Use `-fno-semantic-interposition` on GCC.

PROFILE_TASK

Environment variable used in the Makefile: Python command line arguments for the PGO generation task.

Default: `-m test --pgo --timeout =$(TESTTIMEOUT).`

Added in version 3.8.

3.13 sürümünde değişti: Task failure is no longer ignored silently.

--with-lto=[full|thin|no|yes]

Enable Link Time Optimization (LTO) in any build (disabled by default).

The C compiler Clang requires `llvm-ar` for LTO (`ar` on macOS), as well as an LTO-aware linker (`ld.gold` or `lld`).

Added in version 3.6.

Added in version 3.11: To use ThinLTO feature, use `--with-lto =thin` on Clang.

3.12 sürümünde değişti: Use ThinLTO as the default optimization policy on Clang if the compiler accepts the flag.

--enable-bolt

Enable usage of the BOLT post-link binary optimizer (disabled by default).

BOLT is part of the LLVM project but is not always included in their binary distributions. This flag requires that `llvm-bolt` and `merge-fdata` are available.

BOLT is still a fairly new project so this flag should be considered experimental for now. Because this tool operates on machine code its success is dependent on a combination of the build environment + the other optimization configure args + the CPU architecture, and not all combinations are supported. BOLT versions before LLVM 16 are known to crash BOLT under some scenarios. Use of LLVM 16 or newer for BOLT optimization is strongly encouraged.

The `BOLT_INSTRUMENT_FLAGS` and `BOLT_APPLY_FLAGS` **configure** variables can be defined to override the default set of arguments for **llvm-bolt** to instrument and apply BOLT data to binaries, respectively.

Added in version 3.12.

BOLT_APPLY_FLAGS

Arguments to `llvm-bolt` when creating a BOLT optimized binary.

Added in version 3.12.

BOLT_INSTRUMENT_FLAGS

Arguments to `llvm-bolt` when instrumenting binaries.

Added in version 3.12.

--with-computed-gotos

Enable computed gotos in evaluation loop (enabled by default on supported compilers).

--without-mimalloc

Disable the fast mimalloc allocator (enabled by default).

See also *PYTHONMALLOC* environment variable.

--without-pymalloc

Disable the specialized Python memory allocator pymalloc (enabled by default).

See also *PYTHONMALLOC* environment variable.

--without-doc-strings

Disable static documentation strings to reduce the memory footprint (enabled by default). Documentation strings defined in Python are not affected.

Don't define the `WITH_DOC_STRINGS` macro.

See the `PyDoc_STRVAR()` macro.

--enable-profiling

Enable C-level code profiling with `gprof` (disabled by default).

--with-strict-overflow

Add `-fstrict-overflow` to the C compiler flags (by default we add `-fno-strict-overflow` instead).

3.3.8 Python Debug Build

A debug build is Python built with the *--with-pydebug* configure option.

Effects of a debug build:

- Display all warnings by default: the list of default warning filters is empty in the `warnings` module.
- Add `d` to `sys.abiflags`.
- Add `sys.gettotalrefcount()` function.

- Add *-X showrefcount* command line option.
- Add *-d* command line option and *PYTHONDEBUG* environment variable to debug the parser.
- Add support for the __lltrace__ variable: enable low-level tracing in the bytecode evaluation loop if the variable is defined.
- Install debug hooks on memory allocators to detect buffer overflow and other memory errors.
- Define Py_DEBUG and Py_REF_DEBUG macros.
- Add runtime checks: code surrounded by #ifdef Py_DEBUG and #endif. Enable assert(...) and _PyObject_ASSERT(...) assertions: don't set the NDEBUG macro (see also the *--with-assertions* configure option). Main runtime checks:
  - Add sanity checks on the function arguments.
  - Unicode and int objects are created with their memory filled with a pattern to detect usage of uninitialized objects.
  - Ensure that functions which can clear or replace the current exception are not called with an exception raised.
  - Check that deallocator functions don't change the current exception.
  - The garbage collector (gc.collect() function) runs some basic checks on objects consistency.
  - The Py_SAFE_DOWNCAST() macro checks for integer underflow and overflow when downcasting from wide types to narrow types.

See also the Python Development Mode and the *--with-trace-refs* configure option.

3.8 sürümünde değişti: Release builds and debug builds are now ABI compatible: defining the Py_DEBUG macro no longer implies the Py_TRACE_REFS macro (see the *--with-trace-refs* option).

3.3.9 Debug options

--with-pydebug

Build Python in debug mode: define the Py_DEBUG macro (disabled by default).

--with-trace-refs

Enable tracing references for debugging purpose (disabled by default).

Effects:

- Define the Py_TRACE_REFS macro.
- Add sys.getobjects() function.
- Add *PYTHONDUMPREFS* environment variable.

The *PYTHONDUMPREFS* environment variable can be used to dump objects and reference counts still alive at Python exit.

Statically allocated objects are not traced.

Added in version 3.8.

3.13 sürümünde değişti: This build is now ABI compatible with release build and *debug build*.

--with-assertions

Build with C assertions enabled (default is no): assert(...); and _PyObject_ASSERT(...);.

If set, the NDEBUG macro is not defined in the *OPT* compiler variable.

See also the *--with-pydebug* option (*debug build*) which also enables assertions.

Added in version 3.6.

--with-valgrind

Enable Valgrind support (default is no).

--with-dtrace

Enable DTrace support (default is no).

See Instrumenting CPython with DTrace and SystemTap.

Added in version 3.6.

--with-address-sanitizer

Enable AddressSanitizer memory error detector, `asan` (default is no). To improve ASan detection capabilities you may also want to combine this with *--without-pymalloc* to disable the specialized small-object allocator whose allocations are not tracked by ASan.

Added in version 3.6.

--with-memory-sanitizer

Enable MemorySanitizer allocation error detector, `msan` (default is no).

Added in version 3.6.

--with-undefined-behavior-sanitizer

Enable UndefinedBehaviorSanitizer undefined behaviour detector, `ubsan` (default is no).

Added in version 3.6.

--with-thread-sanitizer

Enable ThreadSanitizer data race detector, `tsan` (default is no).

Added in version 3.13.

3.3.10 Linker options

--enable-shared

Enable building a shared Python library: `libpython` (default is no).

--without-static-libpython

Do not build `libpythonMAJOR.MINOR.a` and do not install `python.o` (built and enabled by default).

Added in version 3.10.

3.3.11 Libraries options

--with-libs`='lib1 ...'`

Link against additional libraries (default is no).

--with-system-expat

Build the `pyexpat` module using an installed `expat` library (default is no).

--with-system-libmpdec

Build the `_decimal` extension module using an installed `mpdecimal` library, see the `decimal` module (default is yes).

Added in version 3.3.

3.13 sürümünde değişti: Default to using the installed `mpdecimal` library.

Deprecated since version 3.13, will be removed in version 3.16: A copy of the `mpdecimal` library sources will no longer be distributed with Python 3.16.

Ayrıca bakınız

LIBMPDEC_CFLAGS and *LIBMPDEC_LIBS*.

--with-readline=readline|editline

Designate a backend library for the `readline` module.

- readline: Use readline as the backend.
- editline: Use editline as the backend.

Added in version 3.10.

--without-readline

Don't build the `readline` module (built by default).

Don't define the `HAVE_LIBREADLINE` macro.

Added in version 3.10.

--with-libm=STRING

Override `libm` math library to *STRING* (default is system-dependent).

--with-libc=STRING

Override `libc` C library to *STRING* (default is system-dependent).

--with-openssl=DIR

Root of the OpenSSL directory.

Added in version 3.7.

--with-openssl-rpath=[no|auto|DIR]

Set runtime library directory (rpath) for OpenSSL libraries:

- `no` (default): don't set rpath;
- `auto`: auto-detect rpath from *--with-openssl* and `pkg-config`;
- *DIR*: set an explicit rpath.

Added in version 3.10.

3.3.12 Security Options

--with-hash-algorithm=[fnv|siphash13|siphash24]

Select hash algorithm for use in `Python/pyhash.c`:

- `siphash13` (default);
- `siphash24`;
- `fnv`.

Added in version 3.4.

Added in version 3.11: `siphash13` is added and it is the new default.

--with-builtin-hashlib-hashes=md5,sha1,sha256,sha512,sha3,blake2

Built-in hash modules:

- `md5`;
- `sha1`;
- `sha256`;
- `sha512`;
- `sha3` (with shake);
- `blake2`.

Added in version 3.9.

--with-ssl-default-suites=[python|openssl|STRING]

Override the OpenSSL default cipher suites string:

- `python` (default): use Python's preferred selection;
- `openssl`: leave OpenSSL's defaults untouched;
- *STRING*: use a custom string

See the `ssl` module.

Added in version 3.7.

3.10 sürümünde değişti: The settings `python` and *STRING* also set TLS 1.2 as minimum protocol version.

3.3.13 macOS Options

See Mac/README.rst.

--enable-universalsdk

--enable-universalsdk=SDKDIR

Create a universal binary build. *SDKDIR* specifies which macOS SDK should be used to perform the build (default is no).

--enable-framework

--enable-framework=INSTALLDIR

Create a Python.framework rather than a traditional Unix install. Optional *INSTALLDIR* specifies the installation path (default is no).

--with-universal-archs=ARCH

Specify the kind of universal binary that should be created. This option is only valid when *--enable-universalsdk* is set.

Options:

- `universal2` (x86-64 and arm64);
- `32-bit` (PPC and i386);
- `64-bit` (PPC64 and x86-64);
- `3-way` (i386, PPC and x86-64);
- `intel` (i386 and x86-64);
- `intel-32` (i386);
- `intel-64` (x86-64);
- `all` (PPC, i386, PPC64 and x86-64).

Note that values for this configuration item are *not* the same as the identifiers used for universal binary wheels on macOS. See the Python Packaging User Guide for details on the packaging platform compatibility tags used on macOS

--with-framework-name=FRAMEWORK

Specify the name for the python framework on macOS only valid when *--enable-framework* is set (default: `Python`).

--with-app-store-compliance

--with-app-store-compliance=PATCH-FILE

The Python standard library contains strings that are known to trigger automated inspection tool errors when submitted for distribution by the macOS and iOS App Stores. If enabled, this option will apply the list of patches that are known to correct app store compliance. A custom patch file can also be specified. This option is disabled by default.

Added in version 3.13.

3.3.14 iOS Options

See iOS/README.rst.

--enable-framework=INSTALLDIR

Create a Python.framework. Unlike macOS, the *INSTALLDIR* argument specifying the installation path is mandatory.

--with-framework-name=FRAMEWORK

Specify the name for the framework (default: `Python`).

3.3.15 Cross Compiling Options

Cross compiling, also known as cross building, can be used to build Python for another CPU architecture or platform. Cross compiling requires a Python interpreter for the build platform. The version of the build Python must match the version of the cross compiled host Python.

--build=BUILD

configure for building on BUILD, usually guessed by **config.guess**.

--host=HOST

cross-compile to build programs to run on HOST (target platform)

--with-build-python=path/to/python

path to build `python` binary for cross compiling

Added in version 3.11.

CONFIG_SITE=file

An environment variable that points to a file with configure overrides.

Example *config.site* file:

```
# config.site-aarch64
ac_cv_buggy_getaddrinfo=no
ac_cv_file__dev_ptmx=yes
ac_cv_file__dev_ptc=no
```

HOSTRUNNER

Program to run CPython for the host platform for cross-compilation.

Added in version 3.11.

Cross compiling example:

```
CONFIG_SITE=config.site-aarch64 ../configure \
    --build=x86_64-pc-linux-gnu \
    --host=aarch64-unknown-linux-gnu \
    --with-build-python=../x86_64/python
```

3.4 Python Build System

3.4.1 Main files of the build system

- `configure.ac` => `configure`;
- `Makefile.pre.in` => `Makefile` (created by `configure`);
- `pyconfig.h` (created by `configure`);
- `Modules/Setup`: C extensions built by the Makefile using `Module/makesetup` shell script;

3.4.2 Main build steps

- C files (`.c`) are built as object files (`.o`).
- A static `libpython` library (`.a`) is created from objects files.
- `python.o` and the static `libpython` library are linked into the final `python` program.
- C extensions are built by the Makefile (see `Modules/Setup`).

3.4.3 Main Makefile targets

make

For the most part, when rebuilding after editing some code or refreshing your checkout from upstream, all you need to do is execute `make`, which (per Make's semantics) builds the default target, the first one defined in the Makefile. By tradition (including in the CPython project) this is usually the `all` target. The `configure` script expands an `autoconf` variable, `@DEF_MAKE_ALL_RULE@` to describe precisely which targets `make all` will build. The three choices are:

- `profile-opt` (configured with `--enable-optimizations`)
- `build_wasm` (configured with `--with-emscripten-target`)
- `build_all` (configured without explicitly using either of the others)

Depending on the most recent source file changes, Make will rebuild any targets (object files and executables) deemed out-of-date, including running `configure` again if necessary. Source/target dependencies are many and maintained manually however, so Make sometimes doesn't have all the information necessary to correctly detect all targets which need to be rebuilt. Depending on which targets aren't rebuilt, you might experience a number of problems. If you have build or test problems which you can't otherwise explain, `make clean && make` should work around most dependency problems, at the expense of longer build times.

make platform

Build the `python` program, but don't build the standard library extension modules. This generates a file named `platform` which contains a single line describing the details of the build platform, e.g., `macosx-14.3-arm64-3.12` or `linux-x86_64-3.13`.

make profile-opt

Build Python using profile-guided optimization (PGO). You can use the configure *`--enable-optimizations`* option to make this the default target of the `make` command (`make all` or just `make`).

make clean

Remove built files.

make distclean

In addition to the work done by `make clean`, remove files created by the configure script. `configure` will have to be run before building again.[1]

make install

Build the `all` target and install Python.

[1] `git clean -fdx` is an even more extreme way to "clean" your checkout. It removes all files not known to Git. When bug hunting using `git bisect`, this is recommended between probes to guarantee a completely clean build. **Use with care**, as it will delete all files not checked into Git, including your new, uncommitted work.

make test

Build the `all` target and run the Python test suite with the `--fast-ci` option. Variables:

- `TESTOPTS`: additional regrtest command-line options.
- `TESTPYTHONOPTS`: additional Python command-line options.
- `TESTTIMEOUT`: timeout in seconds (default: 10 minutes).

make buildbottest

This is similar to `make test`, but uses the `--slow-ci` option and default timeout of 20 minutes, instead of `--fast-ci` option.

make regen-all

Regenerate (almost) all generated files. These include (but are not limited to) bytecode cases, and parser generator file. `make regen-stdlib-module-names` and `autoconf` must be run separately for the remaining *generated files*.

3.4.4 C extensions

Some C extensions are built as built-in modules, like the `sys` module. They are built with the `Py_BUILD_CORE_BUILTIN` macro defined. Built-in modules have no `__file__` attribute:

```
>>> import sys
>>> sys
<module 'sys' (built-in)>
>>> sys.__file__
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
AttributeError: module 'sys' has no attribute '__file__'
```

Other C extensions are built as dynamic libraries, like the `_asyncio` module. They are built with the `Py_BUILD_CORE_MODULE` macro defined. Example on Linux x86-64:

```
>>> import _asyncio
>>> _asyncio
<module '_asyncio' from '/usr/lib64/python3.9/lib-dynload/_asyncio.cpython-39-x86_
↪64-linux-gnu.so'>
>>> _asyncio.__file__
'/usr/lib64/python3.9/lib-dynload/_asyncio.cpython-39-x86_64-linux-gnu.so'
```

`Modules/Setup` is used to generate Makefile targets to build C extensions. At the beginning of the files, C extensions are built as built-in modules. Extensions defined after the `*shared*` marker are built as dynamic libraries.

The `PyAPI_FUNC()`, `PyAPI_DATA()` and `PyMODINIT_FUNC` macros of `Include/exports.h` are defined differently depending if the `Py_BUILD_CORE_MODULE` macro is defined:

- Use `Py_EXPORTED_SYMBOL` if the `Py_BUILD_CORE_MODULE` is defined
- Use `Py_IMPORTED_SYMBOL` otherwise.

If the `Py_BUILD_CORE_BUILTIN` macro is used by mistake on a C extension built as a shared library, its `PyInit_xxx()` function is not exported, causing an `ImportError` on import.

3.5 Compiler and linker flags

Options set by the `./configure` script and environment variables and used by `Makefile`.

3.5.1 Preprocessor flags

CONFIGURE_CPPFLAGS

Value of *CPPFLAGS* variable passed to the `./configure` script.

Added in version 3.6.

CPPFLAGS

(Objective) C/C++ preprocessor flags, e.g. `-I`*include_dir* if you have headers in a nonstandard directory *include_dir*.

Both *CPPFLAGS* and *LDFLAGS* need to contain the shell's value to be able to build extension modules using the directories specified in the environment variables.

BASECPPFLAGS

Added in version 3.4.

PY_CPPFLAGS

Extra preprocessor flags added for building the interpreter object files.

Default: `$(BASECPPFLAGS) -I. -I$(srcdir)/Include $(CONFIGURE_CPPFLAGS) $(CPPFLAGS)`.

Added in version 3.2.

3.5.2 Compiler flags

CC

C compiler command.

Example: `gcc -pthread`.

CXX

C++ compiler command.

Example: `g++ -pthread`.

CFLAGS

C compiler flags.

CFLAGS_NODIST

CFLAGS_NODIST is used for building the interpreter and stdlib C extensions. Use it when a compiler flag should *not* be part of *CFLAGS* once Python is installed (gh-65320).

In particular, *CFLAGS* should not contain:

- the compiler flag `-I` (for setting the search path for include files). The `-I` flags are processed from left to right, and any flags in *CFLAGS* would take precedence over user- and package-supplied `-I` flags.
- hardening flags such as `-Werror` because distributions cannot control whether packages installed by users conform to such heightened standards.

Added in version 3.5.

COMPILEALL_OPTS

Options passed to the `compileall` command line when building PYC files in `make install`. Default: `-j0`.

Added in version 3.12.

EXTRA_CFLAGS

Extra C compiler flags.

CONFIGURE_CFLAGS

Value of *CFLAGS* variable passed to the `./configure` script.

Added in version 3.2.

CONFIGURE_CFLAGS_NODIST

Value of *CFLAGS_NODIST* variable passed to the `./configure` script.

Added in version 3.5.

BASECFLAGS

Base compiler flags.

OPT

Optimization flags.

CFLAGS_ALIASING

Strict or non-strict aliasing flags used to compile `Python/dtoa.c`.

Added in version 3.7.

CCSHARED

Compiler flags used to build a shared library.

For example, `-fPIC` is used on Linux and on BSD.

CFLAGSFORSHARED

Extra C flags added for building the interpreter object files.

Default: `$(CCSHARED)` when *--enable-shared* is used, or an empty string otherwise.

PY_CFLAGS

Default: `$(BASECFLAGS) $(OPT) $(CONFIGURE_CFLAGS) $(CFLAGS) $(EXTRA_CFLAGS)`.

PY_CFLAGS_NODIST

Default: `$(CONFIGURE_CFLAGS_NODIST) $(CFLAGS_NODIST) -I$(srcdir)/Include/internal`.

Added in version 3.5.

PY_STDMODULE_CFLAGS

C flags used for building the interpreter object files.

Default: `$(PY_CFLAGS) $(PY_CFLAGS_NODIST) $(PY_CPPFLAGS) $(CFLAGSFORSHARED)`.

Added in version 3.7.

PY_CORE_CFLAGS

Default: `$(PY_STDMODULE_CFLAGS) -DPy_BUILD_CORE`.

Added in version 3.2.

PY_BUILTIN_MODULE_CFLAGS

Compiler flags to build a standard library extension module as a built-in module, like the `posix` module.

Default: `$(PY_STDMODULE_CFLAGS) -DPy_BUILD_CORE_BUILTIN`.

Added in version 3.8.

PURIFY

Purify command. Purify is a memory debugger program.

Default: empty string (not used).

3.5.3 Linker flags

LINKCC

Linker command used to build programs like `python` and `_testembed`.

Default: `$(PURIFY) $(CC)`.

CONFIGURE_LDFLAGS

Value of *LDFLAGS* variable passed to the `./configure` script.

Avoid assigning *CFLAGS*, *LDFLAGS*, etc. so users can use them on the command line to append to these values without stomping the pre-set values.

Added in version 3.2.

LDFLAGS_NODIST

LDFLAGS_NODIST is used in the same manner as *CFLAGS_NODIST*. Use it when a linker flag should *not* be part of *LDFLAGS* once Python is installed (gh-65320).

In particular, *LDFLAGS* should not contain:

- the compiler flag `-L` (for setting the search path for libraries). The `-L` flags are processed from left to right, and any flags in *LDFLAGS* would take precedence over user- and package-supplied `-L` flags.

CONFIGURE_LDFLAGS_NODIST

Value of *LDFLAGS_NODIST* variable passed to the `./configure` script.

Added in version 3.8.

LDFLAGS

Linker flags, e.g. `-L`*lib_dir* if you have libraries in a nonstandard directory *lib_dir*.

Both *CPPFLAGS* and *LDFLAGS* need to contain the shell's value to be able to build extension modules using the directories specified in the environment variables.

LIBS

Linker flags to pass libraries to the linker when linking the Python executable.

Example: `-lrt`.

LDSHARED

Command to build a shared library.

Default: `@LDSHARED@ $(PY_LDFLAGS)`.

BLDSHARED

Command to build `libpython` shared library.

Default: `@BLDSHARED@ $(PY_CORE_LDFLAGS)`.

PY_LDFLAGS

Default: `$(CONFIGURE_LDFLAGS) $(LDFLAGS)`.

PY_LDFLAGS_NODIST

Default: `$(CONFIGURE_LDFLAGS_NODIST) $(LDFLAGS_NODIST)`.

Added in version 3.8.

PY_CORE_LDFLAGS

Linker flags used for building the interpreter object files.

Added in version 3.8.

BÖLÜM 4

Using Python on Windows

This document aims to give an overview of Windows-specific behaviour you should know about when using Python on Microsoft Windows.

Unlike most Unix systems and services, Windows does not include a system supported installation of Python. To make Python available, the CPython team has compiled Windows installers with every release for many years. These installers are primarily intended to add a per-user installation of Python, with the core interpreter and library being used by a single user. The installer is also able to install for all users of a single machine, and a separate ZIP file is available for application-local distributions.

As specified in **PEP 11**, a Python release only supports a Windows platform while Microsoft considers the platform under extended support. This means that Python 3.13 supports Windows 8.1 and newer. If you require Windows 7 support, please install Python 3.8.

There are a number of different installers available for Windows, each with certain benefits and downsides.

The full installer contains all components and is the best option for developers using Python for any kind of project.

The Microsoft Store package is a simple installation of Python that is suitable for running scripts and packages, and using IDLE or other development environments. It requires Windows 10 and above, but can be safely installed without corrupting other programs. It also provides many convenient commands for launching Python and its tools.

The nuget.org packages are lightweight installations intended for continuous integration systems. It can be used to build Python packages or run scripts, but is not updateable and has no user interface tools.

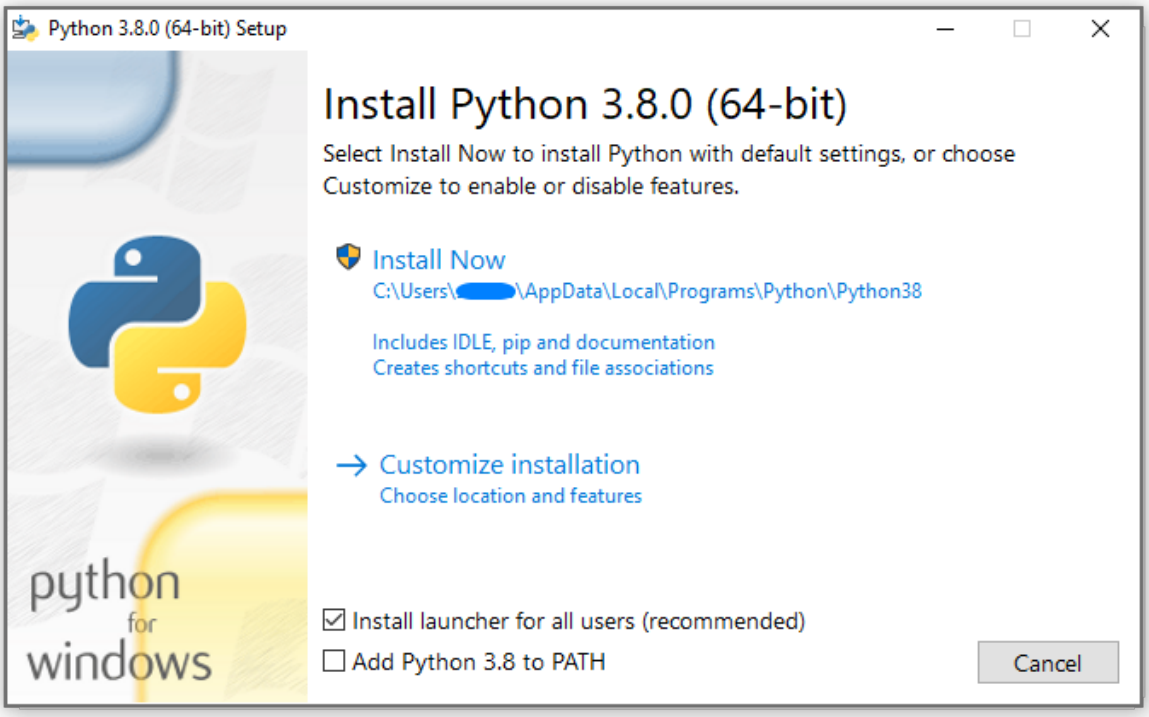
The embeddable package is a minimal package of Python suitable for embedding into a larger application.

4.1 The full installer

4.1.1 Installation steps

Four Python 3.13 installers are available for download - two each for the 32-bit and 64-bit versions of the interpreter. The *web installer* is a small initial download, and it will automatically download the required components as necessary. The *offline installer* includes the components necessary for a default installation and only requires an internet connection for optional features. See *Installing Without Downloading* for other ways to avoid downloading during installation.

After starting the installer, one of two options may be selected:



If you select “Install Now”:

- You will *not* need to be an administrator (unless a system update for the C Runtime Library is required or you install the *Python Launcher for Windows* for all users)
- Python will be installed into your user directory
- The *Python Launcher for Windows* will be installed according to the option at the bottom of the first page
- The standard library, test suite, launcher and pip will be installed
- If selected, the install directory will be added to your `PATH`
- Shortcuts will only be visible for the current user

Selecting “Customize installation” will allow you to select the features to install, the installation location and other options or post-install actions. To install debugging symbols or binaries, you will need to use this option.

To perform an all-users installation, you should select “Customize installation”. In this case:

- You may be required to provide administrative credentials or approval
- Python will be installed into the Program Files directory
- The *Python Launcher for Windows* will be installed into the Windows directory
- Optional features may be selected during installation
- The standard library can be pre-compiled to bytecode
- If selected, the install directory will be added to the system `PATH`
- Shortcuts are available for all users

4.1.2 Removing the MAX_PATH Limitation

Windows historically has limited path lengths to 260 characters. This meant that paths longer than this would not resolve and errors would result.

In the latest versions of Windows, this limitation can be expanded to approximately 32,000 characters. Your administrator will need to activate the "Enable Win32 long paths" group policy, or set `LongPathsEnabled` to `1` in the registry key `HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\FileSystem`.

This allows the `open()` function, the `os` module and most other path functionality to accept and return paths longer than 260 characters.

After changing the above option, no further configuration is required.

3.6 sürümünde değişti: Support for long paths was enabled in Python.

4.1.3 Installing Without UI

All of the options available in the installer UI can also be specified from the command line, allowing scripted installers to replicate an installation on many machines without user interaction. These options may also be set without suppressing the UI in order to change some of the defaults.

The following options (found by executing the installer with `/?`) can be passed into the installer:

Name	Description
/passive	to display progress without requiring user interaction
/quiet	to install/uninstall without displaying any UI
/simple	to prevent user customization
/uninstall	to remove Python (without confirmation)
/layout [directory]	to pre-download all components
/log [filename]	to specify log files location

All other options are passed as `name =value`, where the value is usually `0` to disable a feature, `1` to enable a feature, or a path. The full list of available options is shown below.

Name	Description	Default
InstallAllUsers	Perform a system-wide installation.	0
TargetDir	The installation directory	Selected based on InstallAllUsers
DefaultAllUsersTargetDir	The default installation directory for all-user installs	`%ProgramFiles%\Python X.Y` or `%ProgramFiles(x86)%\Python X.Y`
DefaultJustForMeTargetDir	The default install directory for just-for-me installs	`%LocalAppData%\Programs\Python\PythonXY` or `%LocalAppData%\Programs\Python\PythonXY-32` or `%LocalAppData%\Programs\Python\PythonXY-64`
DefaultCustomTargetDir	The default custom install directory displayed in the UI	(empty)
AssociateFiles	Create file associations if the launcher is also installed.	1
CompileAll	Compile all `.py` files to `.pyc`.	0
PrependPath	Prepend install and Scripts directories to `PATH` and add `.PY` to `PATHEXT`	0
AppendPath	Append install and Scripts directories to `PATH` and add `.PY` to `PATHEXT`	0
Shortcuts	Create shortcuts for the interpreter, documentation and IDLE if installed.	1
Include_doc	Install Python manual	1
Include_debug	Install debug binaries	0
Include_dev	Install developer headers and libraries. Omitting this may lead to an unusable installation.	1
Include_exe	Install `python.exe` and related files. Omitting this may lead to an unusable installation.	1
Include_launche	Install *Python Launcher for Windows*.	1
InstallLauncherAllUsers	Installs the launcher for all users. Also requires `Include_launcher` to be set to 1	1
Include_lib	Install standard library and extension modules. Omitting this may lead to an unusable installation.	1
Include_pip	Install bundled pip and setuptools	1
Include_symbols	Install debugging symbols (`*.pdb`)	0
Include_tcltk	Install Tcl/Tk support and IDLE	1
Include_test	Install standard library test suite	1
Include_tools	Install utility scripts	1
LauncherOnly	Only installs the launcher. This will override most other options.	0
SimpleInstall	Disable most install UI	0
Simple-	A custom message to display when	(empty)

For example, to silently install a default, system-wide Python installation, you could use the following command (from an elevated command prompt):

```
python-3.9.0.exe /quiet InstallAllUsers =1 PrependPath =1 Include_test =0
```

To allow users to easily install a personal copy of Python without the test suite, you could provide a shortcut with the following command. This will display a simplified initial page and disallow customization:

```
python-3.9.0.exe InstallAllUsers =0 Include_launcher =0 Include_test =0
    SimpleInstall =1 SimpleInstallDescription ="Just for me, no test suite."
```

(Note that omitting the launcher also omits file associations, and is only recommended for per-user installs when there is also a system-wide installation that included the launcher.)

The options listed above can also be provided in a file named `unattend.xml` alongside the executable. This file specifies a list of options and values. When a value is provided as an attribute, it will be converted to a number if possible. Values provided as element text are always left as strings. This example file sets the same options as the previous example:

```
<Options>
    <Option Name ="InstallAllUsers" Value ="no" />
    <Option Name ="Include_launcher" Value ="0" />
    <Option Name ="Include_test" Value ="no" />
    <Option Name ="SimpleInstall" Value ="yes" />
    <Option Name ="SimpleInstallDescription">Just for me, no test suite</Option>
</Options>
```

4.1.4 Installing Without Downloading

As some features of Python are not included in the initial installer download, selecting those features may require an internet connection. To avoid this need, all possible components may be downloaded on-demand to create a complete *layout* that will no longer require an internet connection regardless of the selected features. Note that this download may be bigger than required, but where a large number of installations are going to be performed it is very useful to have a locally cached copy.

Execute the following command from Command Prompt to download all possible required files. Remember to substitute `python-3.9.0.exe` for the actual name of your installer, and to create layouts in their own directories to avoid collisions between files with the same name.

```
python-3.9.0.exe /layout [optional target directory]
```

You may also specify the `/quiet` option to hide the progress display.

4.1.5 Modifying an install

Once Python has been installed, you can add or remove features through the Programs and Features tool that is part of Windows. Select the Python entry and choose “Uninstall/Change” to open the installer in maintenance mode.

“Modify” allows you to add or remove features by modifying the checkboxes - unchanged checkboxes will not install or remove anything. Some options cannot be changed in this mode, such as the install directory; to modify these, you will need to remove and then reinstall Python completely.

“Repair” will verify all the files that should be installed using the current settings and replace any that have been removed or modified.

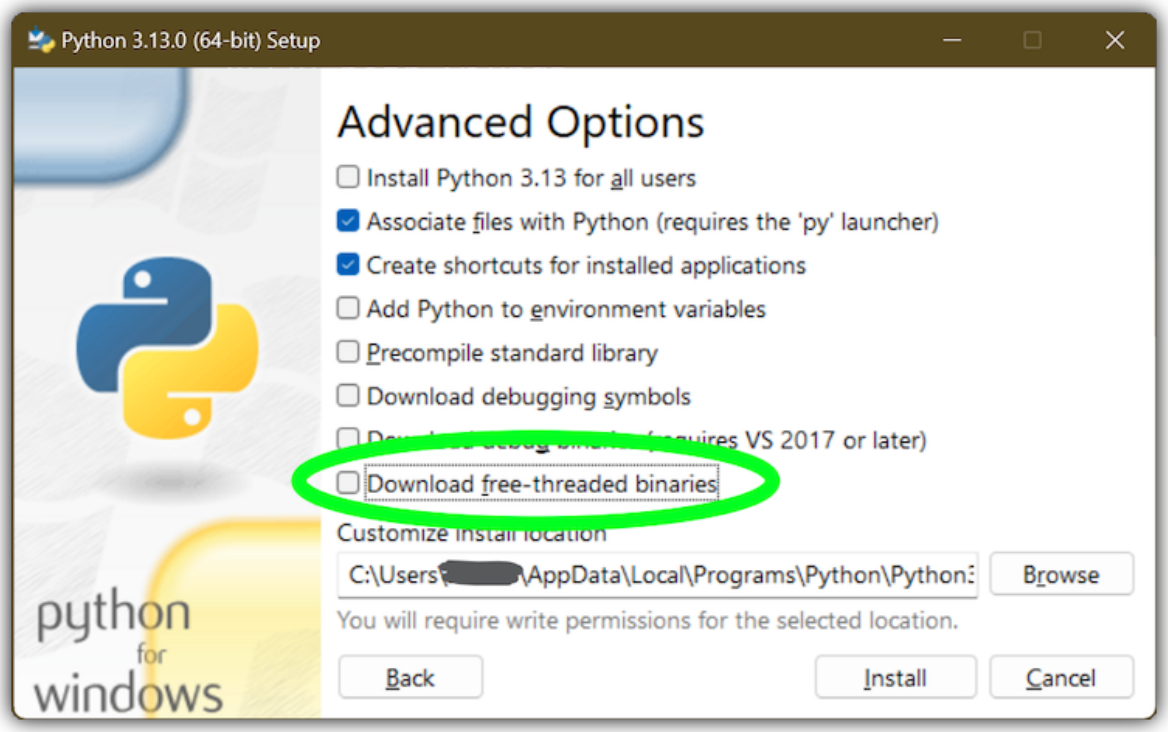
“Uninstall” will remove Python entirely, with the exception of the *Python Launcher for Windows*, which has its own entry in Programs and Features.

4.1.6 Installing Free-threaded Binaries

Added in version 3.13: (Experimental)

> **Not**
>
> Everything described in this section is considered experimental, and should be expected to change in future releases.

To install pre-built binaries with free-threading enabled (see **PEP 703**), you should select “Customize installation”. The second page of options includes the “Download free-threaded binaries” checkbox.



Selecting this option will download and install additional binaries to the same location as the main Python install. The main executable is called `python3.13t.exe`, and other binaries either receive a `t` suffix or a full ABI suffix. Python source files and bundled third-party dependencies are shared with the main install.

The free-threaded version is registered as a regular Python install with the tag `3.13t` (with a `-32` or `-arm64` suffix as normal for those platforms). This allows tools to discover it, and for the *Python Launcher for Windows* to support `py.exe -3.13t`. Note that the launcher will interpret `py.exe -3` (or a `python3` shebang) as “the latest 3.x install”, which will prefer the free-threaded binaries over the regular ones, while `py.exe -3.13` will not. If you use the short style of option, you may prefer to not install the free-threaded binaries at this time.

To specify the install option at the command line, use `Include_freethreaded=1`. See *Installing Without Downloading* for instructions on pre-emptively downloading the additional binaries for offline install. The options to include debug symbols and binaries also apply to the free-threaded builds.

Free-threaded binaries are also available *on nuget.org*.

4.2 The Microsoft Store package

Added in version 3.7.2.

The Microsoft Store package is an easily installable Python interpreter that is intended mainly for interactive use, for example, by students.

To install the package, ensure you have the latest Windows 10 updates and search the Microsoft Store app for "Python 3.13". Ensure that the app you select is published by the Python Software Foundation, and install it.

> **Uyarı**
>
> Python will always be available for free on the Microsoft Store. If you are asked to pay for it, you have not selected the correct package.

After installation, Python may be launched by finding it in Start. Alternatively, it will be available from any Command Prompt or PowerShell session by typing `python`. Further, pip and IDLE may be used by typing `pip` or `idle`. IDLE can also be found in Start.

All three commands are also available with version number suffixes, for example, as `python3.exe` and `python3.x.exe` as well as `python.exe` (where `3.x` is the specific version you want to launch, such as 3.13). Open "Manage App Execution Aliases" through Start to select which version of Python is associated with each command. It is recommended to make sure that `pip` and `idle` are consistent with whichever version of `python` is selected.

Virtual environments can be created with `python -m venv` and activated and used as normal.

If you have installed another version of Python and added it to your `PATH` variable, it will be available as `python.exe` rather than the one from the Microsoft Store. To access the new installation, use `python3.exe` or `python3.x.exe`.

The `py.exe` launcher will detect this Python installation, but will prefer installations from the traditional installer.

To remove Python, open Settings and use Apps and Features, or else find Python in Start and right-click to select Uninstall. Uninstalling will remove all packages you installed directly into this Python installation, but will not remove any virtual environments

4.2.1 Known issues

Redirection of local data, registry, and temporary paths

Because of restrictions on Microsoft Store apps, Python scripts may not have full write access to shared locations such as `TEMP` and the registry. Instead, it will write to a private copy. If your scripts must modify the shared locations, you will need to install the full installer.

At runtime, Python will use a private copy of well-known Windows folders and the registry. For example, if the environment variable `%APPDATA%` is `c:\Users\<user>\AppData\`, then when writing to `C:\Users\<user>\AppData\Local` will write to `C:\Users\<user>\AppData\Local\Packages\PythonSoftwareFoundation.Python.3.8_qbz5n2kfra8p0\LocalCache\Local\`.

When reading files, Windows will return the file from the private folder, or if that does not exist, the real Windows directory. For example reading `C:\Windows\System32` returns the contents of `C:\Windows\System32` plus the contents of `C:\Program Files\WindowsApps\package_name\VFS\SystemX86`.

You can find the real path of any existing file using `os.path.realpath()`:

```
>>> import os
>>> test_file = 'C:\\Users\\example\\AppData\\Local\\test.txt'
>>> os.path.realpath(test_file)
'C:\\Users\\example\\AppData\\Local\\Packages\\PythonSoftwareFoundation.Python.3.8_
↪qbz5n2kfra8p0\\LocalCache\\Local\\test.txt'
```

When writing to the Windows Registry, the following behaviors exist:

- Reading from `HKLM\\Software` is allowed and results are merged with the `registry.dat` file in the package.
- Writing to `HKLM\\Software` is not allowed if the corresponding key/value exists, i.e. modifying existing keys.
- Writing to `HKLM\\Software` is allowed as long as a corresponding key/value does not exist in the package and the user has the correct access permissions.

For more detail on the technical basis for these limitations, please consult Microsoft's documentation on packaged full-trust apps, currently available at docs.microsoft.com/en-us/windows/msix/desktop/desktop-to-uwp-behind-the-scenes

4.3 The nuget.org packages

Added in version 3.5.2.

The nuget.org package is a reduced size Python environment intended for use on continuous integration and build systems that do not have a system-wide install of Python. While nuget is "the package manager for .NET", it also works perfectly fine for packages containing build-time tools.

Visit nuget.org for the most up-to-date information on using nuget. What follows is a summary that is sufficient for Python developers.

The `nuget.exe` command line tool may be downloaded directly from `https://aka.ms/nugetclidl`, for example, using curl or PowerShell. With the tool, the latest version of Python for 64-bit or 32-bit machines is installed using:

```
nuget.exe install python -ExcludeVersion -OutputDirectory .
nuget.exe install pythonx86 -ExcludeVersion -OutputDirectory .
```

To select a particular version, add a `-Version 3.x.y`. The output directory may be changed from `.`, and the package will be installed into a subdirectory. By default, the subdirectory is named the same as the package, and without the `-ExcludeVersion` option this name will include the specific version installed. Inside the subdirectory is a `tools` directory that contains the Python installation:

```
# Without -ExcludeVersion
> .\python.3.5.2\tools\python.exe -V
Python 3.5.2

# With -ExcludeVersion
> .\python\tools\python.exe -V
Python 3.5.2
```

In general, nuget packages are not upgradeable, and newer versions should be installed side-by-side and referenced using the full path. Alternatively, delete the package directory manually and install it again. Many CI systems will do this automatically if they do not preserve files between builds.

Alongside the `tools` directory is a `build\native` directory. This contains a MSBuild properties file `python.props` that can be used in a C++ project to reference the Python install. Including the settings will automatically use the headers and import libraries in your build.

The package information pages on nuget.org are www.nuget.org/packages/python for the 64-bit version, www.nuget.org/packages/pythonx86 for the 32-bit version, and www.nuget.org/packages/pythonarm64 for the ARM64 version

4.3.1 Free-threaded packages

Added in version 3.13: (Experimental)

> **Not**
>
> Everything described in this section is considered experimental, and should be expected to change in future releases.

Packages containing free-threaded binaries are named python-freethreaded for the 64-bit version, pythonx86-freethreaded for the 32-bit version, and pythonarm64-freethreaded for the ARM64 version. These packages contain both the `python3.13t.exe` and `python.exe` entry points, both of which run free threaded.

4.4 The embeddable package

Added in version 3.5.

The embedded distribution is a ZIP file containing a minimal Python environment. It is intended for acting as part of another application, rather than being directly accessed by end-users.

When extracted, the embedded distribution is (almost) fully isolated from the user's system, including environment variables, system registry settings, and installed packages. The standard library is included as pre-compiled and optimized `.pyc` files in a ZIP, and `python3.dll`, `python37.dll`, `python.exe` and `pythonw.exe` are all provided. Tcl/tk (including all dependents, such as Idle), pip and the Python documentation are not included.

> **Not**
>
> The embedded distribution does not include the Microsoft C Runtime and it is the responsibility of the application installer to provide this. The runtime may have already been installed on a user's system previously or automatically via Windows Update, and can be detected by finding `ucrtbase.dll` in the system directory.

Third-party packages should be installed by the application installer alongside the embedded distribution. Using pip to manage dependencies as for a regular Python installation is not supported with this distribution, though with some care it may be possible to include and use pip for automatic updates. In general, third-party packages should be treated as part of the application ("vendoring") so that the developer can ensure compatibility with newer versions before providing updates to users.

The two recommended use cases for this distribution are described below.

4.4.1 Python Application

An application written in Python does not necessarily require users to be aware of that fact. The embedded distribution may be used in this case to include a private version of Python in an install package. Depending on how transparent it should be (or conversely, how professional it should appear), there are two options.

Using a specialized executable as a launcher requires some coding, but provides the most transparent experience for users. With a customized launcher, there are no obvious indications that the program is running on Python: icons can be customized, company and version information can be specified, and file associations behave properly. In most cases, a custom launcher should simply be able to call `Py_Main` with a hard-coded command line.

The simpler approach is to provide a batch file or generated shortcut that directly calls the `python.exe` or `pythonw.exe` with the required command-line arguments. In this case, the application will appear to be Python and not its actual name, and users may have trouble distinguishing it from other running Python processes or file associations.

With the latter approach, packages should be installed as directories alongside the Python executable to ensure they are available on the path. With the specialized launcher, packages can be located in other locations as there is an opportunity to specify the search path before launching the application.

4.4.2 Embedding Python

Applications written in native code often require some form of scripting language, and the embedded Python distribution can be used for this purpose. In general, the majority of the application is in native code, and some part will either invoke `python.exe` or directly use `python3.dll`. For either case, extracting the embedded distribution to a subdirectory of the application installation is sufficient to provide a loadable Python interpreter.

As with the application use, packages can be installed to any location as there is an opportunity to specify search paths before initializing the interpreter. Otherwise, there is no fundamental differences between using the embedded distribution and a regular installation.

4.5 Alternative bundles

Besides the standard CPython distribution, there are modified packages including additional functionality. The following is a list of popular versions and their key features:

ActivePython
: Installer with multi-platform compatibility, documentation, PyWin32

Anaconda
: Popular scientific modules (such as numpy, scipy and pandas) and the `conda` package manager.

Enthought Deployment Manager
: "The Next Generation Python Environment and Package Manager".

  Previously Enthought provided Canopy, but it reached end of life in 2016.

WinPython
: Windows-specific distribution with prebuilt scientific packages and tools for building packages.

Note that these packages may not include the latest versions of Python or other libraries, and are not maintained or supported by the core Python team.

4.6 Configuring Python

To run Python conveniently from a command prompt, you might consider changing some default environment variables in Windows. While the installer provides an option to configure the PATH and PATHEXT variables for you, this is only reliable for a single, system-wide installation. If you regularly use multiple versions of Python, consider using the *Python Launcher for Windows*.

4.6.1 Excursus: Setting environment variables

Windows allows environment variables to be configured permanently at both the User level and the System level, or temporarily in a command prompt.

To temporarily set environment variables, open Command Prompt and use the **`set`** command:

```
C:\>set PATH=C:\Program Files\Python 3.9;%PATH%
C:\>set PYTHONPATH=%PYTHONPATH%;C:\My_python_lib
C:\>python
```

These changes will apply to any further commands executed in that console, and will be inherited by any applications started from the console.

Including the variable name within percent signs will expand to the existing value, allowing you to add your new value at either the start or the end. Modifying `PATH` by adding the directory containing **`python.exe`** to the start is a common way to ensure the correct version of Python is launched.

To permanently modify the default environment variables, click Start and search for 'edit environment variables', or open System properties, *Advanced system settings* and click the *Environment Variables* button. In this dialog, you can add or modify User and System variables. To change System variables, you need non-restricted access to your machine (i.e. Administrator rights).

Not

Windows will concatenate User variables *after* System variables, which may cause unexpected results when modifying `PATH`.

The *`PYTHONPATH`* variable is used by all versions of Python, so you should not permanently configure it unless the listed paths only include code that is compatible with all of your installed Python versions.

Ayrıca bakınız

https://learn.microsoft.com/windows/win32/procthread/environment-variables
Overview of environment variables on Windows

https://learn.microsoft.com/windows-server/administration/windows-commands/set_1
The `set` command, for temporarily modifying environment variables

https://learn.microsoft.com/windows-server/administration/windows-commands/setx
The `setx` command, for permanently modifying environment variables

4.6.2 Finding the Python executable

3.5 sürümünde değişti.

Besides using the automatically created start menu entry for the Python interpreter, you might want to start Python in the command prompt. The installer has an option to set that up for you.

On the first page of the installer, an option labelled "Add Python to PATH" may be selected to have the installer add the install location into the `PATH`. The location of the `Scripts\` folder is also added. This allows you to type **`python`** to run the interpreter, and **`pip`** for the package installer. Thus, you can also execute your scripts with command line options, see *Command line* documentation.

If you don't enable this option at install time, you can always re-run the installer, select Modify, and enable it. Alternatively, you can manually modify the `PATH` using the directions in *Excursus: Setting environment variables*. You need to set your `PATH` environment variable to include the directory of your Python installation, delimited by a semicolon from other entries. An example variable could look like this (assuming the first two entries already existed):

```
C:\WINDOWS\system32;C:\WINDOWS;C:\Program Files\Python 3.9
```

4.7 UTF-8 mode

Added in version 3.7.

Windows still uses legacy encodings for the system encoding (the ANSI Code Page). Python uses it for the default encoding of text files (e.g. `locale.getencoding()`).

This may cause issues because UTF-8 is widely used on the internet and most Unix systems, including WSL (Windows Subsystem for Linux).

You can use the Python UTF-8 Mode to change the default text encoding to UTF-8. You can enable the Python UTF-8 Mode via the `-X utf8` command line option, or the `PYTHONUTF8 =1` environment variable. See *`PYTHONUTF8`* for enabling UTF-8 mode, and *Excursus: Setting environment variables* for how to modify environment variables.

When the Python UTF-8 Mode is enabled, you can still use the system encoding (the ANSI Code Page) via the "mbcs" codec.

Note that adding `PYTHONUTF8 =1` to the default environment variables will affect all Python 3.7+ applications on your system. If you have any Python 3.7+ applications which rely on the legacy system encoding, it is recommended to set the environment variable temporarily or use the `-X utf8` command line option.

Not

Even when UTF-8 mode is disabled, Python uses UTF-8 by default on Windows for:

- Console I/O including standard I/O (see **PEP 528** for details).
- The *filesystem encoding* (see **PEP 529** for details).

4.8 Python Launcher for Windows

Added in version 3.3.

The Python launcher for Windows is a utility which aids in locating and executing of different Python versions. It allows scripts (or the command-line) to indicate a preference for a specific Python version, and will locate and execute that version.

Unlike the `PATH` variable, the launcher will correctly select the most appropriate version of Python. It will prefer per-user installations over system-wide ones, and orders by language version rather than using the most recently installed version.

The launcher was originally specified in **PEP 397**.

4.8.1 Getting started

From the command-line

3.6 sürümünde değişti.

System-wide installations of Python 3.3 and later will put the launcher on your `PATH`. The launcher is compatible with all available versions of Python, so it does not matter which version is installed. To check that the launcher is available, execute the following command in Command Prompt:

```
py
```

You should find that the latest version of Python you have installed is started - it can be exited as normal, and any additional command-line arguments specified will be sent directly to Python.

If you have multiple versions of Python installed (e.g., 3.7 and 3.13) you will have noticed that Python 3.13 was started - to launch Python 3.7, try the command:

```
py -3.7
```

If you want the latest version of Python 2 you have installed, try the command:

```
py -2
```

If you see the following error, you do not have the launcher installed:

```
'py' is not recognized as an internal or external command,
operable program or batch file.
```

The command:

```
py --list
```

displays the currently installed version(s) of Python.

The `-x.y` argument is the short form of the `-V:Company/Tag` argument, which allows selecting a specific Python runtime, including those that may have come from somewhere other than python.org. Any runtime registered by following **PEP 514** will be discoverable. The `--list` command lists all available runtimes using the `-V:` format.

When using the `-V:` argument, specifying the Company will limit selection to runtimes from that provider, while specifying only the Tag will select from all providers. Note that omitting the slash implies a tag:

```
# Select any '3.*' tagged runtime
py -V:3

# Select any 'PythonCore' released runtime
py -V:PythonCore/
```

(sonraki sayfaya devam)

(önceki sayfadan devam)

```
# Select PythonCore's latest Python 3 runtime
py -V:PythonCore/3
```

The short form of the argument (`-3`) only ever selects from core Python releases, and not other distributions. However, the longer form (`-V:3`) will select from any.

The Company is matched on the full string, case-insensitive. The Tag is matched on either the full string, or a prefix, provided the next character is a dot or a hyphen. This allows `-V:3.1` to match `3.1-32`, but not `3.10`. Tags are sorted using numerical ordering (`3.10` is newer than `3.1`), but are compared using text (`-V:3.01` does not match `3.1`).

Virtual environments

Added in version 3.5.

If the launcher is run with no explicit Python version specification, and a virtual environment (created with the standard library `venv` module or the external `virtualenv` tool) active, the launcher will run the virtual environment's interpreter rather than the global one. To run the global interpreter, either deactivate the virtual environment, or explicitly specify the global Python version.

From a script

Let's create a test Python script - create a file called `hello.py` with the following contents

```
#! python
import sys
sys.stdout.write("hello from Python %s\n" % (sys.version,))
```

From the directory in which hello.py lives, execute the command:

```
py hello.py
```

You should notice the version number of your latest Python 2.x installation is printed. Now try changing the first line to be:

```
#! python3
```

Re-executing the command should now print the latest Python 3.x information. As with the above command-line examples, you can specify a more explicit version qualifier. Assuming you have Python 3.7 installed, try changing the first line to `#! python3.7` and you should find the 3.7 version information printed.

Note that unlike interactive use, a bare "python" will use the latest version of Python 2.x that you have installed. This is for backward compatibility and for compatibility with Unix, where the command `python` typically refers to Python 2.

From file associations

The launcher should have been associated with Python files (i.e. `.py`, `.pyw`, `.pyc` files) when it was installed. This means that when you double-click on one of these files from Windows explorer the launcher will be used, and therefore you can use the same facilities described above to have the script specify the version which should be used.

The key benefit of this is that a single launcher can support multiple Python versions at the same time depending on the contents of the first line.

4.8.2 Shebang Lines

If the first line of a script file starts with `#!`, it is known as a "shebang" line. Linux and other Unix like operating systems have native support for such lines and they are commonly used on such systems to indicate how a script should be executed. This launcher allows the same facilities to be used with Python scripts on Windows and the examples above demonstrate their use.

To allow shebang lines in Python scripts to be portable between Unix and Windows, this launcher supports a number of 'virtual' commands to specify which interpreter to use. The supported virtual commands are:

- `/usr/bin/env`
- `/usr/bin/python`
- `/usr/local/bin/python`
- `python`

For example, if the first line of your script starts with

```
#! /usr/bin/python
```

The default Python or an active virtual environment will be located and used. As many Python scripts written to work on Unix will already have this line, you should find these scripts can be used by the launcher without modification. If you are writing a new script on Windows which you hope will be useful on Unix, you should use one of the shebang lines starting with `/usr`.

Any of the above virtual commands can be suffixed with an explicit version (either just the major version, or the major and minor version). Furthermore the 32-bit version can be requested by adding "-32" after the minor version. I.e. `/usr/bin/python3.7-32` will request usage of the 32-bit Python 3.7. If a virtual environment is active, the version will be ignored and the environment will be used.

Added in version 3.7: Beginning with python launcher 3.7 it is possible to request 64-bit version by the "-64" suffix. Furthermore it is possible to specify a major and architecture without minor (i.e. `/usr/bin/python3-64`).

3.11 sürümünde değişti: The "-64" suffix is deprecated, and now implies "any architecture that is not provably i386/32-bit". To request a specific environment, use the new `-V:`*`TAG`* argument with the complete tag.

3.13 sürümünde değişti: Virtual commands referencing `python` now prefer an active virtual environment rather than searching `PATH`. This handles cases where the shebang specifies `/usr/bin/env python3` but `python3.exe` is not present in the active environment.

The `/usr/bin/env` form of shebang line has one further special property. Before looking for installed Python interpreters, this form will search the executable `PATH` for a Python executable matching the name provided as the first argument. This corresponds to the behaviour of the Unix `env` program, which performs a `PATH` search. If an executable matching the first argument after the `env` command cannot be found, but the argument starts with `python`, it will be handled as described for the other virtual commands. The environment variable `PYLAUNCHER_NO_SEARCH_PATH` may be set (to any value) to skip this search of `PATH`.

Shebang lines that do not match any of these patterns are looked up in the `[commands]` section of the launcher's *.INI file*. This may be used to handle certain commands in a way that makes sense for your system. The name of the command must be a single argument (no spaces in the shebang executable), and the value substituted is the full path to the executable (additional arguments specified in the .INI will be quoted as part of the filename).

```
[commands]
/bin/xpython=C:\Program Files\XPython\python.exe
```

Any commands not found in the .INI file are treated as **Windows** executable paths that are absolute or relative to the directory containing the script file. This is a convenience for Windows-only scripts, such as those generated by an installer, since the behavior is not compatible with Unix-style shells. These paths may be quoted, and may include multiple arguments, after which the path to the script and any additional arguments will be appended.

4.8.3 Arguments in shebang lines

The shebang lines can also specify additional options to be passed to the Python interpreter. For example, if you have a shebang line:

```
#! /usr/bin/python -v
```

Then Python will be started with the `-v` option

4.8.4 Customization

Customization via INI files

Two .ini files will be searched by the launcher - `py.ini` in the current user's application data directory (`%LOCALAPPDATA%` or `$env:LocalAppData`) and `py.ini` in the same directory as the launcher. The same .ini files are used for both the 'console' version of the launcher (i.e. py.exe) and for the 'windows' version (i.e. pyw.exe).

Customization specified in the "application directory" will have precedence over the one next to the executable, so a user, who may not have write access to the .ini file next to the launcher, can override commands in that global .ini file.

Customizing default Python versions

In some cases, a version qualifier can be included in a command to dictate which version of Python will be used by the command. A version qualifier starts with a major version number and can optionally be followed by a period ('.') and a minor version specifier. Furthermore it is possible to specify if a 32 or 64 bit implementation shall be requested by adding "-32" or "-64".

For example, a shebang line of `#!python` has no version qualifier, while `#!python3` has a version qualifier which specifies only a major version.

If no version qualifiers are found in a command, the environment variable `PY_PYTHON` can be set to specify the default version qualifier. If it is not set, the default is "3". The variable can specify any value that may be passed on the command line, such as "3", "3.7", "3.7-32" or "3.7-64". (Note that the "-64" option is only available with the launcher included with Python 3.7 or newer.)

If no minor version qualifiers are found, the environment variable `PY_PYTHON{major}` (where `{major}` is the current major version qualifier as determined above) can be set to specify the full version. If no such option is found, the launcher will enumerate the installed Python versions and use the latest minor release found for the major version, which is likely, although not guaranteed, to be the most recently installed version in that family.

On 64-bit Windows with both 32-bit and 64-bit implementations of the same (major.minor) Python version installed, the 64-bit version will always be preferred. This will be true for both 32-bit and 64-bit implementations of the launcher - a 32-bit launcher will prefer to execute a 64-bit Python installation of the specified version if available. This is so the behavior of the launcher can be predicted knowing only what versions are installed on the PC and without regard to the order in which they were installed (i.e., without knowing whether a 32 or 64-bit version of Python and corresponding launcher was installed last). As noted above, an optional "-32" or "-64" suffix can be used on a version specifier to change this behaviour.

Examples:

- If no relevant options are set, the commands `python` and `python2` will use the latest Python 2.x version installed and the command `python3` will use the latest Python 3.x installed.
- The command `python3.7` will not consult any options at all as the versions are fully specified.
- If `PY_PYTHON =3`, the commands `python` and `python3` will both use the latest installed Python 3 version.
- If `PY_PYTHON =3.7-32`, the command `python` will use the 32-bit implementation of 3.7 whereas the command `python3` will use the latest installed Python (PY_PYTHON was not considered at all as a major version was specified.)
- If `PY_PYTHON =3` and `PY_PYTHON3 =3.7`, the commands `python` and `python3` will both use specifically 3.7

In addition to environment variables, the same settings can be configured in the .INI file used by the launcher. The section in the INI file is called `[defaults]` and the key name will be the same as the environment variables without the leading `PY_` prefix (and note that the key names in the INI file are case insensitive.) The contents of an environment variable will override things specified in the INI file.

For example:

- Setting `PY_PYTHON =3.7` is equivalent to the INI file containing:

```
[defaults]
python=3.7
```

- Setting `PY_PYTHON =3` and `PY_PYTHON3 =3.7` is equivalent to the INI file containing:

```
[defaults]
python=3
python3=3.7
```

4.8.5 Diagnostics

If an environment variable `PYLAUNCHER_DEBUG` is set (to any value), the launcher will print diagnostic information to stderr (i.e. to the console). While this information manages to be simultaneously verbose *and* terse, it should allow you to see what versions of Python were located, why a particular version was chosen and the exact command-line used to execute the target Python. It is primarily intended for testing and debugging.

4.8.6 Dry Run

If an environment variable `PYLAUNCHER_DRYRUN` is set (to any value), the launcher will output the command it would have run, but will not actually launch Python. This may be useful for tools that want to use the launcher to detect and then launch Python directly. Note that the command written to standard output is always encoded using UTF-8, and may not render correctly in the console.

4.8.7 Install on demand

If an environment variable `PYLAUNCHER_ALLOW_INSTALL` is set (to any value), and the requested Python version is not installed but is available on the Microsoft Store, the launcher will attempt to install it. This may require user interaction to complete, and you may need to run the command again.

An additional `PYLAUNCHER_ALWAYS_INSTALL` variable causes the launcher to always try to install Python, even if it is detected. This is mainly intended for testing (and should be used with `PYLAUNCHER_DRYRUN`).

4.8.8 Return codes

The following exit codes may be returned by the Python launcher. Unfortunately, there is no way to distinguish these from the exit code of Python itself.

The names of codes are as used in the sources, and are only for reference. There is no way to access or resolve them apart from reading this page. Entries are listed in alphabetical order of names.

Name	Value	Description
RC_BAD_VENV_CFG	107	A `pyvenv.cfg` was found but is corrupt.
RC_CREATE_PROCESS	101	Failed to launch Python.
RC_INSTALLING	111	An install was started, but the command will need to be re-run after it completes.
RC_INTERNAL_ERROR	109	Unexpected error. Please report a bug.
RC_NO_COMMANDLINE	108	Unable to obtain command line from the operating system.
RC_NO_PYTHON	103	Unable to locate the requested version.
RC_NO_VENV_CFG	106	A `pyvenv.cfg` was required but not found.

4.9 Finding modules

These notes supplement the description at sys-path-init with detailed Windows notes.

When no `._pth` file is found, this is how `sys.path` is populated on Windows:

- An empty entry is added at the start, which corresponds to the current directory.
- If the environment variable *PYTHONPATH* exists, as described in *Environment variables*, its entries are added next. Note that on Windows, paths in this variable must be separated by semicolons, to distinguish them from the colon used in drive identifiers (`C:\` etc.).
- Additional "application paths" can be added in the registry as subkeys of `\SOFTWARE\Python\PythonCore{version}\PythonPath` under both the `HKEY_CURRENT_USER` and `HKEY_LOCAL_MACHINE` hives. Subkeys which have semicolon-delimited path strings as their default value will cause each path to be added to `sys.path`. (Note that all known installers only use HKLM, so HKCU is typically empty.)
- If the environment variable *PYTHONHOME* is set, it is assumed as "Python Home". Otherwise, the path of the main Python executable is used to locate a "landmark file" (either `Lib\os.py` or `pythonXY.zip`) to deduce the "Python Home". If a Python home is found, the relevant sub-directories added to `sys.path` (`Lib`, `plat-win`, etc) are based on that folder. Otherwise, the core Python path is constructed from the PythonPath stored in the registry.
- If the Python Home cannot be located, no *PYTHONPATH* is specified in the environment, and no registry entries can be found, a default path with relative entries is used (e.g. `.\Lib;.\plat-win`, etc).

If a `pyvenv.cfg` file is found alongside the main executable or in the directory one level above the executable, the following variations apply:

- If `home` is an absolute path and *PYTHONHOME* is not set, this path is used instead of the path to the main executable when deducing the home location.

The end result of all this is:

- When running `python.exe`, or any other .exe in the main Python directory (either an installed version, or directly from the PCbuild directory), the core path is deduced, and the core paths in the registry are ignored. Other "application paths" in the registry are always read.
- When Python is hosted in another .exe (different directory, embedded via COM, etc), the "Python Home" will not be deduced, so the core path from the registry is used. Other "application paths" in the registry are always read.
- If Python can't find its home and there are no registry value (frozen .exe, some very strange installation setup) you get a path with some default, but relative, paths.

For those who want to bundle Python into their application or distribution, the following advice will prevent conflicts with other installations:

- Include a `._pth` file alongside your executable containing the directories to include. This will ignore paths listed in the registry and environment variables, and also ignore `site` unless `import site` is listed.
- If you are loading `python3.dll` or `python37.dll` in your own executable, explicitly set `PyConfig.module_search_paths` before `Py_InitializeFromConfig()`.
- Clear and/or overwrite *PYTHONPATH* and set *PYTHONHOME* before launching `python.exe` from your application.
- If you cannot use the previous suggestions (for example, you are a distribution that allows people to run `python.exe` directly), ensure that the landmark file (`Lib\os.py`) exists in your install directory. (Note that it will not be detected inside a ZIP file, but a correctly named ZIP file will be detected instead.)

These will ensure that the files in a system-wide installation will not take precedence over the copy of the standard library bundled with your application. Otherwise, your users may experience problems using your application. Note that the first suggestion is the best, as the others may still be susceptible to non-standard paths in the registry and user site-packages.

3.6 sürümünde değişti: Add `._pth` file support and removes `applocal` option from `pyvenv.cfg`.

3.6 sürümünde değişti: Add `pythonXX.zip` as a potential landmark when directly adjacent to the executable.

3.6 sürümünden beri kullanım dışı: Modules specified in the registry under `Modules` (not `PythonPath`) may be imported by `importlib.machinery.WindowsRegistryFinder`. This finder is enabled on Windows in 3.6.0 and earlier, but may need to be explicitly added to `sys.meta_path` in the future.

4.10 Additional modules

Even though Python aims to be portable among all platforms, there are features that are unique to Windows. A couple of modules, both in the standard library and external, and snippets exist to use these features.

The Windows-specific standard modules are documented in mswin-specific-services.

4.10.1 PyWin32

The PyWin32 module by Mark Hammond is a collection of modules for advanced Windows-specific support. This includes utilities for:

- Component Object Model (COM)
- Win32 API calls
- Registry
- Event log
- Microsoft Foundation Classes (MFC) user interfaces

PythonWin is a sample MFC application shipped with PyWin32. It is an embeddable IDE with a built-in debugger.

Ayrıca bakınız

Win32 How Do I…?
by Tim Golden

Python and COM
by David and Paul Boddie

4.10.2 cx_Freeze

cx_Freeze wraps Python scripts into executable Windows programs (`*.exe` files). When you have done this, you can distribute your application without requiring your users to install Python.

4.11 Compiling Python on Windows

If you want to compile CPython yourself, first thing you should do is get the source. You can download either the latest release's source or just grab a fresh checkout.

The source tree contains a build solution and project files for Microsoft Visual Studio, which is the compiler used to build the official Python releases. These files are in the `PCbuild` directory.

Check `PCbuild/readme.txt` for general information on the build process.

For extension modules, consult building-on-windows.

4.12 Other Platforms

With ongoing development of Python, some platforms that used to be supported earlier are no longer supported (due to the lack of users or developers). Check **PEP 11** for details on all unsupported platforms.

- Windows CE is no longer supported since Python 3 (if it ever was).
- The Cygwin installer offers to install the Python interpreter as well

See Python for Windows for detailed information about platforms with pre-compiled installers.

BÖLÜM 5

Using Python on macOS

This document aims to give an overview of macOS-specific behavior you should know about to get started with Python on Mac computers. Python on a Mac running macOS is very similar to Python on other Unix-derived platforms, but there are some differences in installation and some features.

There are various ways to obtain and install Python for macOS. Pre-built versions of the most recent versions of Python are available from a number of distributors. Much of this document describes use of the Pythons provided by the CPython release team for download from the python.org website. See *Alternative Distributions* for some other options.

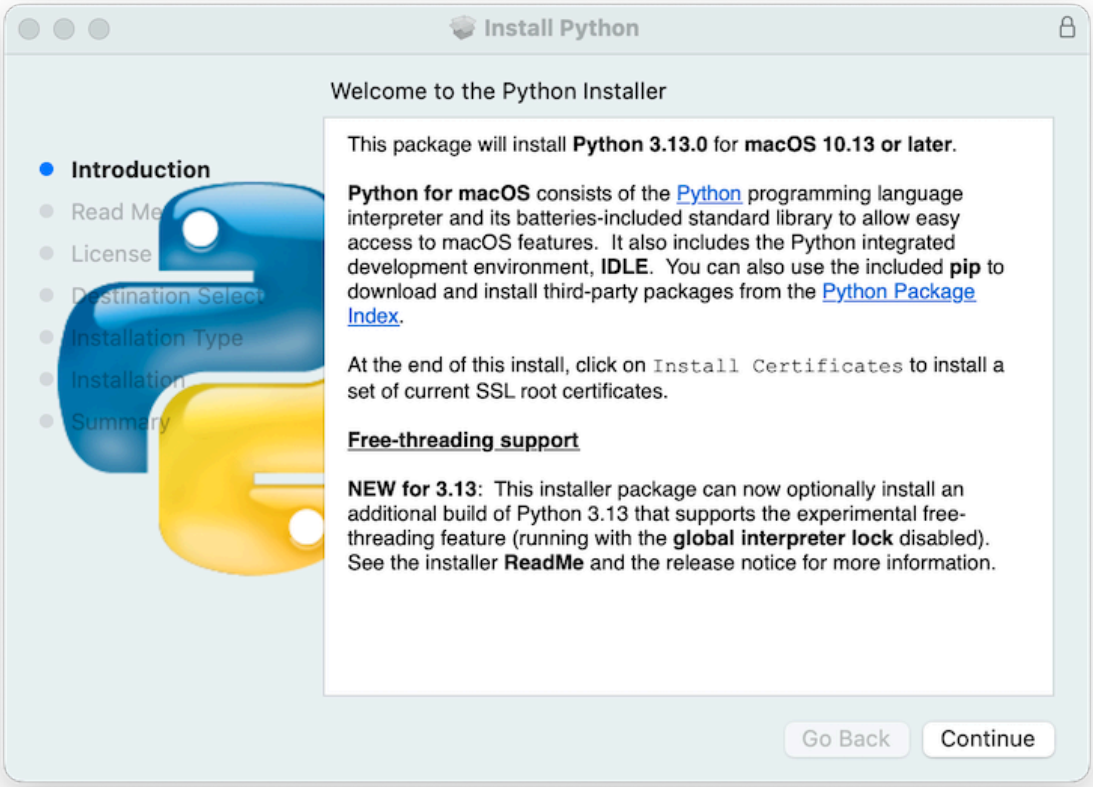
5.1 Using Python for macOS from `python.org`

5.1.1 Installation steps

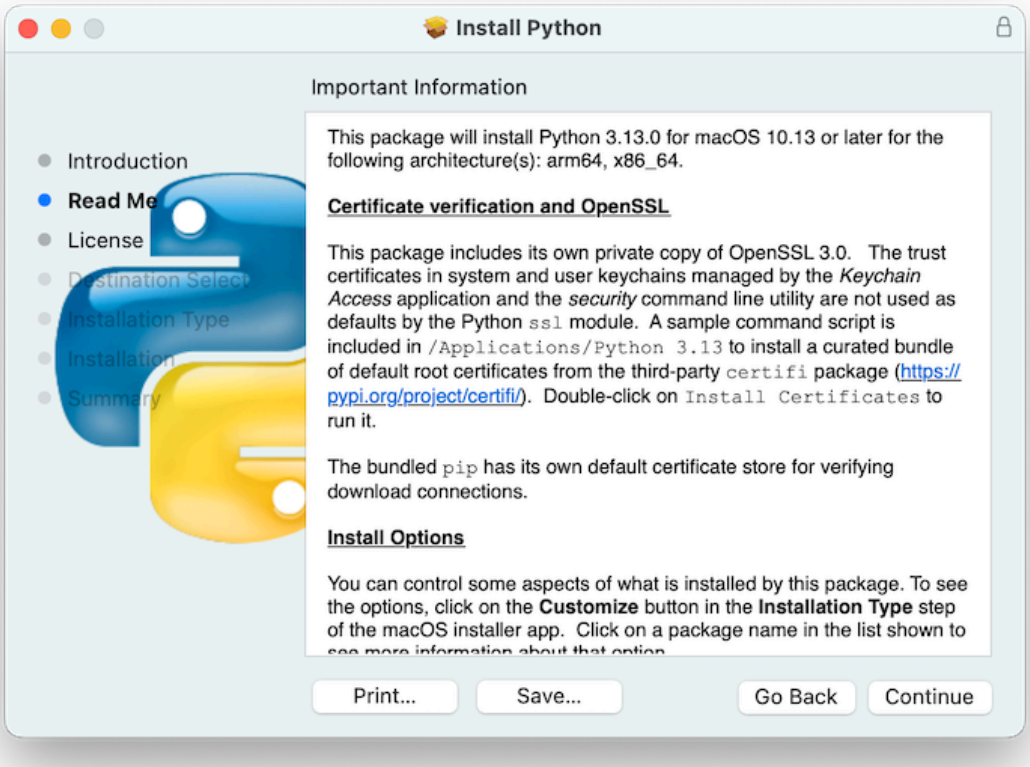
For current Python versions (other than those in `security` status), the release team produces a **Python for macOS** installer package for each new release. A list of available installers is available here. We recommend using the most recent supported Python version where possible. Current installers provide a universal2 binary build of Python which runs natively on all Macs (Apple Silicon and Intel) that are supported by a wide range of macOS versions, currently typically from at least **macOS 10.13 High Sierra** on.

The downloaded file is a standard macOS installer package file (`.pkg`). File integrity information (checksum, size, sigstore signature, etc) for each file is included on the release download page. Installer packages and their contents are signed and notarized with `Python Software Foundation` Apple Developer ID certificates to meet macOS Gatekeeper requirements.

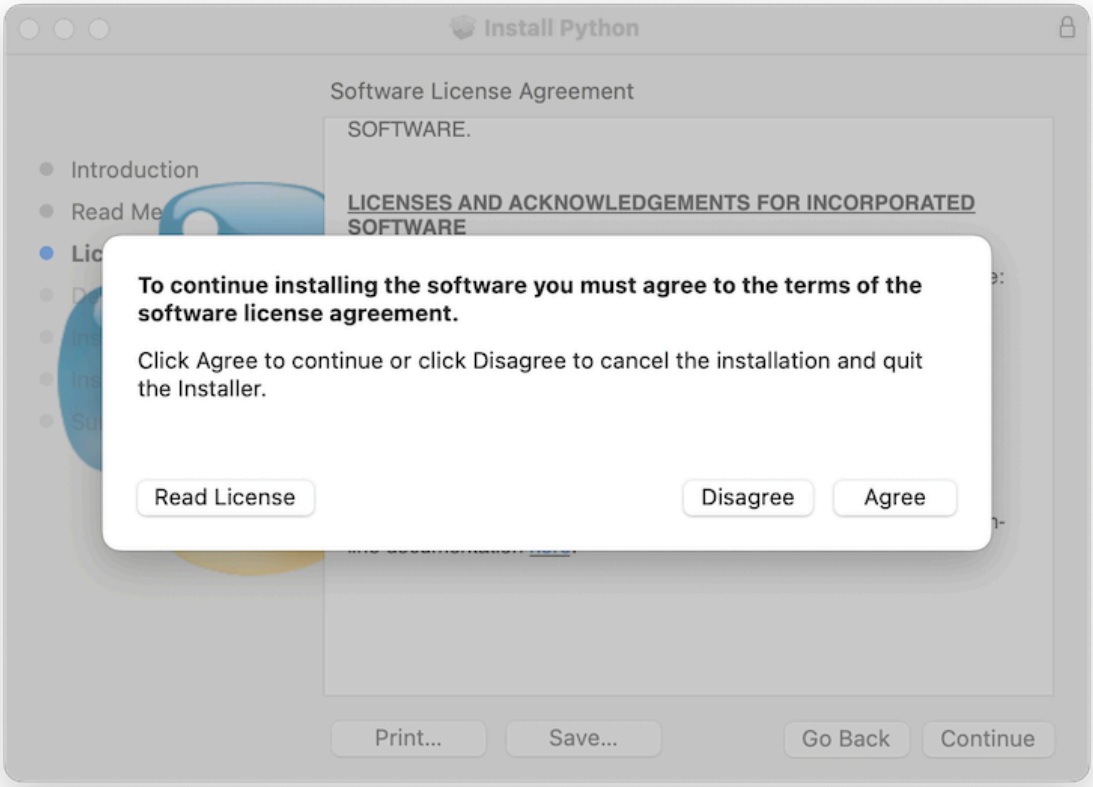
For a default installation, double-click on the downloaded installer package file. This should launch the standard macOS Installer app and display the first of several installer windows steps.



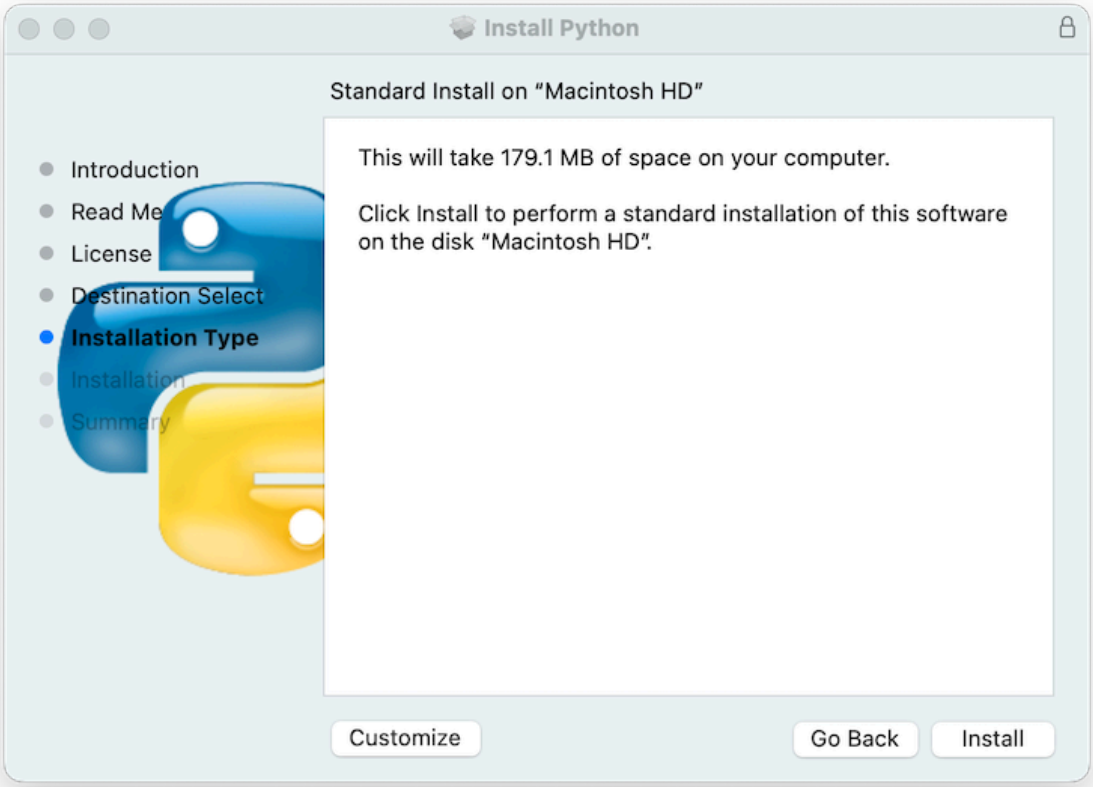
Clicking on the **Continue** button brings up the **Read Me** for this installer. Besides other important information, the **Read Me** documents which Python version is going to be installed and on what versions of macOS it is supported. You may need to scroll through to read the whole file. By default, this **Read Me** will also be installed in `/Applications/Python 3.13/` and available to read anytime.



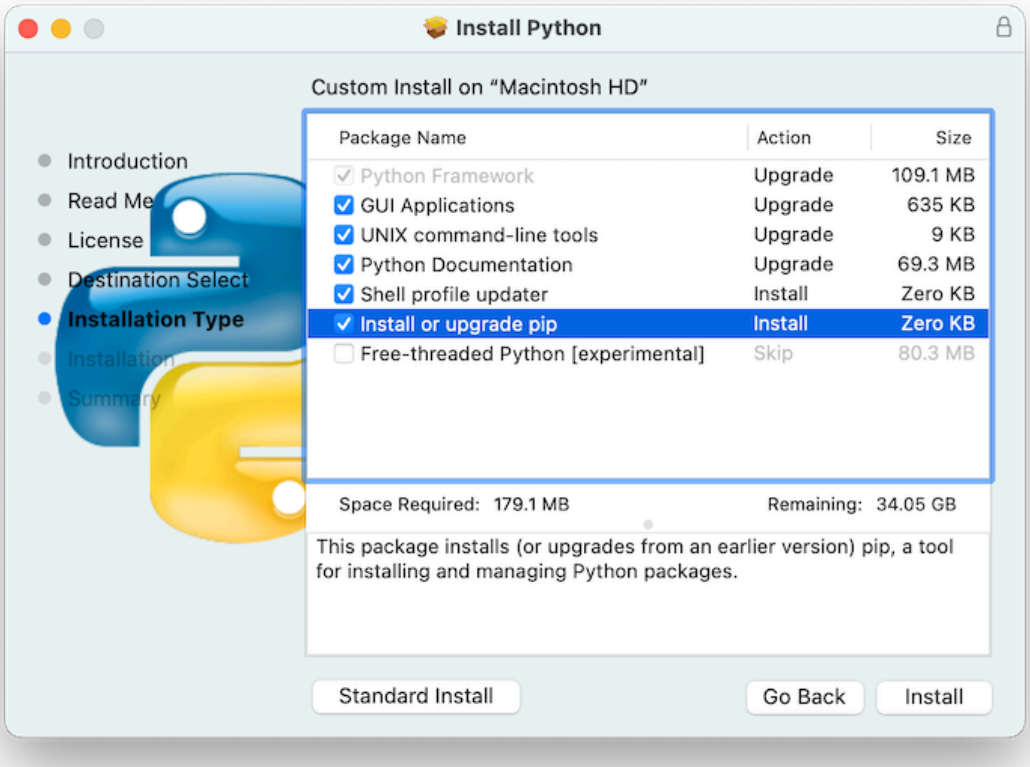
Clicking on **Continue** proceeds to display the license for Python and for other included software. You will then need to **Agree** to the license terms before proceeding to the next step. This license file will also be installed and available to be read later.



After the license terms are accepted, the next step is the **Installation Type** display. For most uses, the standard set of installation operations is appropriate.

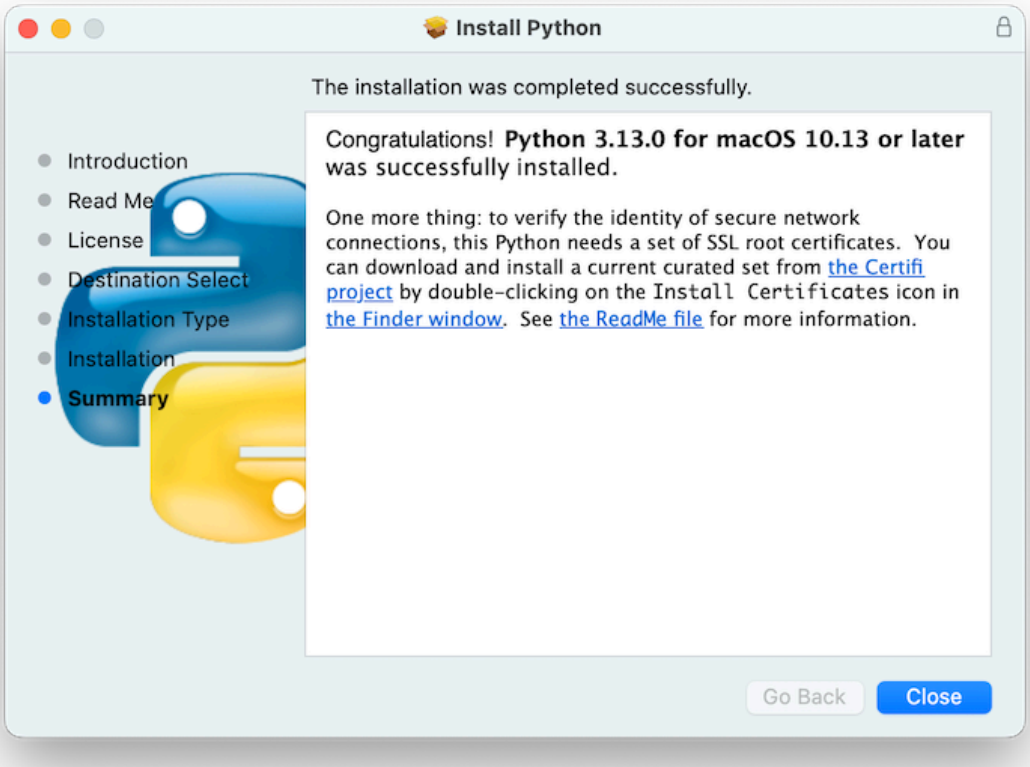


By pressing the **Customize** button, you can choose to omit or select certain package components of the installer. Click on each package name to see a description of what it installs. To also install support for the optional experimental free-threaded feature, see *Installing Free-threaded Binaries*.

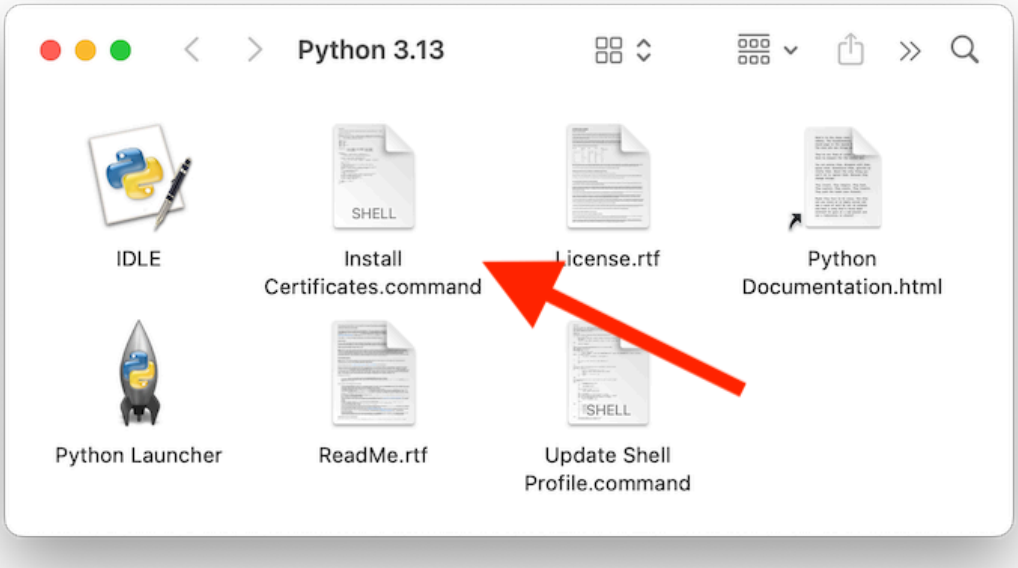


In either case, clicking **Install** will begin the install process by asking permission to install new software. A macOS user name with `Administrator` privilege is needed as the installed Python will be available to all users of the Mac.

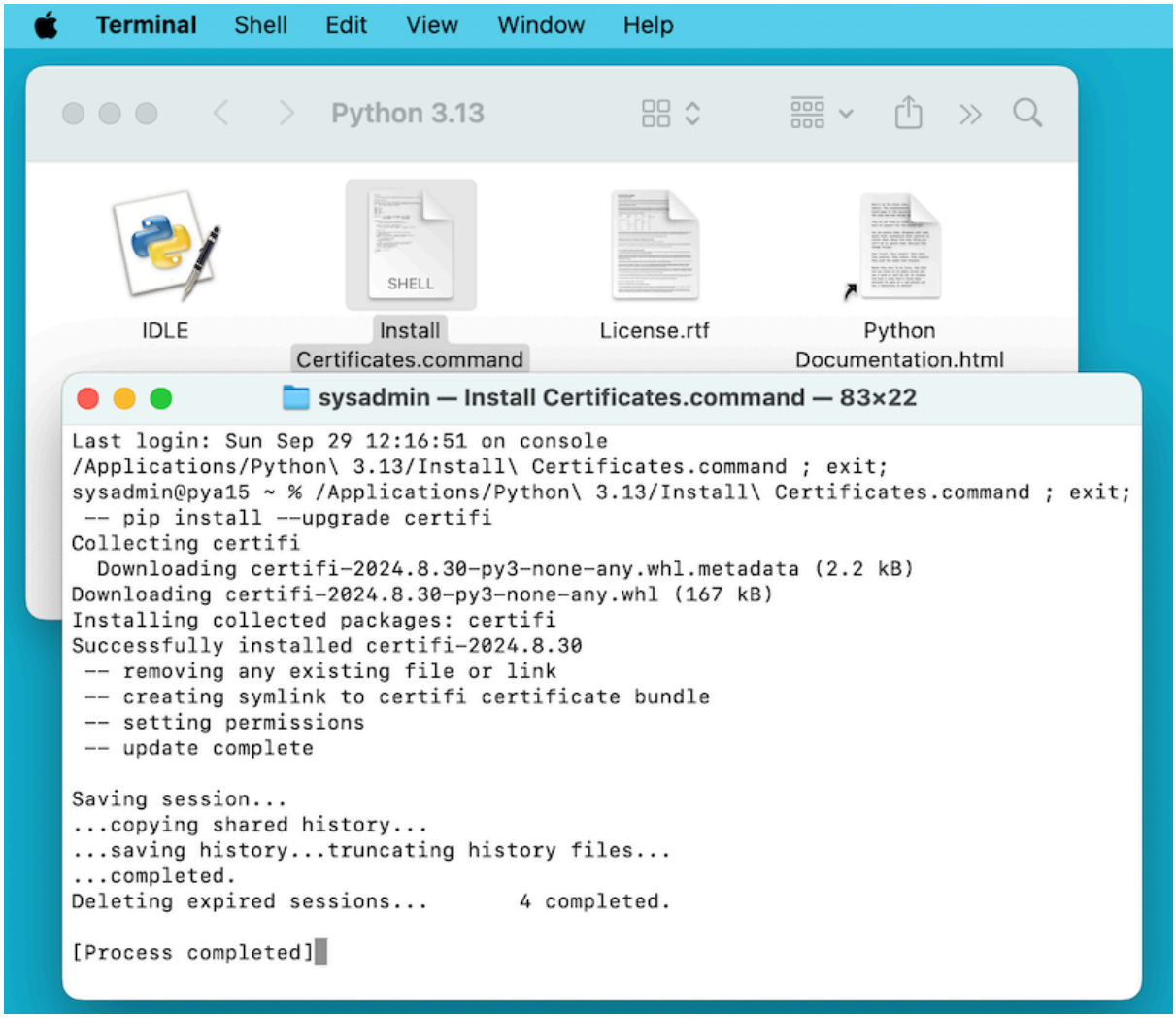
When the installation is complete, the **Summary** window will appear.



Double-click on the **`Install Certificates.command`** icon or file in the `/Applications/Python 3.13/` window to complete the installation.



This will open a temporary **`Terminal`** shell window that will use the new Python to download and install SSL root certificates for its use.



If `Successfully installed certifi` and `update complete` appears in the terminal window, the installation is complete. Close this terminal window and the installer window.

A default install will include:

- A `Python 3.13` folder in your `Applications` folder. In here you find **`IDLE`**, the development environment that is a standard part of official Python distributions; and **`Python Launcher`**, which handles double-clicking Python scripts from the macOS Finder.
- A framework `/Library/Frameworks/Python.framework`, which includes the Python executable and libraries. The installer adds this location to your shell path. To uninstall Python, you can remove these three things. Symlinks to the Python executable are placed in `/usr/local/bin/`.

Not

Recent versions of macOS include a **`python3`** command in `/usr/bin/python3` that links to a usually older and incomplete version of Python provided by and for use by the Apple development tools, **`Xcode`** or the **`Command Line Tools for Xcode`**. You should never modify or attempt to delete this installation, as it is Apple-controlled and is used by Apple-provided or third-party software. If you choose to install a newer Python version from `python.org`, you will have two different but functional Python installations on your computer that can co-exist. The default installer options should ensure that its **`python3`** will be used instead of the system **`python3`**.

5.1.2 How to run a Python script

There are two ways to invoke the Python interpreter. If you are familiar with using a Unix shell in a terminal window, you can invoke `python3.13` or `python3` optionally followed by one or more command line options (described in *Command line and environment*). The Python tutorial also has a useful section on using Python interactively from a shell.

You can also invoke the interpreter through an integrated development environment. idle is a basic editor and interpreter environment which is included with the standard distribution of Python. **`IDLE`** includes a Help menu that allows you to access Python documentation. If you are completely new to Python, you can read the tutorial introduction in that document.

There are many other editors and IDEs available, see *Editors and IDEs* for more information.

To run a Python script file from the terminal window, you can invoke the interpreter with the name of the script file:

```
python3.13 myscript.py
```

To run your script from the Finder, you can either:

- Drag it to **`Python Launcher`**.
- Select **`Python Launcher`** as the default application to open your script (or any `.py` script) through the Finder Info window and double-click it. **`Python Launcher`** has various preferences to control how your script is launched. Option-dragging allows you to change these for one invocation, or use its `Preferences` menu to change things globally.

Be aware that running the script directly from the macOS Finder might produce different results than when running from a terminal window as the script will not be run in the usual shell environment including any setting of environment variables in shell profiles. And, as with any other script or program, be certain of what you are about to run.

5.2 Alternative Distributions

Besides the standard `python.org` for macOS installer, there are third-party distributions for macOS that may include additional functionality. Some popular distributions and their key features:

ActivePython
: Installer with multi-platform compatibility, documentation

Anaconda
: Popular scientific modules (such as numpy, scipy, and pandas) and the `conda` package manager.

Homebrew
: Package manager for macOS including multiple versions of Python and many third-party Python-based packages (including numpy, scipy, and pandas).

MacPorts
: Another package manager for macOS including multiple versions of Python and many third-party Python-based packages. May include pre-built versions of Python and many packages for older versions of macOS.

Note that distributions might not include the latest versions of Python or other libraries, and are not maintained or supported by the core Python team.

5.3 Installing Additional Python Packages

Refer to the Python Packaging User Guide for more information.

5.4 GUI Programming

There are several options for building GUI applications on the Mac with Python.

The standard Python GUI toolkit is `tkinter`, based on the cross-platform Tk toolkit (https://www.tcl.tk). A macOS-native version of Tk is included with the installer.

PyObjC is a Python binding to Apple's Objective-C/Cocoa framework. Information on PyObjC is available from pyobjc.

A number of alternative macOS GUI toolkits are available including:

- PySide: Official Python bindings to the Qt GUI toolkit.
- PyQt: Alternative Python bindings to Qt.
- Kivy: A cross-platform GUI toolkit that supports desktop and mobile platforms.
- Toga: Part of the BeeWare Project; supports desktop, mobile, web and console apps.
- wxPython: A cross-platform toolkit that supports desktop operating systems.

5.5 Advanced Topics

5.5.1 Installing Free-threaded Binaries

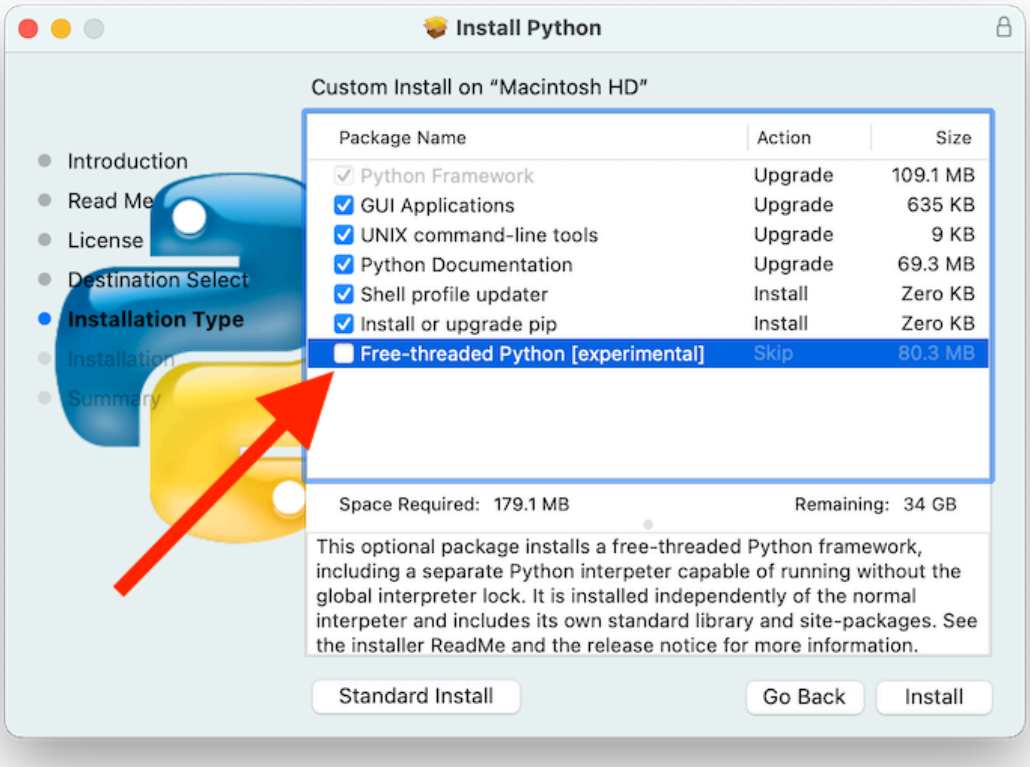
Added in version 3.13: (Experimental)

Not

Everything described in this section is considered experimental, and should be expected to change in future releases.

The `python.org` *Python for macOS* installer package can optionally install an additional build of Python 3.13 that supports **PEP 703**, the experimental free-threading feature (running with the *global interpreter lock* disabled). Check the release page on `python.org` for possible updated information.

Because this feature is still considered experimental, the support for it is not installed by default. It is packaged as a separate install option, available by clicking the **Customize** button on the **Installation Type** step of the installer as described above.



If the box next to the **Free-threaded Python** package name is checked, a separate `PythonT.framework` will also be installed alongside the normal `Python.framework` in `/Library/Frameworks`. This configuration allows a free-threaded Python 3.13 build to co-exist on your system with a traditional (GIL only) Python 3.13 build with minimal risk while installing or testing. This installation layout is itself experimental and is subject to change in future releases.

Known cautions and limitations:

- The **UNIX command-line tools** package, which is selected by default, will install links in `/usr/local/bin` for `python3.13t`, the free-threaded interpreter, and `python3.13t-config`, a configuration utility which may be useful for package builders. Since `/usr/local/bin` is typically included in your shell `PATH`, in most cases no changes to your `PATH` environment variables should be needed to use `python3.13t`.
- For this release, the **Shell profile updater** package and the `Update Shell Profile.command` in `/Applications/Python 3.13/` do not support the free-threaded package.
- The free-threaded build and the traditional build have separate search paths and separate `site-packages` directories so, by default, if you need a package available in both builds, it may need to be installed in both. The free-threaded package will install a separate instance of **`pip`** for use with `python3.13t`.
  - To install a package using **`pip`** without a **`venv`**:

    ```
    python3.13t -m pip install <package_name>
    ```

- When working with multiple Python environments, it is usually safest and easiest to create and use virtual environments. This can avoid possible command name conflicts and confusion about which Python is in use:

  ```
  python3.13t -m venv <venv_name>
  ```

  then **`activate`**.

- To run a free-threaded version of IDLE:

  ```
  python3.13t -m idlelib
  ```

- The interpreters in both builds respond to the same *PYTHON environment variables* which may have unexpected results, for example, if you have `PYTHONPATH` set in a shell profile. If necessary, there are *command line options* like `-E` to ignore these environment variables.
- The free-threaded build links to the third-party shared libraries, such as `OpenSSL` and `Tk`, installed in the traditional framework. This means that both builds also share one set of trust certificates as installed by the **`Install Certificates.command`** script, thus it only needs to be run once.
- If you cannot depend on the link in `/usr/local/bin` pointing to the `python.org` free-threaded `python3.13t` (for example, if you want to install your own version there or some other distribution does), you can explicitly set your shell `PATH` environment variable to include the `PythonT` framework `bin` directory:

  ```
  export PATH ="/Library/Frameworks/PythonT.framework/Versions/3.13/bin":"$PATH"
  ```

  The traditional framework installation by default does something similar, except for `Python.framework`. Be aware that having both framework `bin` directories in `PATH` can lead to confusion if there are duplicate names like `python3.13` in both; which one is actually used depends on the order they appear in `PATH`. The `which python3.x` or `which python3.xt` commands can show which path is being used. Using virtual environments can help avoid such ambiguities. Another option might be to create a shell **`alias`** to the desired interpreter, like:

  ```
  alias py3.13 ="/Library/Frameworks/Python.framework/Versions/3.13/bin/python3.
  ↪13"
  alias py3.13t ="/Library/Frameworks/PythonT.framework/Versions/3.13/bin/
  ↪python3.13t"
  ```

5.5.2 Installing using the command line

If you want to use automation to install the `python.org` installer package (rather than by using the familiar macOS **`Installer`** GUI app), the macOS command line **`installer`** utility lets you select non-default options, too. If you are not familiar with **`installer`**, it can be somewhat cryptic (see **`man installer`** for more information). As an example, the following shell snippet shows one way to do it, using the `3.13.0b2` release and selecting the free-threaded interpreter option:

```
RELEASE ="python-3.130b2-macos11.pkg"

# download installer pkg
curl -O https://www.python.org/ftp/python/3.13.0/${RELEASE}

# create installer choicechanges to customize the install:
#    enable the PythonTFramework-3.13 package
#    while accepting the other defaults (install all other packages)
cat > ./choicechanges.plist <<EOF
<?xml version ="1.0" encoding ="UTF-8"?>
<!DOCTYPE plist PUBLIC "-//Apple//DTD PLIST 1.0//EN" "http://www.apple.com/DTDs/
↪PropertyList-1.0.dtd">
<plist version ="1.0">
<array>
        <dict>
                <key>attributeSetting</key>
                <integer>1</integer>
                <key>choiceAttribute</key>
                <string>selected</string>
                <key>choiceIdentifier</key>
                <string>org.python.Python.PythonTFramework-3.13</string>
        </dict>
</array>
</plist>
EOF
```

```
sudo installer -pkg ./${RELEASE} -applyChoiceChangesXML ./choicechanges.plist␣
↪-target /
```

You can then test that both installer builds are now available with something like:

```
$ # test that the free-threaded interpreter was installed if the Unix Command␣
↪Tools package was enabled
$ /usr/local/bin/python3.13t -VV
Python 3.13.0b2 experimental free-threading build (v3.13.0b2:3a83b172af, Jun  5␣
↪2024, 12:57:31) [Clang 15.0.0 (clang-1500.3.9.4)]
$ #    and the traditional interpreter
$ /usr/local/bin/python3.13 -VV
Python 3.13.0b2 (v3.13.0b2:3a83b172af, Jun  5 2024, 12:50:24) [Clang 15.0.0␣
↪(clang-1500.3.9.4)]
$ # test that they are also available without the prefix if /usr/local/bin is on
↪$PATH
$ python3.13t -VV
Python 3.13.0b2 experimental free-threading build (v3.13.0b2:3a83b172af, Jun  5␣
↪2024, 12:57:31) [Clang 15.0.0 (clang-1500.3.9.4)]
$ python3.13 -VV
Python 3.13.0b2 (v3.13.0b2:3a83b172af, Jun  5 2024, 12:50:24) [Clang 15.0.0␣
↪(clang-1500.3.9.4)]
```

Not

Current `python.org` installers only install to fixed locations like `/Library/Frameworks/`, `/Applications`, and `/usr/local/bin`. You cannot use the **`installer`** `-domain` option to install to other locations.

5.5.3 Distributing Python Applications

A range of tools exist for converting your Python code into a standalone distributable application:

- py2app: Supports creating macOS `.app` bundles from a Python project.
- Briefcase: Part of the BeeWare Project; a cross-platform packaging tool that supports creation of `.app` bundles on macOS, as well as managing signing and notarization.
- PyInstaller: A cross-platform packaging tool that creates a single file or folder as a distributable artifact.

5.5.4 App Store Compliance

Apps submitted for distribution through the macOS App Store must pass Apple's app review process. This process includes a set of automated validation rules that inspect the submitted application bundle for problematic code.

The Python standard library contains some code that is known to violate these automated rules. While these violations appear to be false positives, Apple's review rules cannot be challenged. Therefore, it is necessary to modify the Python standard library for an app to pass App Store review.

The Python source tree contains a patch file that will remove all code that is known to cause issues with the App Store review process. This patch is applied automatically when CPython is configured with the `--with-app-store-compliance` option.

This patch is not normally required to use CPython on a Mac; nor is it required if you are distributing an app *outside* the macOS App Store. It is *only* required if you are using the macOS App Store as a distribution channel.

5.6 Other Resources

The python.org Help page has links to many useful resources. The Pythonmac-SIG mailing list is another support resource specifically for Python users and developers on the Mac.

BÖLÜM 6

Using Python on Android

Python on Android is unlike Python on desktop platforms. On a desktop platform, Python is generally installed as a system resource that can be used by any user of that computer. Users then interact with Python by running a **`python`** executable and entering commands at an interactive prompt, or by running a Python script.

On Android, there is no concept of installing as a system resource. The only unit of software distribution is an "app". There is also no console where you could run a **`python`** executable, or interact with a Python REPL.

As a result, the only way you can use Python on Android is in embedded mode – that is, by writing a native Android application, embedding a Python interpreter using `libpython`, and invoking Python code using the Python embedding API. The full Python interpreter, the standard library, and all your Python code is then packaged into your app for its own private use.

The Python standard library has some notable omissions and restrictions on Android. See the API availability guide for details.

6.1 Adding Python to an Android app

Most app developers should use one of the following tools, which will provide a much easier experience:

- Briefcase, from the BeeWare project
- Buildozer, from the Kivy project
- Chaquopy
- pyqtdeploy
- Termux

If you're sure you want to do all of this manually, read on. You can use the testbed app as a guide; each step below contains a link to the relevant file.

- Build Python by following the instructions in Android/README.md. This will create the directory `cross-build/HOST/prefix`.
- Add code to your build.gradle file to copy the following items into your project. All except your own Python code can be copied from `prefix/lib`:
  - In your JNI libraries:
    * `libpython*.*.so`
    * `lib*_python.so` (external libraries such as OpenSSL)

  - In your assets:
    * `python*.*` (the Python standard library)
    * `python*.*/site-packages` (your own Python code)
- Add code to your app to extract the assets to the filesystem.
- Add code to your app to start Python in embedded mode. This will need to be C code called via JNI.

6.2 Building a Python package for Android

Python packages can be built for Android as wheels and released on PyPI. The recommended tool for doing this is cibuildwheel, which automates all the details of setting up a cross-compilation environment, building the wheel, and testing it on an emulator.

BÖLÜM 7

Using Python on iOS

Authors
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Python on iOS is unlike Python on desktop platforms. On a desktop platform, Python is generally installed as a system resource that can be used by any user of that computer. Users then interact with Python by running a **`python`** executable and entering commands at an interactive prompt, or by running a Python script.

On iOS, there is no concept of installing as a system resource. The only unit of software distribution is an "app". There is also no console where you could run a **`python`** executable, or interact with a Python REPL.

As a result, the only way you can use Python on iOS is in embedded mode - that is, by writing a native iOS application, and embedding a Python interpreter using `libPython`, and invoking Python code using the Python embedding API. The full Python interpreter, the standard library, and all your Python code is then packaged as a standalone bundle that can be distributed via the iOS App Store.

If you're looking to experiment for the first time with writing an iOS app in Python, projects such as BeeWare and Kivy will provide a much more approachable user experience. These projects manage the complexities associated with getting an iOS project running, so you only need to deal with the Python code itself.

7.1 Python at runtime on iOS

7.1.1 iOS version compatibility

The minimum supported iOS version is specified at compile time, using the `--host` option to `configure`. By default, when compiled for iOS, Python will be compiled with a minimum supported iOS version of 13.0. To use a different minimum iOS version, provide the version number as part of the `--host` argument - for example, `--host =arm64-apple-ios15.4-simulator` would compile an ARM64 simulator build with a deployment target of 15.4.

7.1.2 Platform identification

When executing on iOS, `sys.platform` will report as `ios`. This value will be returned on an iPhone or iPad, regardless of whether the app is running on the simulator or a physical device.

Information about the specific runtime environment, including the iOS version, device model, and whether the device is a simulator, can be obtained using `platform.ios_ver()`. `platform.system()` will report `iOS` or `iPadOS`, depending on the device.

`os.uname()` reports kernel-level details; it will report a name of `Darwin`.

7.1.3 Standard library availability

The Python standard library has some notable omissions and restrictions on iOS. See the API availability guide for iOS for details.

7.1.4 Binary extension modules

One notable difference about iOS as a platform is that App Store distribution imposes hard requirements on the packaging of an application. One of these requirements governs how binary extension modules are distributed.

The iOS App Store requires that *all* binary modules in an iOS app must be dynamic libraries, contained in a framework with appropriate metadata, stored in the `Frameworks` folder of the packaged app. There can be only a single binary per framework, and there can be no executable binary material outside the `Frameworks` folder.

This conflicts with the usual Python approach for distributing binaries, which allows a binary extension module to be loaded from any location on `sys.path`. To ensure compliance with App Store policies, an iOS project must post-process any Python packages, converting `.so` binary modules into individual standalone frameworks with appropriate metadata and signing. For details on how to perform this post-processing, see the guide for *adding Python to your project*.

To help Python discover binaries in their new location, the original `.so` file on `sys.path` is replaced with a `.fwork` file. This file is a text file containing the location of the framework binary, relative to the app bundle. To allow the framework to resolve back to the original location, the framework must contain a `.origin` file that contains the location of the `.fwork` file, relative to the app bundle.

For example, consider the case of an import `from foo.bar import _whiz`, where `_whiz` is implemented with the binary module `sources/foo/bar/_whiz.abi3.so`, with `sources` being the location registered on `sys.path`, relative to the application bundle. This module *must* be distributed as `Frameworks/foo.bar._whiz.framework/foo.bar._whiz` (creating the framework name from the full import path of the module), with an `Info.plist` file in the `.framework` directory identifying the binary as a framework. The `foo.bar._whiz` module would be represented in the original location with a `sources/foo/bar/_whiz.abi3.fwork` marker file, containing the path `Frameworks/foo.bar._whiz/foo.bar._whiz`. The framework would also contain `Frameworks/foo.bar._whiz.framework/foo.bar._whiz.origin`, containing the path to the `.fwork` file.

When running on iOS, the Python interpreter will install an `AppleFrameworkLoader` that is able to read and import `.fwork` files. Once imported, the `__file__` attribute of the binary module will report as the location of the `.fwork` file. However, the `ModuleSpec` for the loaded module will report the `origin` as the location of the binary in the framework folder.

7.1.5 Compiler stub binaries

Xcode doesn't expose explicit compilers for iOS; instead, it uses an `xcrun` script that resolves to a full compiler path (e.g., `xcrun --sdk iphoneos clang` to get the `clang` for an iPhone device). However, using this script poses two problems:

- The output of `xcrun` includes paths that are machine specific, resulting in a sysconfig module that cannot be shared between users; and
- It results in `CC`/`CPP`/`LD`/`AR` definitions that include spaces. There is a lot of C ecosystem tooling that assumes that you can split a command line at the first space to get the path to the compiler executable; this isn't the case when using `xcrun`.

To avoid these problems, Python provided stubs for these tools. These stubs are shell script wrappers around the underingly `xcrun` tools, distributed in a `bin` folder distributed alongside the compiled iOS framework. These scripts are relocatable, and will always resolve to the appropriate local system paths. By including these scripts in the bin folder that accompanies a framework, the contents of the `sysconfig` module becomes useful for end-users to compile their own modules. When compiling third-party Python modules for iOS, you should ensure these stub binaries are on your path.

7.2 Installing Python on iOS

7.2.1 Tools for building iOS apps

Building for iOS requires the use of Apple's Xcode tooling. It is strongly recommended that you use the most recent stable release of Xcode. This will require the use of the most (or second-most) recently released macOS version, as Apple does not maintain Xcode for older macOS versions. The Xcode Command Line Tools are not sufficient for iOS development; you need a *full* Xcode install.

If you want to run your code on the iOS simulator, you'll also need to install an iOS Simulator Platform. You should be prompted to select an iOS Simulator Platform when you first run Xcode. Alternatively, you can add an iOS Simulator Platform by selecting from the Platforms tab of the Xcode Settings panel.

7.2.2 Adding Python to an iOS project

Python can be added to any iOS project, using either Swift or Objective C. The following examples will use Objective C; if you are using Swift, you may find a library like PythonKit to be helpful.

To add Python to an iOS Xcode project:

1. Build or obtain a Python `XCFramework`. See the instructions in iOS/README.rst (in the CPython source distribution) for details on how to build a Python `XCFramework`. At a minimum, you will need a build that supports `arm64-apple-ios`, plus one of either `arm64-apple-ios-simulator` or `x86_64-apple-ios-simulator`.
2. Drag the `XCframework` into your iOS project. In the following instructions, we'll assume you've dropped the `XCframework` into the root of your project; however, you can use any other location that you want by adjusting paths as needed.
3. Drag the `iOS/Resources/dylib-Info-template.plist` file into your project, and ensure it is associated with the app target.
4. Add your application code as a folder in your Xcode project. In the following instructions, we'll assume that your user code is in a folder named `app` in the root of your project; you can use any other location by adjusting paths as needed. Ensure that this folder is associated with your app target.
5. Select the app target by selecting the root node of your Xcode project, then the target name in the sidebar that appears.
6. In the "General" settings, under "Frameworks, Libraries and Embedded Content", add `Python.xcframework`, with "Embed & Sign" selected.
7. In the "Build Settings" tab, modify the following:
   - Build Options
     - User Script Sandboxing: No
     - Enable Testability: Yes
   - Search Paths
     - Framework Search Paths: `$(PROJECT_DIR)`
     - Header Search Paths: `"$(BUILT_PRODUCTS_DIR)/Python.framework/Headers"`
   - Apple Clang - Warnings - All languages
     - Quoted Include In Framework Header: No
8. Add a build step that copies the Python standard library into your app. In the "Build Phases" tab, add a new "Run Script" build step *before* the "Embed Frameworks" step, but *after* the "Copy Bundle Resources" step. Name the step "Install Target Specific Python Standard Library", disable the "Based on dependency analysis" checkbox, and set the script content to:

```
set -e

mkdir -p "$CODESIGNING_FOLDER_PATH/python/lib"
if [ "$EFFECTIVE_PLATFORM_NAME" = "-iphonesimulator" ]; then
    echo "Installing Python modules for iOS Simulator"
    rsync -au --delete "$PROJECT_DIR/Python.xcframework/ios-arm64_x86_64-
↪simulator/lib/" "$CODESIGNING_FOLDER_PATH/python/lib/"
else
    echo "Installing Python modules for iOS Device"
    rsync -au --delete "$PROJECT_DIR/Python.xcframework/ios-arm64/lib/" "
↪$CODESIGNING_FOLDER_PATH/python/lib/"
fi
```

Note that the name of the simulator "slice" in the XCframework may be different, depending the CPU architectures your `XCFramework` supports.

9. Add a second build step that processes the binary extension modules in the standard library into "Framework" format. Add a "Run Script" build step *directly after* the one you added in step 8, named "Prepare Python Binary Modules". It should also have "Based on dependency analysis" unchecked, with the following script content:

```
set -e

install_dylib () {
    INSTALL_BASE=$1
    FULL_EXT=$2

    # The name of the extension file
    EXT=$(basename "$FULL_EXT")
    # The location of the extension file, relative to the bundle
    RELATIVE_EXT=${FULL_EXT#$CODESIGNING_FOLDER_PATH/}
    # The path to the extension file, relative to the install base
    PYTHON_EXT=${RELATIVE_EXT/$INSTALL_BASE/}
    # The full dotted name of the extension module, constructed from the file␣
↪path.
    FULL_MODULE_NAME=$(echo $PYTHON_EXT | cut -d "." -f 1 | tr "/" ".");
    # A bundle identifier; not actually used, but required by Xcode framework␣
↪packaging
    FRAMEWORK_BUNDLE_ID=$(echo $PRODUCT_BUNDLE_IDENTIFIER.$FULL_MODULE_NAME |␣
↪tr "_" "-")
    # The name of the framework folder.
    FRAMEWORK_FOLDER="Frameworks/$FULL_MODULE_NAME.framework"

    # If the framework folder doesn't exist, create it.
    if [ ! -d "$CODESIGNING_FOLDER_PATH/$FRAMEWORK_FOLDER" ]; then
        echo "Creating framework for $RELATIVE_EXT"
        mkdir -p "$CODESIGNING_FOLDER_PATH/$FRAMEWORK_FOLDER"
        cp "$CODESIGNING_FOLDER_PATH/dylib-Info-template.plist" "$CODESIGNING_
↪FOLDER_PATH/$FRAMEWORK_FOLDER/Info.plist"
        plutil -replace CFBundleExecutable -string "$FULL_MODULE_NAME" "
↪$CODESIGNING_FOLDER_PATH/$FRAMEWORK_FOLDER/Info.plist"
        plutil -replace CFBundleIdentifier -string "$FRAMEWORK_BUNDLE_ID" "
↪$CODESIGNING_FOLDER_PATH/$FRAMEWORK_FOLDER/Info.plist"
    fi

    echo "Installing binary for $FRAMEWORK_FOLDER/$FULL_MODULE_NAME"
    mv "$FULL_EXT" "$CODESIGNING_FOLDER_PATH/$FRAMEWORK_FOLDER/$FULL_MODULE_
↪NAME"
```

(sonraki sayfaya devam)

(önceki sayfadan devam)

```
    # Create a placeholder .fwork file where the .so was
    echo "$FRAMEWORK_FOLDER/$FULL_MODULE_NAME" > ${FULL_EXT%.so}.fwork
    # Create a back reference to the .so file location in the framework
    echo "${RELATIVE_EXT%.so}.fwork" > "$CODESIGNING_FOLDER_PATH/$FRAMEWORK_
↪FOLDER/$FULL_MODULE_NAME.origin"
}

PYTHON_VER=$(ls -1 "$CODESIGNING_FOLDER_PATH/python/lib")
echo "Install Python $PYTHON_VER standard library extension modules..."
find "$CODESIGNING_FOLDER_PATH/python/lib/$PYTHON_VER/lib-dynload" -name "*.so
↪" | while read FULL_EXT; do
    install_dylib python/lib/$PYTHON_VER/lib-dynload/ "$FULL_EXT"
done

# Clean up dylib template
rm -f "$CODESIGNING_FOLDER_PATH/dylib-Info-template.plist"

echo "Signing frameworks as $EXPANDED_CODE_SIGN_IDENTITY_NAME ($EXPANDED_CODE_
↪SIGN_IDENTITY)..."
find "$CODESIGNING_FOLDER_PATH/Frameworks" -name "*.framework" -exec /usr/bin/
↪codesign --force --sign "$EXPANDED_CODE_SIGN_IDENTITY" ${OTHER_CODE_SIGN_
↪FLAGS:-} -o runtime --timestamp=none --preserve-metadata=identifier,
↪entitlements,flags --generate-entitlement-der "{}" \;
```

10. Add Objective C code to initialize and use a Python interpreter in embedded mode. You should ensure that:

    - UTF-8 mode (`PyPreConfig.utf8_mode`) is *enabled*;
    - Buffered stdio (`PyConfig.buffered_stdio`) is *disabled*;
    - Writing bytecode (`PyConfig.write_bytecode`) is *disabled*;
    - Signal handlers (`PyConfig.install_signal_handlers`) are *enabled*;
    - *`PYTHONHOME`* for the interpreter is configured to point at the `python` subfolder of your app's bundle; and
    - The *`PYTHONPATH`* for the interpreter includes:
        - the `python/lib/python3.X` subfolder of your app's bundle,
        - the `python/lib/python3.X/lib-dynload` subfolder of your app's bundle, and
        - the `app` subfolder of your app's bundle

    Your app's bundle location can be determined using `[[NSBundle mainBundle] resourcePath]`.

Steps 8, 9 and 10 of these instructions assume that you have a single folder of pure Python application code, named `app`. If you have third-party binary modules in your app, some additional steps will be required:

- You need to ensure that any folders containing third-party binaries are either associated with the app target, or copied in as part of step 8. Step 8 should also purge any binaries that are not appropriate for the platform a specific build is targeting (i.e., delete any device binaries if you're building an app targeting the simulator).
- Any folders that contain third-party binaries must be processed into framework form by step 9. The invocation of `install_dylib` that processes the `lib-dynload` folder can be copied and adapted for this purpose.
- If you're using a separate folder for third-party packages, ensure that folder is included as part of the *`PYTHONPATH`* configuration in step 10.
- If any of the folders that contain third-party packages will contain `.pth` files, you should add that folder as a *site directory* (using `site.addsitedir()`), rather than adding to *`PYTHONPATH`* or `sys.path` directly.

7.2.3 Testing a Python package

The CPython source tree contains a testbed project that is used to run the CPython test suite on the iOS simulator. This testbed can also be used as a testbed project for running your Python library's test suite on iOS.

After building or obtaining an iOS XCFramework (See iOS/README.rst for details), create a clone of the Python iOS testbed project by running:

```
$ python iOS/testbed clone --framework <path/to/Python.xcframework> --app <path/to/
↪module1> --app <path/to/module2> app-testbed
```

You will need to modify the `iOS/testbed` reference to point to that directory in the CPython source tree; any folders specified with the `--app` flag will be copied into the cloned testbed project. The resulting testbed will be created in the `app-testbed` folder. In this example, the `module1` and `module2` would be importable modules at runtime. If your project has additional dependencies, they can be installed into the `app-testbed/iOSTestbed/app_packages` folder (using `pip install --target app-testbed/iOSTestbed/app_packages` or similar).

You can then use the `app-testbed` folder to run the test suite for your app, For example, if `module1.tests` was the entry point to your test suite, you could run:

```
$ python app-testbed run -- module1.tests
```

This is the equivalent of running `python -m module1.tests` on a desktop Python build. Any arguments after the `--` will be passed to the testbed as if they were arguments to `python -m` on a desktop machine.

You can also open the testbed project in Xcode by running:

```
$ open app-testbed/iOSTestbed.xcodeproj
```

This will allow you to use the full Xcode suite of tools for debugging.

The arguments used to run the test suite are defined as part of the test plan. To modify the test plan, select the test plan node of the project tree (it should be the first child of the root node), and select the "Configurations" tab. Modify the "Arguments Passed On Launch" value to change the testing arguments.

The test plan also disables parallel testing, and specifies the use of the `iOSTestbed.lldbinit` file for providing configuration of the debugger. The default debugger configuration disables automatic breakpoints on the `SIGINT`, `SIGUSR1`, `SIGUSR2`, and `SIGXFSZ` signals.

7.3 App Store Compliance

The only mechanism for distributing apps to third-party iOS devices is to submit the app to the iOS App Store; apps submitted for distribution must pass Apple's app review process. This process includes a set of automated validation rules that inspect the submitted application bundle for problematic code.

The Python standard library contains some code that is known to violate these automated rules. While these violations appear to be false positives, Apple's review rules cannot be challenged; so, it is necessary to modify the Python standard library for an app to pass App Store review.

The Python source tree contains a patch file that will remove all code that is known to cause issues with the App Store review process. This patch is applied automatically when building for iOS.

BÖLÜM 8

Editors and IDEs

There are a number of IDEs that support Python programming language. Many editors and IDEs provide syntax highlighting, debugging tools, and **PEP 8** checks.

8.1 IDLE — Python editor and shell

IDLE is Python's Integrated Development and Learning Environment and is generally bundled with Python installs. If you are on Linux and do not have IDLE installed see *Installing IDLE on Linux*. For more information see the IDLE docs.

8.2 Other Editors and IDEs

Python's community wiki has information submitted by the community on Editors and IDEs. Please go to Python Editors and Integrated Development Environments for a comprehensive list.

EK A

Sözlük

>>>
: The default Python prompt of the *interactive* shell. Often seen for code examples which can be executed interactively in the interpreter.

...
: Şunlara başvurabilir:

  - The default Python prompt of the *interactive* shell when entering the code for an indented code block, when within a pair of matching left and right delimiters (parentheses, square brackets, curly braces or triple quotes), or after specifying a decorator.
  - The three dots form of the Ellipsis object.

soyut temel sınıf
: Soyut temel sınıflar *duck-typing* 'i, `hasattr()` gibi diğer teknikler beceriksiz veya tamamen yanlış olduğunda arayüzleri tanımlamanın bir yolunu sağlayarak tamamlar (örneğin sihirli yöntemlerle). ABC'ler, bir sınıftan miras almayan ancak yine de `isinstance()` ve `issubclass()` tarafından tanınan sınıflar olan sanal alt sınıfları tanıtır; `abc` modül belgelerine bakın. Python comes with many built-in ABCs for data structures (in the `collections.abc` module), numbers (in the `numbers` module), streams (in the `io` module), import finders and loaders (in the `importlib.abc` module). `abc` modülü ile kendi ABC'lerinizi oluşturabilirsiniz.

dipnot
: Bir değişkenle, bir sınıf niteliğiyle veya bir fonksiyon parametresiyle veya bir dönüş değeriyle ilişkilendirilen, gelenek olarak *type hint* biçiminde kullanılan bir etiket.

  Yerel değişkenlerin açıklamalarına çalışma zamanında erişilemez, ancak global değişkenlerin, sınıf niteliklerinin ve işlevlerin açıklamaları, sırasıyla modüllerin, sınıfların ve işlevlerin `__annotations__` özel özelliğinde saklanır.

  Bu işlevi açıklayan *variable annotation*, *function annotation*, **PEP 484** ve **PEP 526**'e bakın. Ek açıklamalarla çalışmaya ilişkin en iyi uygulamalar için ayrıca bkz. annotations-howto.

argüman
: Fonksiyon çağrılırken bir *function* 'a (veya *method*) geçirilen bir değer. İki tür argüman vardır:

  - *keyword argument*: bir işlev çağrısında bir tanımlayıcının (ör. `ad =`) önüne geçen veya bir sözlükte `**` ile başlayan bir değer olarak geçirilen bir argüman. Örneğin, `3` ve `5`, aşağıdaki `complex()`: çağrılarında anahtar kelimenin argümanleridir:

```
complex(real=3, imag=5)
complex(**{'real': 3, 'imag': 5})
```

- *positional argument*: anahtar kelime argümanı olmayan bir argüman. Konumsal argümanler, bir argüman listesinin başında görünebilir ve/veya `*` ile başlayan bir *iterable* öğesinin öğeleri olarak iletilebilir. Örneğin, `3` ve `5`, aşağıdaki çağrılarda konumsal argümanlerdir:

```
complex(3, 5)
complex(*(3, 5))
```

Argümanler, bir fonksiyon gövdesindeki adlandırılmış yerel değişkenlere atanır. Bu atamayı yöneten kurallar için calls bölümüne bakın. Sözdizimsel olarak, bir argümanı temsil etmek için herhangi bir ifade kullanılabilir; değerlendirilen değer yerel değişkene atanır.

Ayrıca *parameter* sözlüğü girişine, the difference between arguments and parameters hakkındaki SSS sorusuna ve **PEP 362** 'ye bakın.

asenkron bağlam yöneticisi
An object which controls the environment seen in an `async with` statement by defining `__aenter__()` and `__aexit__()` methods. Introduced by **PEP 492**.

asenkron jeneratör
asynchronous generator iterator döndüren bir işlev. Bir `async for` döngüsünde kullanılabilen bir dizi değer üretmek için `yield` ifadeleri içermesi dışında `async def` ile tanımlanmış bir eşyordam işlevine benziyor.

Genellikle bir asenkron üreteç işlevine atıfta bulunur, ancak bazı bağlamlarda bir *asynchronous generator iterator* 'e karşılık gelebilir. Amaçlanan anlamın net olmadığı durumlarda, tam terimlerin kullanılması belirsizliği önler.

Bir asenkron üretici fonksiyonu, `await` ifadelerinin yanı sıra `async for` ve `async with` ifadeleri içerebilir.

asenkron jeneratör yineleyici
An object created by an *asynchronous generator* function.

This is an *asynchronous iterator* which when called using the `__anext__()` method returns an awaitable object which will execute the body of the asynchronous generator function until the next `yield` expression.

Each `yield` temporarily suspends processing, remembering the execution state (including local variables and pending try-statements). When the *asynchronous generator iterator* effectively resumes with another awaitable returned by `__anext__()`, it picks up where it left off. See **PEP 492** and **PEP 525**.

eşzamansız yinelenebilir
An object, that can be used in an `async for` statement. Must return an *asynchronous iterator* from its `__aiter__()` method. Introduced by **PEP 492**.

asenkron yineleyici
An object that implements the `__aiter__()` and `__anext__()` methods. `__anext__()` must return an *awaitable* object. `async for` resolves the awaitables returned by an asynchronous iterator's `__anext__()` method until it raises a `StopAsyncIteration` exception. Introduced by **PEP 492**.

nitelik
Noktalı ifadeler kullanılarak adıyla başvurulan bir nesneyle ilişkili değer. Örneğin, *o* nesnesinin *a* özniteliği varsa, bu nesneye *o.a* olarak başvurulur.

Bir nesneye, eğer nesne izin veriyorsa, örneğin `setattr()` kullanarak, adı identifiers tarafından tanımlandığı gibi tanımlayıcı olmayan bir öznitelik vermek mümkündür. Böyle bir özniteliğe noktalı bir ifade kullanılarak erişilemez ve bunun yerine `getattr()` ile alınması gerekir.

beklenebilir
An object that can be used in an `await` expression. Can be a *coroutine* or an object with an `__await__()` method. See also **PEP 492**.

BDFL
Benevolent Dictator For Life, namı diğer Guido van Rossum, Python'un yaratıcısı.

ikili dosya
A *file object* able to read and write *bytes-like objects*. Examples of binary files are files opened in binary mode (`'rb'`, `'wb'` or `'rb+'`), `sys.stdin.buffer`, `sys.stdout.buffer`, and instances of `io.BytesIO` and `gzip.GzipFile`.

Ayrıca `str` nesnelerini okuyabilen ve yazabilen bir dosya nesnesi için *text file* 'a bakın.

ödünç alınan referans
In Python's C API, a borrowed reference is a reference to an object, where the code using the object does not own the reference. It becomes a dangling pointer if the object is destroyed. For example, a garbage collection can remove the last *strong reference* to the object and so destroy it.

borrowed reference üzerinde `Py_INCREF()` çağırmak, nesnenin ödünç alınanın son kullanımından önce yok edilemediği durumlar dışında, onu yerinde bir *strong reference* 'a dönüştürmek için tavsiye edilir. referans. `Py_NewRef()` işlevi, yeni bir *strong reference* oluşturmak için kullanılabilir.

bayt benzeri nesne
bufferobjects 'i destekleyen ve bir C-*contiguous* arabelleğini dışa aktarabilen bir nesne. Bu, tüm `bytes`, `bytearray` ve `array.array` nesnelerinin yanı sıra birçok yaygın `memoryview` nesnesini içerir. Bayt benzeri nesneler, ikili verilerle çalışan çeşitli işlemler için kullanılabilir; bunlara sıkıştırma, ikili dosyaya kaydetme ve bir soket üzerinden gönderme dahildir.

Bazı işlemler, değişken olması için ikili verilere ihtiyaç duyar. Belgeler genellikle bunlara "okuma-yazma bayt benzeri nesneler" olarak atıfta bulunur. Örnek değiştirilebilir arabellek nesneleri `bytearray` ve bir `bytearray` `memoryview` içerir. Diğer işlemler, ikili verilerin değişmez nesnelerde ("salt okunur bayt benzeri nesneler") depolanmasını gerektirir; bunların örnekleri arasında `bytes` ve bir `bytes` nesnesinin `memoryview` bulunur.

bayt kodu
Python kaynak kodu, bir Python programının CPython yorumlayıcısındaki dahili temsili olan bayt kodunda derlenir. Bayt kodu ayrıca `.pyc` dosyalarında önbelleğe alınır, böylece aynı dosyanın ikinci kez çalıştırılması daha hızlı olur (kaynaktan bayt koduna yeniden derleme önlenebilir). Bu "ara dilin", her bir bayt koduna karşılık gelen makine kodunu yürüten bir *sanal makine* üzerinde çalıştığı söylenir. Bayt kodlarının farklı Python sanal makineleri arasında çalışması veya Python sürümleri arasında kararlı olması beklenmediğini unutmayın.

Bayt kodu talimatlarının bir listesi bytecodes dokümanında bulunabilir.

çağırılabilir
Bir çağrılabilir, muhtemelen bir dizi argümanla (bkz. *argument*) ve aşağıdaki sözdizimiyle çağrılabilen bir nesnedir:

```
callable(argument1, argument2, argumentN)
```

Bir *fonksiyon* ve uzantısı olarak bir *metot* bir çağrılabilirdir. `__call__()` yöntemini uygulayan bir sınıf örneği de bir çağrılabilirdir.

geri çağırmak
Gelecekte bir noktada yürütülecek bir argüman olarak iletilen bir alt program işlevi.

sınıf
Kullanıcı tanımlı nesneler oluşturmak için bir şablon. Sınıf tanımları normalde sınıfın örnekleri üzerinde çalışan yöntem tanımlarını içerir.

sınıf değişkeni
Bir sınıfta tanımlanmış ve yalnızca sınıf düzeyinde (yani sınıfın bir örneğinde değil) değiştirilmesi amaçlanan bir değişken.

closure variable
A *free variable* referenced from a *nested scope* that is defined in an outer scope rather than being resolved at runtime from the globals or builtin namespaces. May be explicitly defined with the `nonlocal` keyword to allow write access, or implicitly defined if the variable is only being read.

For example, in the `inner` function in the following code, both `x` and `print` are *free variables*, but only `x` is a *closure variable*:

```
def outer():
    x = 0
    def inner():
        nonlocal x
```

(sonraki sayfaya devam)

(önceki sayfadan devam)

```
        x += 1
        print(x)
    return inner
```

Due to the `codeobject.co_freevars` attribute (which, despite its name, only includes the names of closure variables rather than listing all referenced free variables), the more general *free variable* term is sometimes used even when the intended meaning is to refer specifically to closure variables.

karmaşık sayı
Tüm sayıların bir reel kısım ve bir sanal kısım toplamı olarak ifade edildiği bilinen gerçek sayı sisteminin bir uzantısı. Hayali sayılar, hayali birimin gerçek katlarıdır (`-1` 'in karekökü), genellikle matematikte `i` veya mühendislikte `j` ile yazılır. Python, bu son gösterimle yazılan karmaşık sayılar için yerleşik desteğe sahiptir; hayali kısım bir `j` son ekiyle yazılır, örneğin `3+1j`. `math` modülünün karmaşık eş değerlerine erişmek için `cmath` kullanın. Karmaşık sayıların kullanımı oldukça gelişmiş bir matematiksel özelliktir. Onlara olan ihtiyacın farkında değilseniz, onları güvenle görmezden gelebileceğiniz neredeyse kesindir.

context
This term has different meanings depending on where and how it is used. Some common meanings:

- The temporary state or environment established by a *context manager* via a `with` statement.
- The collection of keyvalue bindings associated with a particular `contextvars.Context` object and accessed via `ContextVar` objects. Also see *context variable*.
- A `contextvars.Context` object. Also see *current context*.

context management protocol
The `__enter__()` and `__exit__()` methods called by the `with` statement. See **PEP 343**.

bağlam yöneticisi
An object which implements the *context management protocol* and controls the environment seen in a `with` statement. See **PEP 343**.

bağlam değişkeni
A variable whose value depends on which context is the *current context*. Values are accessed via `contextvars.ContextVar` objects. Context variables are primarily used to isolate state between concurrent asynchronous tasks.

bitişik
Bir arabellek, *C-bitişik* veya *Fortran bitişik* ise tam olarak bitişik olarak kabul edilir. Sıfır boyutlu arabellekler C ve Fortran bitişiktir. Tek boyutlu dizilerde, öğeler sıfırdan başlayarak artan dizinler sırasına göre bellekte yan yana yerleştirilmelidir. Çok boyutlu C-bitişik dizilerde, öğeleri bellek adresi sırasına göre ziyaret ederken son dizin en hızlı şekilde değişir. Ancak, Fortran bitişik dizilerinde, ilk dizin en hızlı şekilde değişir.

eşyordam
Eşyordamlar, altyordamların daha genelleştirilmiş bir biçimidir. Alt programlara bir noktada girilir ve başka bir noktada çıkılır. Eşyordamlar birçok farklı noktada girilebilir, çıkılabilir ve devam ettirilebilir. `async def` ifadesi ile uygulanabilirler. Ayrıca bakınız **PEP 492**.

eşyordam işlevi
Bir *coroutine* nesnesi döndüren bir işlev. Bir eşyordam işlevi `async def` ifadesiyle tanımlanabilir ve `await`, `async for` ve `async with` anahtar kelimelerini içerebilir. Bunlar **PEP 492** tarafından tanıtıldı.

CPython
Python programlama dilinin python.org üzerinde dağıtıldığı şekliyle kurallı uygulaması. "CPython" terimi, gerektiğinde bu uygulamayı Jython veya IronPython gibi diğerlerinden ayırmak için kullanılır.

current context
The *context* (`contextvars.Context` object) that is currently used by `ContextVar` objects to access (get or set) the values of *context variables*. Each thread has its own current context. Frameworks for executing asynchronous tasks (see `asyncio`) associate each task with a context which becomes the current context whenever the task starts or resumes execution.

dekoratör
Genellikle `@wrapper` sözdizimi kullanılarak bir işlev dönüşümü olarak uygulanan, başka bir işlevi döndüren bir işlev. Dekoratörler için yaygın örnekler şunlardır: `classmethod()` ve `staticmethod()`.

Dekoratör sözdizimi yalnızca sözdizimsel şekerdir, aşağıdaki iki işlev tanımı anlamsal olarak eş değerdir:

```
def f(arg):
    ...
f = staticmethod(f)

@staticmethod
def f(arg):
    ...
```

Aynı kavram sınıflar için de mevcuttur, ancak orada daha az kullanılır. Dekoratörler hakkında daha fazla bilgi için function definitions ve class definitions belgelerine bakın.

tanımlayıcı
Any object which defines the methods `__get__()`, `__set__()`, or `__delete__()`. When a class attribute is a descriptor, its special binding behavior is triggered upon attribute lookup. Normally, using *a.b* to get, set or delete an attribute looks up the object named *b* in the class dictionary for *a*, but if *b* is a descriptor, the respective descriptor method gets called. Understanding descriptors is a key to a deep understanding of Python because they are the basis for many features including functions, methods, properties, class methods, static methods, and reference to super classes.

Tanımlayıcıların yöntemleri hakkında daha fazla bilgi için, bkz. descriptors veya Descriptor How To Guide.

sözlük
An associative array, where arbitrary keys are mapped to values. The keys can be any object with `__hash__()` and `__eq__()` methods. Called a hash in Perl.

sözlük anlama
Öğelerin tümünü veya bir kısmını yinelenebilir bir şekilde işlemenin ve sonuçları içeren bir sözlük döndürmenin kompakt bir yolu. `results = {n: n ** 2 for range(10)}`, `n ** 2` değerine eşlenmiş `n` anahtarını içeren bir sözlük oluşturur. Bkz. comprehensions.

sözlük görünümü
`dict.keys()`, `dict.values()` ve `dict.items()` 'den döndürülen nesnelere sözlük görünümleri denir. Sözlüğün girişleri üzerinde dinamik bir görünüm sağlarlar; bu, sözlük değiştiğinde görünümün bu değişiklikleri yansıttığı anlamına gelir. Sözlük görünümünü tam liste olmaya zorlamak için `list(dictview)` kullanın. Bakınız dict-views.

belge dizisi
A string literal which appears as the first expression in a class, function or module. While ignored when the suite is executed, it is recognized by the compiler and put into the `__doc__` attribute of the enclosing class, function or module. Since it is available via introspection, it is the canonical place for documentation of the object.

ördek yazma
Doğru arayüze sahip olup olmadığını belirlemek için bir nesnenin türüne bakmayan bir programlama stili; bunun yerine, yöntem veya nitelik basitçe çağrılır veya kullanılır ("Ördek gibi görünüyorsa ve ördek gibi vaklıyorsa, ördek olmalıdır.") İyi tasarlanmış kod, belirli türlerden ziyade arayüzleri vurgulayarak, polimorfik ikameye izin vererek esnekliğini artırır. Ördek yazma, `type()` veya `isinstance()` kullanan testleri önler. (Ancak, ördek yazmanın *abstract base class* ile tamamlanabileceğini unutmayın.) Bunun yerine, genellikle `hasattr()` testleri veya *EAFP* programlamasını kullanır.

dunder
An informal short-hand for "double underscore", used when talking about a *special method*. For example, `__init__` is often pronounced "dunder init".

EAFP
Af dilemek izin almaktan daha kolaydır. Bu yaygın Python kodlama stili, geçerli anahtarların veya niteliklerin varlığını varsayar ve varsayımın yanlış çıkması durumunda istisnaları yakalar. Bu temiz ve hızlı stil, birçok `try`

ve `except` ifadesinin varlığı ile karakterize edilir. Teknik, C gibi diğer birçok dilde ortak olan *LBYL* stiliyle çelişir.

ifade (değer döndürür)
Bir değere göre değerlendirilebilecek bir sözdizimi parçası. Başka bir deyişle, bir ifade, tümü bir değer döndüren sabit değerler, adlar, öznitelik erişimi, işleçler veya işlev çağrıları gibi ifade öğelerinin bir toplamıdır. Diğer birçok dilin aksine, tüm dil yapıları ifade değildir. Ayrıca `while` gibi kullanılamayan *ifadeler* de vardır. Atamalar da değer döndürmeyen ifadelerdir (statement).

uzatma modülü
Çekirdekle ve kullanıcı koduyla etkileşim kurmak için Python'un C API'sini kullanan, C veya C++ ile yazılmış bir modül.

f-string
Ön eki `'f'` veya `'F'` olan dize değişmezleri genellikle "f-strings" olarak adlandırılır; bu, formatted string literals 'ın kısaltmasıdır. Ayrıca bkz. **PEP 498**.

dosya nesnesi
An object exposing a file-oriented API (with methods such as `read()` or `write()`) to an underlying resource. Depending on the way it was created, a file object can mediate access to a real on-disk file or to another type of storage or communication device (for example standard input/output, in-memory buffers, sockets, pipes, etc.). File objects are also called *file-like objects* or *streams*.

Aslında üç dosya nesnesi kategorisi vardır: ham *binary files*, arabelleğe alınmış *binary files* ve *text files*. Arayüzleri `io` modülünde tanımlanmıştır. Bir dosya nesnesi yaratmanın kurallı yolu `open()` işlevini kullanmaktır.

dosya benzeri nesne
dosya nesnesi ile eşanlamlıdır.

dosya sistemi kodlaması ve hata işleyicisi
Python tarafından işletim sistemindeki baytların kodunu çözmek ve Unicode'u işletim sistemine kodlamak için kullanılan kodlama ve hata işleyici.

Dosya sistemi kodlaması, 128'in altındaki tüm baytların kodunu başarıyla çözmeyi garanti etmelidir. Dosya sistemi kodlaması bu garantiyi sağlayamazsa, API işlevleri `UnicodeError` değerini yükseltebilir.

`sys.getfilesystemencoding()` ve `sys.getfilesystemencodeerrors()` işlevleri, dosya sistemi kodlamasını ve hata işleyicisini almak için kullanılabilir.

filesystem encoding and error handler Python başlangıcında `PyConfig_Read()` işleviyle yapılandırılır: bkz. `filesystem_encoding` ve `filesystem_errors` üyeleri `PyConfig`.

Ayrıca bkz. *locale encoding*.

bulucu
İçe aktarılmakta olan bir modül için *loader* 'ı bulmaya çalışan bir nesne.

There are two types of finder: *meta path finders* for use with `sys.meta_path`, and *path entry finders* for use with `sys.path_hooks`.

See finders-and-loaders and `importlib` for much more detail.

kat bölümü
En yakın tam sayıya yuvarlayan matematiksel bölme. Kat bölme operatörü `//` şeklindedir. Örneğin, `11 // 4` ifadesi, gerçek yüzer bölme tarafından döndürülen `2.75` değerinin aksine `2` olarak değerlendirilir. `(-11) // 4` 'ün `-3` olduğuna dikkat edin, çünkü bu `-2.75` yuvarlatılmış *aşağı*. Bakınız **PEP 238**.

free threading
A threading model where multiple threads can run Python bytecode simultaneously within the same interpreter. This is in contrast to the *global interpreter lock* which allows only one thread to execute Python bytecode at a time. See **PEP 703**.

free variable
Formally, as defined in the language execution model, a free variable is any variable used in a namespace which is not a local variable in that namespace. See *closure variable* for an example. Pragmatically, due to the name of the `codeobject.co_freevars` attribute, the term is also sometimes used as a synonym for *closure variable*.

fonksiyon
Bir arayana bir değer döndüren bir dizi ifade. Ayrıca, gövdenin yürütülmesinde kullanılabilen sıfır veya daha fazla *argüman* iletilebilir. Ayrıca *parameter*, *method* ve function bölümüne bakın.

fonksiyon açıklaması
Bir işlev parametresinin veya dönüş değerinin *ek açıklaması*.

İşlev ek açıklamaları genellikle *type hints* için kullanılır: örneğin, bu fonksiyonun iki `int` argüman alması ve ayrıca bir `int` dönüş değerine sahip olması beklenir

```
def sum_two_numbers(a: int, b: int) -> int:
   return a + b
```

İşlev açıklama sözdizimi function bölümünde açıklanmaktadır.

Bu işlevi açıklayan *variable annotation* ve **PEP 484** 'e bakın. Ek açıklamalarla çalışmaya ilişkin en iyi uygulamalar için ayrıca annotations-howto konusuna bakın.

__future__
Bir future ifadesi, `from __future__ import <feature>`, derleyiciyi, Python'un gelecekteki bir sürümünde standart hale gelecek olan sözdizimini veya semantiği kullanarak mevcut modülü derlemeye yönlendirir. `__future__` modülü, *feature*'ın olası değerlerini belgeler. Bu modülü içe aktararak ve değişkenlerini değerlendirerek, dile ilk kez yeni bir özelliğin ne zaman eklendiğini ve ne zaman varsayılan olacağını (ya da yaptığını) görebilirsiniz:

```
>>> import __future__
>>> __future__.division
_Feature((2, 2, 0, 'alpha', 2), (3, 0, 0, 'alpha', 0), 8192)
```

çöp toplama
Artık kullanılmadığında belleği boşaltma işlemi. Python, referans sayımı ve referans döngülerini algılayıp kırabilen bir döngüsel çöp toplayıcı aracılığıyla çöp toplama gerçekleştirir. Çöp toplayıcı `gc` modülü kullanılarak kontrol edilebilir.

jeneratör
Bir *generator iterator* döndüren bir işlev. Bir for döngüsünde kullanılabilen bir dizi değer üretmek için `yield` ifadeleri içermesi veya `next()` işleviyle birer birer alınabilmesi dışında normal bir işleve benziyor.

Genellikle bir üretici işlevine atıfta bulunur, ancak bazı bağlamlarda bir *jeneratör yineleyicisine* atıfta bulunabilir. Amaçlanan anlamın net olmadığı durumlarda, tam terimlerin kullanılması belirsizliği önler.

jeneratör yineleyici
Bir *generator* işlevi tarafından oluşturulan bir nesne.

Each `yield` temporarily suspends processing, remembering the execution state (including local variables and pending try-statements). When the *generator iterator* resumes, it picks up where it left off (in contrast to functions which start fresh on every invocation).

jeneratör ifadesi
An *expression* that returns an *iterator*. It looks like a normal expression followed by a `for` clause defining a loop variable, range, and an optional `if` clause. The combined expression generates values for an enclosing function:

```
>>> sum(i*i for i in range(10))         # sum of squares 0, 1, 4, ... 81
285
```

genel işlev
Farklı türler için aynı işlemi uygulayan birden çok işlevden oluşan bir işlev. Bir çağrı sırasında hangi uygulamanın kullanılması gerektiği, gönderme algoritması tarafından belirlenir.

Ayrıca *single dispatch* sözlük girdisine, `functools.singledispatch()` dekoratörüne ve **PEP 443** 'e bakın.

genel tip
Parametrelendirilebilen bir *type*; tipik olarak bir konteyner sınıfı, örneğin `list` veya `dict`. *type hint* ve *annotation* için kullanılır.

Daha fazla ayrıntı için generic allias types, **PEP 483**, **PEP 484**, **PEP 585** ve `typing` modülüne bakın.

GIL
Bakınız *global interpreter lock*.

genel tercüman kilidi
CPython yorumlayıcısı tarafından aynı anda yalnızca bir iş parçacığının Python *bytecode* 'u yürütmesini sağlamak için kullanılan mekanizma. Bu, nesne modelini (`dict` gibi kritik yerleşik türler dahil) eşzamanlı erişime karşı örtük olarak güvenli hale getirerek CPython uygulamasını basitleştirir. Tüm yorumlayıcıyı kilitlemek, çok işlemcili makinelerin sağladığı paralelliğin çoğu pahasına, yorumlayıcının çok iş parçacıklı olmasını kolaylaştırır.

Bununla birlikte, standart veya üçüncü taraf bazı genişletme modülleri, sıkıştırma veya karma gibi hesaplama açısından yoğun görevler yaparken GIL'yi serbest bırakacak şekilde tasarlanmıştır. Ayrıca, GIL, G/Ç yaparken her zaman serbest bırakılır.

As of Python 3.13, the GIL can be disabled using the *`--disable-gil`* build configuration. After building Python with this option, code must be run with *`-X gil =0`* or after setting the *`PYTHON_GIL =0`* environment variable. This feature enables improved performance for multi-threaded applications and makes it easier to use multi-core CPUs efficiently. For more details, see **PEP 703**.

karma tabanlı pyc
Geçerliliğini belirlemek için ilgili kaynak dosyanın son değiştirilme zamanı yerine karma değerini kullanan bir bayt kodu önbellek dosyası. Bakınız pyc-invalidation.

yıkanabilir
An object is *hashable* if it has a hash value which never changes during its lifetime (it needs a `__hash__()` method), and can be compared to other objects (it needs an `__eq__()` method). Hashable objects which compare equal must have the same hash value.

Hashability, bir nesneyi bir sözlük anahtarı ve bir set üyesi olarak kullanılabilir hale getirir, çünkü bu veri yapıları hash değerini dahili olarak kullanır.

Python'un değişmez yerleşik nesnelerinin çoğu, yıkanabilir; değiştirilebilir kaplar (listeler veya sözlükler gibi) değildir; değişmez kaplar (tüpler ve donmuş kümeler gibi) yalnızca öğelerinin yıkanabilir olması durumunda yıkanabilirdir. Kullanıcı tanımlı sınıfların örnekleri olan nesneler varsayılan olarak hash edilebilirdir. Hepsi eşit olmayanı karşılaştırır (kendileriyle hariç) ve hash değerleri `id()` 'lerinden türetilir.

BOŞTA
Python için Entegre Geliştirme Ortamı. idle, Python'un standart dağıtımıyla birlikte gelen temel bir düzenleyici ve yorumlayıcı ortamıdır.

immortal
Immortal objects are a CPython implementation detail introduced in **PEP 683**.

If an object is immortal, its *reference count* is never modified, and therefore it is never deallocated while the interpreter is running. For example, `True` and `None` are immortal in CPython.

değişmez
Sabit değeri olan bir nesne. Değişmez nesneler arasında sayılar, dizeler ve demetler bulunur. Böyle bir nesne değiştirilemez. Farklı bir değerin saklanması gerekiyorsa yeni bir nesne oluşturulmalıdır. Örneğin bir sözlükte anahtar olarak, sabit bir karma değerinin gerekli olduğu yerlerde önemli bir rol oynarlar.

içe aktarım yolu
İçe aktarılacak modüller için *path based finder* tarafından aranan konumların (veya *path entries*) listesi. İçe aktarma sırasında, bu konum listesi genellikle `sys.path` adresinden gelir, ancak alt paketler için üst paketin `__path__` özelliğinden de gelebilir.

içe aktarma
Bir modüldeki Python kodunun başka bir modüldeki Python koduna sunulması süreci.

içe aktarıcı
Bir modülü hem bulan hem de yükleyen bir nesne; hem bir *finder* hem de *loader* nesnesi.

etkileşimli
Python has an interactive interpreter which means you can enter statements and expressions at the interpreter prompt, immediately execute them and see their results. Just launch `python` with no arguments (possibly by selecting it from your computer's main menu). It is a very powerful way to test out new ideas or inspect modules and packages (remember `help(x)`). For more on interactive mode, see tut-interac.

yorumlanmış
Python, derlenmiş bir dilin aksine yorumlanmış bir dildir, ancak bayt kodu derleyicisinin varlığı nedeniyle ayrım bulanık olabilir. Bu, kaynak dosyaların daha sonra çalıştırılacak bir yürütülebilir dosya oluşturmadan doğrudan çalıştırılabileceği anlamına gelir. Yorumlanan diller genellikle derlenmiş dillerden daha kısa bir geliştirme/hata ayıklama döngüsüne sahiptir, ancak programları genellikle daha yavaş çalışır. Ayrıca bkz. *interactive*.

tercüman kapatma
Kapatılması istendiğinde, Python yorumlayıcısı, modüller ve çeşitli kritik iç yapılar gibi tahsis edilen tüm kaynakları kademeli olarak serbest bıraktığı özel bir aşamaya girer. Ayrıca *garbage collector* için birkaç çağrı yapar. Bu, kullanıcı tanımlı yıkıcılarda veya zayıf referans geri aramalarında kodun yürütülmesini tetikleyebilir. Kapatma aşamasında yürütülen kod, dayandığı kaynaklar artık çalışmayabileceğinden çeşitli istisnalarla karşılaşabilir (yaygın örnekler kütüphane modülleri veya uyarı makineleridir).

Yorumlayıcının kapatılmasının ana nedeni, `__main__` modülünün veya çalıştırılan betiğin yürütmeyi bitirmiş olmasıdır.

yinelenebilir
An object capable of returning its members one at a time. Examples of iterables include all sequence types (such as `list`, `str`, and `tuple`) and some non-sequence types like `dict`, *file objects*, and objects of any classes you define with an `__iter__()` method or with a `__getitem__()` method that implements *sequence* semantics.

Iterables can be used in a `for` loop and in many other places where a sequence is needed (`zip()`, `map()`, …). When an iterable object is passed as an argument to the built-in function `iter()`, it returns an iterator for the object. This iterator is good for one pass over the set of values. When using iterables, it is usually not necessary to call `iter()` or deal with iterator objects yourself. The `for` statement does that automatically for you, creating a temporary unnamed variable to hold the iterator for the duration of the loop. See also *iterator*, *sequence*, and *generator*.

yineleyici
An object representing a stream of data. Repeated calls to the iterator's `__next__()` method (or passing it to the built-in function `next()`) return successive items in the stream. When no more data are available a `StopIteration` exception is raised instead. At this point, the iterator object is exhausted and any further calls to its `__next__()` method just raise `StopIteration` again. Iterators are required to have an `__iter__()` method that returns the iterator object itself so every iterator is also iterable and may be used in most places where other iterables are accepted. One notable exception is code which attempts multiple iteration passes. A container object (such as a `list`) produces a fresh new iterator each time you pass it to the `iter()` function or use it in a `for` loop. Attempting this with an iterator will just return the same exhausted iterator object used in the previous iteration pass, making it appear like an empty container.

Daha fazla bilgi typeiter içinde bulunabilir.

CPython uygulama ayrıntısı: CPython does not consistently apply the requirement that an iterator define `__iter__()`. And also please note that the free-threading CPython does not guarantee the thread-safety of iterator operations.

anahtar işlev
Anahtar işlevi veya harmanlama işlevi, sıralama veya sıralama için kullanılan bir değeri döndüren bir çağrılabilir. Örneğin, `locale.strxfrm()`, yerel ayara özgü sıralama kurallarının farkında olan bir sıralama anahtarı üretmek için kullanılır.

Python'daki bir dizi araç, öğelerin nasıl sıralandığını veya gruplandırıldığını kontrol etmek için temel işlevleri kabul eder. Bunlar `min()`, `max()`, `sorted()`, `list.sort()`, `heapq.merge()`, `heapq.nsmallest()`, `heapq.nlargest()` ve `itertools.groupby()`.

Bir tuş fonksiyonu oluşturmanın birkaç yolu vardır. Örneğin. `str.lower()` yöntemi, büyük/küçük harfe duyarlı olmayan sıralamalar için bir anahtar fonksiyonu işlevi görebilir. Alternatif olarak, `lambda r: (r[0], r[2])` gibi bir `lambda` ifadesinden bir anahtar işlevi oluşturulabilir. Ayrıca, `attrgetter()`, `itemgetter()` ve `methodcaller()` fonksiyonları üç anahtar fonksiyon kurucularıdır. Anahtar işlevlerin nasıl oluşturulacağı ve kullanılacağına ilişkin örnekler için Sorting HOW TO bölümüne bakın.

anahtar kelime argümanı
Bakınız *argument*.

lambda
İşlev çağrıldığında değerlendirilen tek bir *expression* 'dan oluşan anonim bir satır içi işlev. Bir lambda işlevi oluşturmak için sözdizimi `lambda [parametreler]: ifade` şeklindedir

LBYL
Zıplamadan önce Bak. Bu kodlama stili, arama veya arama yapmadan önce ön koşulları açıkça test eder. Bu stil, *EAFP* yaklaşımıyla çelişir ve birçok `if` ifadesinin varlığı ile karakterize edilir.

Çok iş parçacıklı bir ortamda, LBYL yaklaşımı "bakan" ve "sıçrayan" arasında bir yarış koşulu getirme riskini taşıyabilir. Örneğin, `if key in mapping: return mapping[key]` kodu, testten sonra, ancak aramadan önce başka bir iş parçacığı *eşlemeden key* kaldırırsa başarısız olabilir. Bu sorun, kilitlerle veya EAFP yaklaşımı kullanılarak çözülebilir.

lexical analyzer
Formal name for the *tokenizer*; see *token*.

liste
A built-in Python *sequence*. Despite its name it is more akin to an array in other languages than to a linked list since access to elements is *O*(1).

liste anlama
Bir dizideki öğelerin tümünü veya bir kısmını işlemenin ve sonuçları içeren bir liste döndürmenin kompakt bir yolu. `sonuç = ['{:#04x}'.format(x) for range(256) if x % 2 == 0]`, dizinde çift onaltılık sayılar (0x..) içeren bir diziler listesi oluşturur. 0 ile 255 arasındadır. `if` yan tümcesi isteğe bağlıdır. Atlanırsa, "aralık(256)" içindeki tüm öğeler işlenir.

yükleyici
An object that loads a module. It must define the `exec_module()` and `create_module()` methods to implement the `Loader` interface. A loader is typically returned by a *finder*. See also:

- finders-and-loaders
- `importlib.abc.Loader`
- **PEP 302**

yerel kodlama
Unix'te, LC_CTYPE yerel ayarının kodlamasıdır. `locale.setlocale(locale.LC_CTYPE, new_locale)` ile ayarlanabilir.

Windows'ta bu, ANSI kod sayfasıdır (ör. `"cp1252"`).

Android ve VxWorks'te Python, yerel kodlama olarak `"utf-8"` kullanır.

`locale.getencoding()` can be used to get the locale encoding.

Ayrıca *filesystem encoding and error handler* 'ne bakın.

sihirli yöntem
special method için gayri resmi bir eşanlamlı.

haritalama
Keyfi anahtar aramalarını destekleyen ve `Mapping` veya `MutableMapping` collections-abstract-base-classes içinde belirtilen yöntemleri uygulayan bir kapsayıcı nesnesi. Örnekler arasında `dict`, `collections.defaultdict`, `collections.OrderedDict` ve `collections.Counter` sayılabilir.

meta yol bulucu
Bir *finder*, `sys.meta_path` aramasıyla döndürülür. Meta yol bulucular, *yol girişi bulucuları* ile ilişkilidir, ancak onlardan farklıdır.

Meta yol bulucuların uyguladığı yöntemler için `importlib.abc.MetaPathFinder` bölümüne bakın.

metasınıf
Bir sınıfın sınıfı. Sınıf tanımları, bir sınıf adı, bir sınıf sözlüğü ve temel sınıfların bir listesini oluşturur. Metasınıf, bu üç argümanı almaktan ve sınıfı oluşturmaktan sorumludur. Çoğu nesne yönelimli programlama dili, varsayılan bir uygulama sağlar. Python'u özel yapan şey, özel metasınıflar oluşturmanın mümkün olmasıdır. Çoğu kullanıcı bu araca hiçbir zaman ihtiyaç duymaz, ancak ihtiyaç duyulduğunda, metasınıflar güçlü ve zarif çözümler sağlayabilir. Nitelik erişimini günlüğe kaydetmek, iş parçacığı güvenliği eklemek, nesne oluşturmayı izlemek, tekilleri uygulamak ve diğer birçok görev için kullanılmışlardır.

Daha fazla bilgi metaclasses içinde bulunabilir.

metot
Bir sınıf gövdesi içinde tanımlanan bir işlev. Bu sınıfın bir örneğinin özniteliği olarak çağrılırsa, yöntem örnek nesnesini ilk *argument* (genellikle `self` olarak adlandırılır) olarak alır. Bkz. *function* ve *nested scope*.

metot kalite sıralaması
Method Resolution Order is the order in which base classes are searched for a member during lookup. See python_2.3_mro for details of the algorithm used by the Python interpreter since the 2.3 release.

modül
Python kodunun kuruluş birimi olarak hizmet eden bir nesne. Modüller, rastgele Python nesneleri içeren bir ad alanına sahiptir. Modüller, *importing* işlemiyle Python'a yüklenir.

Ayrıca bakınız *package*.

modül özelliği
Bir modülü yüklemek için kullanılan içe aktarmayla ilgili bilgileri içeren bir ad alanı. Bir `importlib.machinery.ModuleSpec` örneği.

See also module-specs.

MRO
Bakınız *metot çözüm sırası*.

değiştirilebilir
Değiştirilebilir (mutable) nesneler değerlerini değiştirebilir ancak `idlerini` koruyabilirler. Ayrıca bkz. *immutable*.

adlandırılmış demet
"named tuple" terimi, demetten miras alan ve dizinlenebilir öğelerine de adlandırılmış nitelikler kullanılarak erişilebilen herhangi bir tür veya sınıf için geçerlidir. Tür veya sınıfın başka özellikleri de olabilir.

Çeşitli yerleşik türler, `time.localtime()` ve `os.stat()` tarafından döndürülen değerler de dahil olmak üzere, tanımlama grupları olarak adlandırılır. Başka bir örnek `sys.float_info`:

```
>>> sys.float_info[1]                    # indexed access
1024
>>> sys.float_info.max_exp               # named field access
1024
>>> isinstance(sys.float_info, tuple)    # kind of tuple
True
```

Some named tuples are built-in types (such as the above examples). Alternatively, a named tuple can be created from a regular class definition that inherits from `tuple` and that defines named fields. Such a class can be written by hand, or it can be created by inheriting `typing.NamedTuple`, or with the factory function `collections.namedtuple()`. The latter techniques also add some extra methods that may not be found in hand-written or built-in named tuples.

ad alanı
Değişkenin saklandığı yer. Ad alanları sözlükler olarak uygulanır. Nesnelerde (yöntemlerde) yerel, genel ve yerleşik ad alanlarının yanı sıra iç içe ad alanları vardır. Ad alanları, adlandırma çakışmalarını önleyerek modülerliği destekler. Örneğin, `builtins.open` ve `os.open()` işlevleri ad alanlarıyla ayırt edilir. Ad alanları, hangi modülün bir işlevi uyguladığını açıkça belirterek okunabilirliğe ve sürdürülebilirliğe de yardım-

cı olur. Örneğin, `random.seed()` veya `itertools.islice()` yazmak, bu işlevlerin sırasıyla `random` ve `itertools` modülleri tarafından uygulandığını açıkça gösterir.

ad alanı paketi
A *package* which serves only as a container for subpackages. Namespace packages may have no physical representation, and specifically are not like a *regular package* because they have no `__init__.py` file.

Namespace packages allow several individually installable packages to have a common parent package. Otherwise, it is recommended to use a *regular package*.

For more information, see **PEP 420** and reference-namespace-package.

Ayrıca bkz. *module*.

iç içe kapsam
Kapsamlı bir tanımdaki bir değişkene atıfta bulunma yeteneği. Örneğin, başka bir fonksiyonun içinde tanımlanan bir fonksiyon, dış fonksiyondaki değişkenlere atıfta bulunabilir. İç içe kapsamların varsayılan olarak yalnızca başvuru için çalıştığını ve atama için çalışmadığını unutmayın. Yerel değişkenler en içteki kapsamda hem okur hem de yazar. Benzer şekilde, global değişkenler global ad alanını okur ve yazar. `nonlocal`, dış kapsamlara yazmaya izin verir.

yeni stil sınıf
Old name for the flavor of classes now used for all class objects. In earlier Python versions, only new-style classes could use Python's newer, versatile features like `__slots__`, descriptors, properties, `__getattribute__()`, class methods, and static methods.

obje
Durum (öznitelikler veya değer) ve tanımlanmış davranış (yöntemler) içeren herhangi bir veri. Ayrıca herhangi bir *yeni tarz sınıfın* nihai temel sınıfı.

optimized scope
A scope where target local variable names are reliably known to the compiler when the code is compiled, allowing optimization of read and write access to these names. The local namespaces for functions, generators, coroutines, comprehensions, and generator expressions are optimized in this fashion. Note: most interpreter optimizations are applied to all scopes, only those relying on a known set of local and nonlocal variable names are restricted to optimized scopes.

paket
Alt modüller veya yinelemeli olarak alt paketler içerebilen bir Python *module*. Teknik olarak bir paket, `__path__` özniteliğine sahip bir Python modülüdür.

Ayrıca bkz. *regular package* ve *namespace package*.

parametre
Bir *function* (veya yöntem) tanımında, işlevin kabul edebileceği bir *argument* (veya bazı durumlarda, argümanlar) belirten adlandırılmış bir varlık. Beş çeşit parametre vardır:

- *positional-or-keyword*: *pozisyonel* veya bir *keyword argümanı* olarak iletilebilen bir argüman belirtir. Bu, varsayılan parametre türüdür, örneğin aşağıdakilerde *foo* ve *bar*:

```
def func(foo, bar=None): ...
```

- *positional-only*: yalnızca konuma göre sağlanabilen bir argüman belirtir. Yalnızca konumsal parametreler, onlardan sonra fonksiyon tanımının parametre listesine bir `/` karakteri eklenerek tanımlanabilir, örneğin aşağıdakilerde *posonly1* ve *posonly2*:

```
def func(posonly1, posonly2, /, positional_or_keyword): ...
```

- *keyword-only*: sadece anahtar kelime ile sağlanabilen bir argüman belirtir. Yalnızca anahtar kelime (keyword-only) parametreleri, onlardan önceki fonksiyon tanımının parametre listesine tek bir değişken konumlu parametre veya çıplak `*` dahil edilerek tanımlanabilir, örneğin aşağıdakilerde *kw_only1* ve *kw_only2*:

```
def func(arg, *, kw_only1, kw_only2): ...
```

- *var-positional*: keyfi bir pozisyonel argüman dizisinin sağlanabileceğini belirtir (diğer parametreler tarafından zaten kabul edilmiş herhangi bir konumsal argümana ek olarak). Böyle bir parametre, parametre adının başına `*` eklenerek tanımlanabilir, örneğin aşağıdakilerde *args*:

```
def func(*args, **kwargs): ...
```

- *var-keyword*: keyfi olarak birçok anahtar kelime argümanının sağlanabileceğini belirtir (diğer parametreler tarafından zaten kabul edilen herhangi bir anahtar kelime argümanına ek olarak). Böyle bir parametre, parametre adının başına `**`, örneğin yukarıdaki örnekte *kwargs* eklenerek tanımlanabilir.

Parametreler, hem isteğe bağlı hem de gerekli argümanleri ve ayrıca bazı isteğe bağlı bağımsız değişkenler için varsayılan değerleri belirtebilir.

Ayrıca bkz. *argüman*, argümanlar ve parametreler arasındaki fark, `inspect.Parameter`, function ve **PEP 362**.

yol girişi
path based finder içe aktarma modüllerini bulmak için başvurduğu *import path* üzerindeki tek bir konum.

yol girişi bulucu
Bir *finder* `sys.path_hooks` (yani bir *yol giriş kancası*) üzerinde bir çağrılabilir tarafından döndürülür ve *path entry* verilen modüllerin nasıl bulunacağını bilir.

Yol girişi bulucularının uyguladığı yöntemler için `importlib.abc.PathEntryFinder` bölümüne bakın.

yol giriş kancası
A callable on the `sys.path_hooks` list which returns a *path entry finder* if it knows how to find modules on a specific *path entry*.

yol tabanlı bulucu
Modüller için bir *import path* arayan varsayılan *meta yol bulucular*dan biri.

yol benzeri nesne
Bir dosya sistemi yolunu temsil eden bir nesne. Yol benzeri bir nesne, bir yolu temsil eden bir `str` veya `bytes` nesnesi veya `os.PathLike` protokolünü uygulayan bir nesnedir. `os.PathLike` protokolünü destekleyen bir nesne, `os.fspath()` işlevi çağrılarak bir `str` veya `bytes` dosya sistemi yoluna dönüştürülebilir; `os.fsdecode()` ve `os.fsencode()`, bunun yerine sırasıyla `str` veya `bytes` sonucunu garanti etmek için kullanılabilir. **PEP 519** tarafından tanıtıldı.

PEP
Python Geliştirme Önerisi. PEP, Python topluluğuna bilgi sağlayan veya Python veya süreçleri ya da ortamı için yeni bir özelliği açıklayan bir tasarım belgesidir. PEP'ler, önerilen özellikler için özlü bir teknik şartname ve bir gerekçe sağlamalıdır.

PEP'lerin, önemli yeni özellikler önermek, bir sorun hakkında topluluk girdisi toplamak ve Python'a giren tasarım kararlarını belgelemek için birincil mekanizmalar olması amaçlanmıştır. PEP yazarı, topluluk içinde fikir birliği oluşturmaktan ve muhalif görüşleri belgelemekten sorumludur.

Bakınız **PEP 1**.

kısım
PEP 420 içinde tanımlandığı gibi, bir ad alanı paketine katkıda bulunan tek bir dizindeki (muhtemelen bir zip dosyasında depolanan) bir dizi dosya.

konumsal argüman
Bakınız *argument*.

geçici API
Geçici bir API, standart kitaplığın geriye dönük uyumluluk garantilerinden kasıtlı olarak hariç tutulan bir API'dir. Bu tür arayüzlerde büyük değişiklikler beklenmese de, geçici olarak işaretlendikleri sürece, çekirdek geliştiriciler tarafından gerekli görüldüğü takdirde geriye dönük uyumsuz değişiklikler (arayüzün kaldırılmasına kadar ve buna kadar) meydana gelebilir. Bu tür değişiklikler karşılıksız yapılmayacaktır - bunlar yalnızca API'nin eklenmesinden önce gözden kaçan ciddi temel kusurlar ortaya çıkarsa gerçekleşecektir.

Geçici API'ler için bile, geriye dönük uyumsuz değişiklikler "son çare çözümü" olarak görülür - tanımlanan herhangi bir soruna geriye dönük uyumlu bir çözüm bulmak için her türlü girişimde bulunulacaktır.

Bu süreç, standart kitaplığın, uzun süreler boyunca sorunlu tasarım hatalarına kilitlenmeden zaman içinde gelişmeye devam etmesini sağlar. Daha fazla ayrıntı için bkz. **PEP 411**.

geçici paket
Bakınız *provisional API*.

Python 3000
Python 3.x sürüm satırının takma adı (uzun zaman önce sürüm 3'ün piyasaya sürülmesi uzak bir gelecekte olduğu zaman ortaya çıktı.) Bu aynı zamanda "Py3k" olarak da kısaltılır.

Pythonic
Diğer dillerde ortak kavramları kullanarak kod uygulamak yerine Python dilinin en yaygın deyimlerini yakından takip eden bir fikir veya kod parçası. Örneğin, Python'da yaygın bir deyim, bir `for` ifadesi kullanarak yinelenebilir bir öğenin tüm öğeleri üzerinde döngü oluşturmaktır. Diğer birçok dilde bu tür bir yapı yoktur, bu nedenle Python'a aşina olmayan kişiler bazen bunun yerine sayısal bir sayaç kullanır:

```
for i in range(len(food)):
    print(food[i])
```

Temizleyicinin aksine, Pythonic yöntemi:

```
for piece in food:
    print(piece)
```

nitelikli isim
PEP 3155 içinde tanımlandığı gibi, bir modülün genel kapsamından o modülde tanımlanan bir sınıfa, işleve veya yönteme giden "yolu" gösteren noktalı ad. Üst düzey işlevler ve sınıflar için nitelikli ad, nesnenin adıyla aynıdır:

```
>>> class C:
...     class D:
...         def meth(self):
...             pass
...
>>> C.__qualname__
'C'
>>> C.D.__qualname__
'C.D'
>>> C.D.meth.__qualname__
'C.D.meth'
```

Modüllere atıfta bulunmak için kullanıldığında, *tam nitelenmiş ad*, herhangi bir üst paket de dahil olmak üzere, modüle giden tüm noktalı yol anlamına gelir, örn. `email.mime.text`:

```
>>> import email.mime.text
>>> email.mime.text.__name__
'email.mime.text'
```

referans sayısı
The number of references to an object. When the reference count of an object drops to zero, it is deallocated. Some objects are *immortal* and have reference counts that are never modified, and therefore the objects are never deallocated. Reference counting is generally not visible to Python code, but it is a key element of the *CPython* implementation. Programmers can call the `sys.getrefcount()` function to return the reference count for a particular object.

In *CPython*, reference counts are not considered to be stable or well-defined values; the number of references to an object, and how that number is affected by Python code, may be different between versions.

sürekli paketleme
`__init__.py` dosyası içeren bir dizin gibi geleneksel bir *package*.

Ayrıca bkz. *ad alanı paketi*.

REPL
An acronym for the "read–eval–print loop", another name for the *interactive* interpreter shell.

__slots__
Örnek öznitelikleri için önceden yer bildirerek ve örnek sözlüklerini ortadan kaldırarak bellekten tasarruf sağlayan bir sınıf içindeki bildirim. Popüler olmasına rağmen, tekniğin doğru olması biraz zor ve en iyi, bellek açısından kritik bir uygulamada çok sayıda örneğin bulunduğu nadir durumlar için ayrılmıştır.

dizi
An *iterable* which supports efficient element access using integer indices via the `__getitem__()` special method and defines a `__len__()` method that returns the length of the sequence. Some built-in sequence types are `list`, `str`, `tuple`, and `bytes`. Note that `dict` also supports `__getitem__()` and `__len__()`, but is considered a mapping rather than a sequence because the lookups use arbitrary *hashable* keys rather than integers.

The `collections.abc.Sequence` abstract base class defines a much richer interface that goes beyond just `__getitem__()` and `__len__()`, adding `count()`, `index()`, `__contains__()`, and `__reversed__()`. Types that implement this expanded interface can be registered explicitly using `register()`. For more documentation on sequence methods generally, see Common Sequence Operations.

anlamak
Öğelerin tümünü veya bir kısmını yinelenebilir bir şekilde işlemenin ve sonuçlarla birlikte bir küme döndürmenin kompakt bir yolu. `results = {c for c in 'abracadabra' if c not in 'abc'}`, `{'r', 'd'}` dizelerini oluşturur. Bakınız comprehensions.

tek sevk
Uygulamanın tek bir argüman türüne göre seçildiği bir *generic function* gönderimi biçimi.

parçalamak
Genellikle bir *sequence* 'nin bir bölümünü içeren bir nesne. Bir dilim, örneğin `variable_name[1:3:5]` 'de olduğu gibi, birkaç tane verildiğinde, sayılar arasında iki nokta üst üste koyarak, `[]` alt simge gösterimi kullanılarak oluşturulur. Köşeli ayraç (alt simge) gösterimi, dahili olarak `slice` nesnelerini kullanır.

soft deprecated
A soft deprecated API should not be used in new code, but it is safe for already existing code to use it. The API remains documented and tested, but will not be enhanced further.

Soft deprecation, unlike normal deprecation, does not plan on removing the API and will not emit warnings.

See PEP 387: Soft Deprecation.

özel metod
Toplama gibi bir tür üzerinde belirli bir işlemi yürütmek için Python tarafından örtük olarak çağrılan bir yöntem. Bu tür yöntemlerin çift alt çizgi ile başlayan ve biten adları vardır. Özel yöntemler specialnames içinde belgelenmiştir.

standard library
The collection of *packages*, *modules* and *extension modules* distributed as a part of the official Python interpreter package. The exact membership of the collection may vary based on platform, available system libraries, or other criteria. Documentation can be found at library-index.

See also `sys.stdlib_module_names` for a list of all possible standard library module names.

ifade (değer döndürmez)
Bir ifade, bir paketin parçasıdır (kod "bloğu"). Bir ifade, bir *expression* veya `if`, `while` veya `for` gibi bir anahtar kelimeye sahip birkaç yapıdan biridir.

static type checker
An external tool that reads Python code and analyzes it, looking for issues such as incorrect types. See also *type hints* and the `typing` module.

stdlib
An abbreviation of *standard library*.

güçlü referans
In Python's C API, a strong reference is a reference to an object which is owned by the code holding the

reference. The strong reference is taken by calling `Py_INCREF()` when the reference is created and released with `Py_DECREF()` when the reference is deleted.

`Py_NewRef()` fonksiyonu, bir nesneye güçlü bir başvuru oluşturmak için kullanılabilir. Genellikle `Py_DECREF()` fonksiyonu, bir referansın sızmasını önlemek için güçlü referans kapsamından çıkmadan önce güçlü referansta çağrılmalıdır.

Ayrıca bkz. *ödünç alınan referans*.

yazı çözümleme
Python'da bir dize, bir Unicode kod noktaları dizisidir (`U+0000–U+10FFFF` aralığında). Bir dizeyi depolamak veya aktarmak için, bir bayt dizisi olarak seri hale getirilmesi gerekir.

Bir dizeyi bir bayt dizisi halinde seri hale getirmek "kodlama (encoding)" olarak bilinir ve dizeyi bayt dizisinden yeniden oluşturmak "kod çözme (decoding)" olarak bilinir.

Toplu olarak "metin kodlamaları" olarak adlandırılan çeşitli farklı metin serileştirme kodekleri vardır.

yazı dosyası
A *file object* `str` nesnelerini okuyabilir ve yazabilir. Çoğu zaman, bir metin dosyası aslında bir bayt yönelimli veri akışına erişir ve otomatik olarak *text encoding* işler. Metin dosyalarına örnek olarak metin modunda açılan dosyalar (`'r'` veya `'w'`), `sys.stdin`, `sys.stdout` ve `io.StringIO` örnekleri verilebilir.

Ayrıca *ikili dosyaları* okuyabilen ve yazabilen bir dosya nesnesi için *bayt benzeri nesnelere* bakın.

token
A small unit of source code, generated by the lexical analyzer (also called the *tokenizer*). Names, numbers, strings, operators, newlines and similar are represented by tokens.

The `tokenize` module exposes Python's lexical analyzer. The `token` module contains information on the various types of tokens.

üç tırnaklı dize
Üç tırnak işareti (") veya kesme işareti (') ile sınırlanan bir dize. Tek tırnaklı dizelerde bulunmayan herhangi bir işlevsellik sağlamasalar da, birkaç nedenden dolayı faydalıdırlar. bir dizeye çıkışsız tek ve çift tırnak eklemeniz gerekir ve bunlar, devam karakterini kullanmadan birden çok satıra yayılabilir, bu da onları özellikle belge dizileri yazarken kullanışlı hale getirir.

tip
The type of a Python object determines what kind of object it is; every object has a type. An object's type is accessible as its `__class__` attribute or can be retrieved with `type(obj)`.

tip takma adı
Bir tanımlayıcıya tür atanarak oluşturulan, bir tür için eş anlamlı.

Tür takma adları, *tür ipuçlarını* basitleştirmek için kullanışlıdır. Örneğin:

```
def remove_gray_shades(
        colors: list[tuple[int, int, int]]) -> list[tuple[int, int, int]]:
    pass
```

bu şekilde daha okunaklı hale getirilebilir:

```
Color = tuple[int, int, int]

def remove_gray_shades(colors: list[Color]) -> list[Color]:
    pass
```

Bu işlevi açıklayan `typing` ve **PEP 484** bölümlerine bakın.

tür ipucu
Bir değişken, bir sınıf niteliği veya bir işlev parametresi veya dönüş değeri için beklenen türü belirten bir *ek açıklama*.

Type hints are optional and are not enforced by Python but they are useful to *static type checkers*. They can also aid IDEs with code completion and refactoring.

Genel değişkenlerin, sınıf özniteliklerinin ve işlevlerin tür ipuçlarına, yerel değişkenlere değil, `typing.get_type_hints()` kullanılarak erişilebilir.

Bu işlevi açıklayan `typing` ve **PEP 484** bölümlerine bakın.

evrensel yeni satırlar
Aşağıdakilerin tümünün bir satırın bitişi olarak kabul edildiği metin akışlarını yorumlamanın bir yolu: Unix satır sonu kuralı `\n'`, Windows kuralı `'\r\n'`, ve eski Macintosh kuralı `'\r'`. Ek bir kullanım için **PEP 278** ve **PEP 3116** ve ayrıca `bytes.splitlines()` bakın.

değişken açıklama
Bir değişkenin veya bir sınıf özniteliğinin *ek açıklaması*.

Bir değişkene veya sınıf niteliğine açıklama eklerken atama isteğe bağlıdır:

```
class C:
    field: 'annotation'
```

Değişken açıklamaları genellikle *tür ipuçları* için kullanılır: örneğin, bu değişkenin `int` değerlerini alması beklenir:

```
count: int = 0
```

Değişken açıklama sözdizimi annassign bölümünde açıklanmıştır.

Bu işlevi açıklayan; *function annotation*, **PEP 484** ve **PEP 526** bölümlerine bakın. Ek açıklamalarla çalışmaya ilişkin en iyi uygulamalar için ayrıca bkz. annotations-howto.

sanal ortam
Python kullanıcılarının ve uygulamalarının, aynı sistem üzerinde çalışan diğer Python uygulamalarının davranışına müdahale etmeden Python dağıtım paketlerini kurmasına ve yükseltmesine olanak tanıyan, işbirliği içinde yalıtılmış bir çalışma zamanı ortamı.

Ayrıca bakınız `venv`.

sanal makine
Tamamen yazılımla tanımlanmış bir bilgisayar. Python'un sanal makinesi, bayt kodu derleyicisi tarafından yayınlanan *bytecode* 'u çalıştırır.

walrus operator
A light-hearted way to refer to the assignment expression operator `:=` because it looks a bit like a walrus if you turn your head.

Python'un Zen'i
Dili anlamaya ve kullanmaya yardımcı olan Python tasarım ilkeleri ve felsefelerinin listesi. Liste, etkileşimli komut isteminde "`import this`" yazarak bulunabilir.

EK B

About this documentation

Python's documentation is generated from reStructuredText sources using Sphinx, a documentation generator originally created for Python and now maintained as an independent project.

Dokümantasyonun ve araç zincirinin geliştirilmesi, tıpkı Python'un kendisi gibi tamamen gönüllü bir çabadır. Katkıda bulunmak istiyorsanız, nasıl yapacağınıza ilişkin bilgi için lütfen reporting-bugs sayfasına göz atın. Yeni gönüllülere her zaman açığız!

Destekleri için teşekkürler:

- Fred L. Drake, Jr., the creator of the original Python documentation toolset and author of much of the content;
- Docutils projesi, reStructuredText ve Docutils paketini oluşturdukları için;
- Fredrik Lundh, Sphinx'in pek çok iyi fikir edindiği Alternatif Python Referansı projesi için.

B.1 Contributors to the Python documentation

Birçok kişi Python diline, Python standart kütüphanesine ve Python dokümantasyonuna katkıda bulunmuştur. Katkıda bulunanların kısmi bir listesi için Python kaynak dağıtımında Misc/ACKS dosyasına bakın.

Python topluluğunun girdileri ve katkıları sayesinde böyle harika bir dokümantasyona sahibiz – Teşekkürler!

EK C

Tarihçe ve Lisans

C.1 Yazılımın tarihçesi

Python was created in the early 1990s by Guido van Rossum at Stichting Mathematisch Centrum (CWI, see https://www.cwi.nl) in the Netherlands as a successor of a language called ABC. Guido remains Python's principal author, although it includes many contributions from others.

In 1995, Guido continued his work on Python at the Corporation for National Research Initiatives (CNRI, see https://www.cnri.reston.va.us) in Reston, Virginia where he released several versions of the software.

In May 2000, Guido and the Python core development team moved to BeOpen.com to form the BeOpen PythonLabs team. In October of the same year, the PythonLabs team moved to Digital Creations, which became Zope Corporation. In 2001, the Python Software Foundation (PSF, see https://www.python.org/psf/) was formed, a non-profit organization created specifically to own Python-related Intellectual Property. Zope Corporation was a sponsoring member of the PSF.

All Python releases are Open Source (see https://opensource.org for the Open Source Definition). Historically, most, but not all, Python releases have also been GPL-compatible; the table below summarizes the various releases.

Yayın	Şundan türedi:	Yıl	Sahibi	GPL-compatible? (1)
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1.3 'dan 1.5.2'ye	1.2	1995-1999	CNRI	evet
1.6	1.5.2	2000	CNRI	hayır
2.0	1.6	2000	BeOpen.com	hayır
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2.0.1	2.0+1.6.1	2001	PSF	evet
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Bu yayınları mümkün kılmak için Guido'nun yönetimi altında çalışan birçok gönüllüye teşekkürler.

C.2 Python'a erişmek veya başka bir şekilde kullanmak için şartlar ve koşullar

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Starting with Python 3.8.6, examples, recipes, and other code in the documentation are dual licensed under the PSF License Version 2 and the *Zero-Clause BSD license*.

Python'a dahil edilen bazı yazılımlar farklı lisanslar altındadır. Lisanslar, bu lisansa giren kodla listelenir. Bu lisansların eksik listesi için bkz. *Tüzel Yazılımlar için Lisanslar ve Onaylar*.

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C.3 Tüzel Yazılımlar için Lisanslar ve Onaylar

Bu bölüm, Python dağıtımına dahil edilmiş üçüncü taraf yazılımlar için tamamlanmamış ancak büyüyen bir lisans ve onay listesidir.

C.3.1 Mersenne Twister'ı

`random` modülünün altyapısını oluşturan `_random` C uzantısı, http://www.math.sci.hiroshima-u.ac.jp/~m-mat/MT/MT2002/emt19937ar.html adresinden indirilen kodu temel alır. Orijinal koddan kelimesi kelimesine yorumlar aşağıdadır:

```
A C-program for MT19937, with initialization improved 2002/1/26.
Coded by Takuji Nishimura and Makoto Matsumoto.

Before using, initialize the state by using init_genrand(seed)
```

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```
or init_by_array(init_key, key_length).

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Any feedback is very welcome.
http://www.math.sci.hiroshima-u.ac.jp/~m-mat/MT/emt.html
email: m-mat @ math.sci.hiroshima-u.ac.jp (remove space)
```

C.3.2 Soketler

`socket` modülü, https://www.wide.ad.jp/ adresindeki WIDE Projesi'nden ayrı kaynak dosyalarında kodlanan `getaddrinfo()` ve `getnameinfo()` fonksiyonlarını kullanır.

```
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C.3.6 UUencode ve UUdecode fonksiyonları

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Modified by Jack Jansen, CWI, July 1995:
- Use binascii module to do the actual line-by-line conversion
  between ascii and binary. This results in a 1000-fold speedup. The C
  version is still 5 times faster, though.
- Arguments more compliant with Python standard
```

C.3.7 XML Uzaktan Yordam Çağrıları

`xmlrpc.client` modülü aşağıdaki uyarıyı içerir:

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C.3.8 test_epoll

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C.3.9 kqueue seçin

`select` modülü, kqueue arayüzü için aşağıdaki uyarıyı içerir:

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C.3.10 SipHash24

`Python/pyhash.c` dosyası, Dan Bernstein'ın SipHash24 algoritmasının Marek Majkowski uygulamasını içerir. Burada aşağıdaki not yer alır:

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Original location:
   https://github.com/majek/csiphash/

Solution inspired by code from:
   Samuel Neves (supercop/crypto_auth/siphash24/little)
   djb (supercop/crypto_auth/siphash24/little2)
   Jean-Philippe Aumasson (https://131002.net/siphash/siphash24.c)
```

C.3.11 strtod ve dtoa

C double'larının dizelere ve dizelerden dönüştürülmesi için dtoa ve strtod C fonksiyonlarını sağlayan `Python/dtoa.c` dosyası, şu anda https://web.archive.org/web/20220517033456/http://www.netlib.org/fp/dtoa.c 'den erişilebilen David M. Gay tarafından aynı adlı dosyadan türetilmiştir. 16 Mart 2009'da alınan orijinal dosya aşağıdaki telif hakkı ve lisans bildirimini içerir:

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C.3.14 libffi

`ctypes` modülünün altyapsını oluşturan `_ctypes` C uzantısı, `--with-system-libffi` olarak yapılandırılmadığı sürece libffi kaynaklarının dahil edildiği bir kopya kullanılarak oluşturulur:

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C.3.15 zlib

`zlib` uzantısı, sistemde bulunan zlib sürümü derleme için kullanılamayacak kadar eskiyse, zlib kaynaklarının dahil edildiği bir kopya kullanılarak oluşturulur:

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```

C.3.16 cfuhash

`tracemalloc` tarafından kullanılan hash tablosunun uygulanması cfuhash projesine dayanmaktadır:

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C.3.17 libmpdec

The `_decimal` C extension underlying the `decimal` module is built using an included copy of the libmpdec library unless the build is configured `--with-system-libmpdec`:

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C.3.18 W3C C14N test paketi

`test` paketindeki C14N 2.0 test paketi (`Lib/test/xmltestdata/c14n-20/`), https://www.w3.org/TR/xml-c14n2-testcases/ adresindeki W3C web sitesinden alınmıştır ve 3 maddeli BSD lisansı altında dağıtılmaktadır:

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C.3.19 mimalloc

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C.3.20 asyncio

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C.3.21 Global Unbounded Sequences (GUS)

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Dizin

Alfabetik olmayan

... , **85**
    ellipsis literal, 85
-?
    komut satırı seçeneği, 5
>>>, **85**
__future__, **91**
__slots__, **99**

A

ad alanı, **95**
ad alanı paketi, **96**
adlandırılmış demet, **95**
anahtar işlev, **93**
anahtar kelime argümanı, **94**
anlamak, **99**
argüman, **85**
asenkron bağlam yöneticisi, **86**
asenkron jeneratör, **86**
asenkron jeneratör yineleyici, **86**
asenkron yineleyici, **86**

B

-B
    komut satırı seçeneği, 6
-b
    komut satırı seçeneği, 6
bağlam değişkeni, **88**
bağlam yöneticisi, **88**
bayt benzeri nesne, **87**
bayt kodu, **87**
BDFL, **86**
beklenebilir, **86**
belge dizisi, **89**
bitişik, **88**
BOLT_APPLY_FLAGS
    komut satırı seçeneği, 31
BOLT_INSTRUMENT_FLAGS
    komut satırı seçeneği, 31
BOŞTA, **92**
--build
    komut satırı seçeneği, 36
bulucu, **90**
BZIP2_CFLAGS
    komut satırı seçeneği, 28
BZIP2_LIBS
    komut satırı seçeneği, 28

C

-c
    komut satırı seçeneği, 3
CC
    komut satırı seçeneği, 27
C-contiguous, 88
CFLAGS, 30, 39, 41
    komut satırı seçeneği, 27
CFLAGS_NODIST, 3941
--check-hash-based-pycs
    komut satırı seçeneği, 6
closure variable, **87**
CONFIG_SITE
    komut satırı seçeneği, 36
context, **88**
context management protocol, **88**
CPP
    komut satırı seçeneği, 27
CPPFLAGS, 39, 41
    komut satırı seçeneği, 27
CPython, **88**
current context, **88**
CURSES_CFLAGS
    komut satırı seçeneği, 28
CURSES_LIBS
    komut satırı seçeneği, 28

Ç

çağırılabilir, **87**
çöp toplama, **91**

D

-d
    komut satırı seçeneği, 6
değişken açıklama, **101**
değişmez, **92**
değiştirilebilir, **95**
dekoratör, **89**

dipnot, **85**
--disable-gil
    komut satırı seçeneği, 27
--disable-ipv6
    komut satırı seçeneği, 24
--disable-test-modules
    komut satırı seçeneği, 30
dizi, **99**
dosya benzeri nesne, **90**
dosya nesnesi, **90**
dosya sistemi kodlaması ve hata işleyicisi, **90**
dunder, **89**

E

-E
    komut satırı seçeneği, 6
EAFP, **89**
--enable-big-digits
    komut satırı seçeneği, 24
--enable-bolt
    komut satırı seçeneği, 31
--enable-experimental-jit
    komut satırı seçeneği, 27
--enable-framework
    komut satırı seçeneği, 35, 36
--enable-loadable-sqlite-extensions
    komut satırı seçeneği, 24
--enable-optimizations
    komut satırı seçeneği, 30
--enable-profiling
    komut satırı seçeneği, 31
--enable-pystats
    komut satırı seçeneği, 25
--enable-shared
    komut satırı seçeneği, 33
--enable-universalsdk
    komut satırı seçeneği, 35
--enable-wasm-dynamic-linking
    komut satırı seçeneği, 29
--enable-wasm-pthreads
    komut satırı seçeneği, 29
eşyordam, **88**
eşyordam işlevi, **88**
eşzamansız yinelenebilir, **86**
etkileşimli, **93**
evrensel yeni satırlar, **101**
--exec-prefix
    komut satırı seçeneği, 29

F

f-string, **90**
fonksiyon, **91**
fonksiyon açıklaması, **91**
Fortran contiguous, 88
free threading, **90**
free variable, **90**

G

GDBM_CFLAGS
    komut satırı seçeneği, 28
GDBM_LIBS
    komut satırı seçeneği, 28
geçici API, **97**
geçici paket, **98**
genel işlev, **91**
genel tercüman kilidi, **92**
genel tip, **92**
geri çağırmak, **87**
GIL, **92**
güçlü referans, **99**

H

-h
    komut satırı seçeneği, 5
haritalama, **94**
--help
    komut satırı seçeneği, 5
--help-all
    komut satırı seçeneği, 5
--help-env
    komut satırı seçeneği, 5
--help-xoptions
    komut satırı seçeneği, 5
--host
    komut satırı seçeneği, 36
HOSTRUNNER
    komut satırı seçeneği, 36

I

-I
    komut satırı seçeneği, 6

İ

-i
    komut satırı seçeneği, 6
iç içe kapsam, **96**
içe aktarıcı, **93**
içe aktarım yolu, **92**
içe aktarma, **92**
ifade (*değer döndürmez*), **99**
ifade (*değer döndürür*), **90**
ikili dosya, **86**
immortal, **92**

J

-J
    komut satırı seçeneği, 10
jeneratör, **91**
jeneratör ifadesi, **91**
jeneratör yineleyici, **91**

K

karma tabanlı pyc, **92**
karmaşık sayı, **88**

kat bölümü, **90**
kısım, **97**
komut satırı seçeneği
    -?, 5
    -B, 6
    -b, 6
    BOLT_APPLY_FLAGS, 31
    BOLT_INSTRUMENT_FLAGS, 31
    --build, 36
    BZIP2_CFLAGS, 28
    BZIP2_LIBS, 28
    -c, 3
    CC, 27
    CFLAGS, 27
    --check-hash-based-pycs, 6
    CONFIG_SITE, 36
    CPP, 27
    CPPFLAGS, 27
    CURSES_CFLAGS, 28
    CURSES_LIBS, 28
    -d, 6
    --disable-gil, 27
    --disable-ipv6, 24
    --disable-test-modules, 30
    -E, 6
    --enable-big-digits, 24
    --enable-bolt, 31
    --enable-experimental-jit, 27
    --enable-framework, 35, 36
    --enable-loadable-sqlite-extensions, 24
    --enable-optimizations, 30
    --enable-profiling, 31
    --enable-pystats, 25
    --enable-shared, 33
    --enable-universalsdk, 35
    --enable-wasm-dynamic-linking, 29
    --enable-wasm-pthreads, 29
    --exec-prefix, 29
    GDBM_CFLAGS, 28
    GDBM_LIBS, 28
    -h, 5
    --help, 5
    --help-all, 5
    --help-env, 5
    --help-xoptions, 5
    --host, 36
    HOSTRUNNER, 36
    -I, 6
    -i, 6
    -J, 10
    LDFLAGS, 28
    LIBB2_CFLAGS, 28
    LIBB2_LIBS, 28
    LIBEDIT_CFLAGS, 28
    LIBEDIT_LIBS, 28
    LIBFFI_CFLAGS, 28
    LIBFFI_LIBS, 28
    LIBLZMA_CFLAGS, 28
    LIBLZMA_LIBS, 28
    LIBMPDEC_CFLAGS, 28
    LIBMPDEC_LIBS, 28
    LIBREADLINE_CFLAGS, 28
    LIBREADLINE_LIBS, 28
    LIBS, 28
    LIBSQLITE3_CFLAGS, 29
    LIBSQLITE3_LIBS, 29
    LIBUUID_CFLAGS, 29
    LIBUUID_LIBS, 29
    -m, 4
    MACHDEP, 28
    -O, 6
    -OO, 7
    -P, 7
    PANEL_CFLAGS, 29
    PANEL_LIBS, 29
    PKG_CONFIG, 27
    PKG_CONFIG_LIBDIR, 27
    PKG_CONFIG_PATH, 27
    --prefix, 29
    -q, 7
    -R, 7
    -S, 7
    -s, 7
    TCLTK_CFLAGS, 29
    TCLTK_LIBS, 29
    -u, 7
    -V, 5
    -v, 8
    --version, 5
    -W, 8
    --with-address-sanitizer, 33
    --with-app-store-compliance, 35
    --with-assertions, 32
    --with-build-python, 36
    --with-builtin-hashlib-hashes, 34
    --with-computed-gotos, 31
    --with-dbmliborder, 25
    --with-dtrace, 33
    --with-emscripten-target, 29
    --with-ensurepip, 30
    --with-framework-name, 35, 36
    --with-hash-algorithm, 34
    --with-libc, 34
    --with-libm, 34
    --with-libs, 33
    --with-lto, 30
    --with-memory-sanitizer, 33
    --with-openssl, 34
    --with-openssl-rpath, 34
    --without-c-locale-coercion, 25
    --without-decimal-contextvar, 25
    --without-doc-strings, 31
    --without-freelists, 25
    --without-mimalloc, 31
    --without-pymalloc, 31

--without-readline, 34
--without-static-libpython, 33
--with-pkg-config, 25
--with-platlibdir, 25
--with-pydebug, 32
--with-readline, 34
--with-ssl-default-suites, 34
--with-strict-overflow, 31
--with-suffix, 24
--with-system-expat, 33
--with-system-libmpdec, 33
--with-thread-sanitizer, 33
--with-trace-refs, 32
--with-tzpath, 24
--with-undefined-behavior-sanitizer, 33
--with-universal-archs, 35
--with-valgrind, 32
--with-wheel-pkg-dir, 25
-X, 8
-x, 8
ZLIB_CFLAGS, 29
ZLIB_LIBS, 29
konumsal argüman, **97**

L

lambda, **94**
LBYL, **94**
LDFLAGS, 39, 41
komut satırı seçeneği, 28
LDFLAGS_NODIST, 41
lexical analyzer, **94**
LIBB2_CFLAGS
komut satırı seçeneği, 28
LIBB2_LIBS
komut satırı seçeneği, 28
LIBEDIT_CFLAGS
komut satırı seçeneği, 28
LIBEDIT_LIBS
komut satırı seçeneği, 28
LIBFFI_CFLAGS
komut satırı seçeneği, 28
LIBFFI_LIBS
komut satırı seçeneği, 28
LIBLZMA_CFLAGS
komut satırı seçeneği, 28
LIBLZMA_LIBS
komut satırı seçeneği, 28
LIBMPDEC_CFLAGS
komut satırı seçeneği, 28
LIBMPDEC_LIBS
komut satırı seçeneği, 28
LIBREADLINE_CFLAGS
komut satırı seçeneği, 28
LIBREADLINE_LIBS
komut satırı seçeneği, 28
LIBS
komut satırı seçeneği, 28
LIBSQLITE3_CFLAGS
komut satırı seçeneği, 29
LIBSQLITE3_LIBS
komut satırı seçeneği, 29
LIBUUID_CFLAGS
komut satırı seçeneği, 29
LIBUUID_LIBS
komut satırı seçeneği, 29
liste, **94**
liste anlama, **94**

M

-m
komut satırı seçeneği, 4
MACHDEP
komut satırı seçeneği, 28
magic
metot, 94
meta yol bulucu, **94**
metasınıf, **95**
metot, **95**
magic, 94
special, 99
metot kalite sıralaması, **95**
modül, **95**
modül özelliği, **95**
MRO, **95**

N

nitelik, **86**
nitelikli isim, **98**

O

-O
komut satırı seçeneği, 6
obje, **96**
-OO
komut satırı seçeneği, 7
OPT, 32
optimized scope, **96**
ortam değişkeni
BASECFLAGS, 40
BASECPPFLAGS, 39
BLDSHARED, 41
CC, 39
CCSHARED, 40
CFLAGS, 30, 39, 41
CFLAGS_ALIASING, 40
CFLAGS_NODIST, 3941
CFLAGSFORSHARED, 40
COMPILEALL_OPTS, 39
CONFIGURE_CFLAGS, 39
CONFIGURE_CFLAGS_NODIST, 39
CONFIGURE_CPPFLAGS, 39
CONFIGURE_LDFLAGS, 40
CONFIGURE_LDFLAGS_NODIST, 41
CPPFLAGS, 39, 41
CXX, 39

EXTRA_CFLAGS, 39
LDFLAGS, 39, 41
LDFLAGS_NODIST, 41
LDSHARED, 41
LIBS, 41
LINKCC, 40
OPT, 32, 40
PATH, 11, 21, 44, 46, 5254, 56
PATHEXT, 46
PROFILE_TASK, 30
PURIFY, 40
PY_BUILTIN_MODULE_CFLAGS, 40
PY_CFLAGS, 40
PY_CFLAGS_NODIST, 40
PY_CORE_CFLAGS, 40
PY_CORE_LDFLAGS, 41
PY_CPPFLAGS, 39
PY_LDFLAGS, 41
PY_LDFLAGS_NODIST, 41
PY_STDMODULE_CFLAGS, 40
PYTHON_BASIC_REPL, 16
PYTHON_COLORS, 10, 16
PYTHON_CPU_COUNT, 10, 16
PYTHON_FROZEN_MODULES, 9, 16
PYTHON_GIL, 10, 16, 92
PYTHON_HISTORY, 16
PYTHON_JIT, 17
PYTHON_PERF_JIT_SUPPORT, 10, 16
PYTHON_PRESITE, 10, 17
PYTHONASYNCIODEBUG, 13
PYTHONBREAKPOINT, 11
PYTHONCASEOK, 12
PYTHONCOERCECLOCALE, 14, 25
PYTHONDEBUG, 6, 11, 32
PYTHONDEVMODE, 9, 15
PYTHONDONTWRITEBYTECODE, 6, 12
PYTHONDUMPREFS, 17, 32
PYTHONDUMPREFSFILE, 17
PYTHONEXECUTABLE, 13
PYTHONFAULTHANDLER, 9, 13
PYTHONHASHSEED, 7, 12
PYTHONHOME, 6, 10, 11, 59, 81
PYTHONINSPECT, 6, 11
PYTHONINTMAXSTRDIGITS, 9, 12
PYTHONIOENCODING, 12, 15
PYTHONLEGACYWINDOWSFSENCODING, 14
PYTHONLEGACYWINDOWSSTDIO, 12, 14
PYTHONMALLOC, 14, 31
PYTHONMALLOCSTATS, 14
PYTHONNODEBUGRANGES, 9, 15
PYTHONNOUSERSITE, 7, 12
PYTHONOPTIMIZE, 7, 11
PYTHONPATH, 6, 11, 52, 59, 81
PYTHONPERFSUPPORT, 10, 16
PYTHONPLATLIBDIR, 11
PYTHONPROFILEIMPORTTIME, 9, 13
PYTHONPYCACHEPREFIX, 9, 12
PYTHONSAFEPATH, 7, 11
PYTHONSTARTUP, 6, 11, 12
PYTHONTRACEMALLOC, 9, 13
PYTHONUNBUFFERED, 8, 12
PYTHONUSERBASE, 13
PYTHONUTF8, 9, 15, 53
PYTHONVERBOSE, 8, 12
PYTHONWARNDEFAULTENCODING, 9, 15
PYTHONWARNINGS, 8, 13
TEMP, 49

Ö

ödünç alınan referans, **87**
ördek yazma, **89**
özel metod, **99**

P

-P
    komut satırı seçeneği, 7
paket, **96**
PANEL_CFLAGS
    komut satırı seçeneği, 29
PANEL_LIBS
    komut satırı seçeneği, 29
parametre, **96**
parçalamak, **99**
PATH, 11, 21, 44, 46, 5254, 56
PATHEXT, 46
PEP, **97**
PKG_CONFIG
    komut satırı seçeneği, 27
PKG_CONFIG_LIBDIR
    komut satırı seçeneği, 27
PKG_CONFIG_PATH
    komut satırı seçeneği, 27
--prefix
    komut satırı seçeneği, 29
PROFILE_TASK, 30
Python 3000, **98**
Python Geliştirme Önerileri
    PEP 1, 97
    PEP 7, 23
    PEP 8, 83
    PEP 11, 23, 43, 60
    PEP 238, 90
    PEP 278, 101
    PEP 302, 94
    PEP 338, 4
    PEP 343, 88
    PEP 362, 86, 97
    PEP 370, 7, 13
    PEP 397, 54
    PEP 411, 98
    PEP 420, 96, 97
    PEP 443, 91
    PEP 483, 92
    PEP 484, 85, 91, 92, 100, 101
    PEP 488, 7
    PEP 492, 86, 88

PEP 498, 90
PEP 514, 54
PEP 519, 97
PEP 525, 86
PEP 526, 85, 101
PEP 528, 53
PEP 529, 14, 53
PEP 538, 15, 25
PEP 585, 92
PEP 683, 92
PEP 703, 48, 70, 90, 92
PEP 3116, 101
PEP 3155, 98
PYTHON_COLORS, 10
PYTHON_CPU_COUNT, 10
PYTHON_FROZEN_MODULES, 9
PYTHON_GIL, 10, 92
PYTHON_PERF_JIT_SUPPORT, 10
PYTHON_PRESITE, 10
PYTHONCOERCECLOCALE, 25
PYTHONDEBUG, 6, 32
PYTHONDEVMODE, 9
PYTHONDONTWRITEBYTECODE, 6
PYTHONDUMPREFS, 32
PYTHONFAULTHANDLER, 9
PYTHONHASHSEED, 7, 12
PYTHONHOME, 6, 11, 59, 81
PYTHONINSPECT, 6
PYTHONINTMAXSTRDIGITS, 9
PYTHONIOENCODING, 15
Pythonic, **98**
PYTHONLEGACYWINDOWSSTDIO, 12
PYTHONMALLOC, 14, 31
PYTHONNODEBUGRANGES, 9
PYTHONNOUSERSITE, 7
PYTHONOPTIMIZE, 7
PYTHONPATH, 6, 11, 52, 59, 81
PYTHONPERFSUPPORT, 10
PYTHONPROFILEIMPORTTIME, 9
PYTHONPYCACHEPREFIX, 9
PYTHONSAFEPATH, 7
PYTHONSTARTUP, 6, 12
PYTHONTRACEMALLOC, 9
Python'un Zen'i, **101**
PYTHONUNBUFFERED, 8
PYTHONUTF8, 9, 15, 53
PYTHONVERBOSE, 8
PYTHONWARNDEFAULTENCODING, 9
PYTHONWARNINGS, 8

Q

-q
komut satırı seçeneği, 7

R

-R
komut satırı seçeneği, 7
referans sayısı, **98**
REPL, **99**

S

-S
komut satırı seçeneği, 7
-s
komut satırı seçeneği, 7
sanal makine, **101**
sanal ortam, **101**
sınıf, **87**
sınıf değişkeni, **87**
sihirli yöntem, **94**
soft deprecated, **99**
soyut temel sınıf, **85**
sözlük, **89**
sözlük anlama, **89**
sözlük görünümü, **89**
special
metot, 99
standard library, **99**
static type checker, **99**
stdlib, **99**
sürekli paketleme, **98**

T

tanımlayıcı, **89**
TCLTK_CFLAGS
komut satırı seçeneği, 29
TCLTK_LIBS
komut satırı seçeneği, 29
tek sevk, **99**
TEMP, 49
tercüman kapatma, **93**
tip, **100**
tip takma adı, **100**
token, **100**
tür ipucu, **100**

U

-u
komut satırı seçeneği, 7
uzatma modülü, **90**

Ü

üç tırnaklı dize, **100**

V

-V
komut satırı seçeneği, 5
-v
komut satırı seçeneği, 8
--version
komut satırı seçeneği, 5

W

-W
komut satırı seçeneği, 8

walrus operator, **101**
--with-address-sanitizer
    komut satırı seçeneği, 33
--with-app-store-compliance
    komut satırı seçeneği, 35
--with-assertions
    komut satırı seçeneği, 32
--with-build-python
    komut satırı seçeneği, 36
--with-builtin-hashlib-hashes
    komut satırı seçeneği, 34
--with-computed-gotos
    komut satırı seçeneği, 31
--with-dbmliborder
    komut satırı seçeneği, 25
--with-dtrace
    komut satırı seçeneği, 33
--with-emscripten-target
    komut satırı seçeneği, 29
--with-ensurepip
    komut satırı seçeneği, 30
--with-framework-name
    komut satırı seçeneği, 35, 36
--with-hash-algorithm
    komut satırı seçeneği, 34
--with-libc
    komut satırı seçeneği, 34
--with-libm
    komut satırı seçeneği, 34
--with-libs
    komut satırı seçeneği, 33
--with-lto
    komut satırı seçeneği, 30
--with-memory-sanitizer
    komut satırı seçeneği, 33
--with-openssl
    komut satırı seçeneği, 34
--with-openssl-rpath
    komut satırı seçeneği, 34
--without-c-locale-coercion
    komut satırı seçeneği, 25
--without-decimal-contextvar
    komut satırı seçeneği, 25
--without-doc-strings
    komut satırı seçeneği, 31
--without-freelists
    komut satırı seçeneği, 25
--without-mimalloc
    komut satırı seçeneği, 31
--without-pymalloc
    komut satırı seçeneği, 31
--without-readline
    komut satırı seçeneği, 34
--without-static-libpython
    komut satırı seçeneği, 33
--with-pkg-config
    komut satırı seçeneği, 25
--with-platlibdir
    komut satırı seçeneği, 25
--with-pydebug
    komut satırı seçeneği, 32
--with-readline
    komut satırı seçeneği, 34
--with-ssl-default-suites
    komut satırı seçeneği, 34
--with-strict-overflow
    komut satırı seçeneği, 31
--with-suffix
    komut satırı seçeneği, 24
--with-system-expat
    komut satırı seçeneği, 33
--with-system-libmpdec
    komut satırı seçeneği, 33
--with-thread-sanitizer
    komut satırı seçeneği, 33
--with-trace-refs
    komut satırı seçeneği, 32
--with-tzpath
    komut satırı seçeneği, 24
--with-undefined-behavior-sanitizer
    komut satırı seçeneği, 33
--with-universal-archs
    komut satırı seçeneği, 35
--with-valgrind
    komut satırı seçeneği, 32
--with-wheel-pkg-dir
    komut satırı seçeneği, 25

X

-X
    komut satırı seçeneği, 8
-x
    komut satırı seçeneği, 8

Y

yazı çözümleme, **100**
yazı dosyası, **100**
yeni stil sınıf, **96**
yerel kodlama, **94**
yıkanabilir, **92**
yinelenebilir, **93**
yineleyici, **93**
yol benzeri nesne, **97**
yol giriş kancası, **97**
yol girişi, **97**
yol girişi bulucu, **97**
yol tabanlı bulucu, **97**
yorumlanmış, **93**
yükleyici, **94**

Z

ZLIB_CFLAGS
    komut satırı seçeneği, 29
ZLIB_LIBS
    komut satırı seçeneği, 29