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# Installing Python Modules

*Revised 3.7.17*

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**June 28, 2023**

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Sebagai proyek pengembangan open source yang populer, Python memiliki komunitas pendukung aktif dan pengguna yang juga membuat perangkat lunak mereka tersedia untuk pengembang Python lain untuk digunakan di bawah persyaratan lisensi sumber terbuka.

Hal ini memungkinkan pengguna Python untuk berbagi dan berkolaborasi secara efektif, mendapatkan manfaat dari solusi yang telah dibuat oleh orang lain untuk masalah umum (dan kadang-kadang bahkan langka!), Serta berpotensi memberikan kontribusi solusi mereka sendiri ke kumpulan umum.

Panduan ini mencakup bagian instalasi dari proses. Untuk panduan untuk membuat dan berbagi proyek Python Anda sendiri, lihat panduan distribusi.

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**Catatan:** Untuk pengguna korporat dan institusi lainnya, sadarilah bahwa banyak organisasi memiliki kebijakan mereka sendiri tentang penggunaan dan kontribusi untuk perangkat lunak sumber terbuka. Harap pertimbangkan kebijakan tersebut saat menggunakan alat distribusi dan instalasi yang disediakan dengan Python.

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## Istilah utama

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- `pip` adalah program penginstal yang disukai. Mulai dari Python 3.4, disertakan secara bawaan pada *installer* biner Python.
- Sebuah *virtual environment* adalah lingkungan Python semi-terisolasi yang memungkinkan paket diinstal untuk digunakan oleh aplikasi tertentu, dibandingkan diinstal sistem luas atau global.
- `venv` is the standard tool for creating virtual environments, and has been part of Python since Python 3.3. Starting with Python 3.4, it defaults to installing `pip` into all created virtual environments.
- `virtualenv` is a third party alternative (and predecessor) to `venv`. It allows virtual environments to be used on versions of Python prior to 3.4, which either don't provide `venv` at all, or aren't able to automatically install `pip` into created environments.
- The [Python Packaging Index](#) is a public repository of open source licensed packages made available for use by other Python users.
- the [Python Packaging Authority](#) is the group of developers and documentation authors responsible for the maintenance and evolution of the standard packaging tools and the associated metadata and file format standards. They maintain a variety of tools, documentation, and issue trackers on both [GitHub](#) and [Bitbucket](#).
- `distutils` is the original build and distribution system first added to the Python standard library in 1998. While direct use of `distutils` is being phased out, it still laid the foundation for the current packaging and distribution infrastructure, and it not only remains part of the standard library, but its name lives on in other ways (such as the name of the mailing list used to coordinate Python packaging standards development).

Ditinggalkan sejak versi 3.6: `pyvenv` was the recommended tool for creating virtual environments for Python 3.3 and 3.4, and is [deprecated in Python 3.6](#).

Berubah pada versi 3.5: Penggunaan `venv` sekarang disarankan untuk membuat lingkungan virtual.

### Lihat juga:

[Panduan Pengguna \\*Python Packaging\\*](#): Pembuatan dan penggunaan *\*virtual environments\**





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## Penggunaan dasar

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The standard packaging tools are all designed to be used from the command line.

The following command will install the latest version of a module and its dependencies from the Python Packaging Index:

```
python -m pip install SomePackage
```

---

**Catatan:** For POSIX users (including Mac OS X and Linux users), the examples in this guide assume the use of a *virtual environment*.

For Windows users, the examples in this guide assume that the option to adjust the system PATH environment variable was selected when installing Python.

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It's also possible to specify an exact or minimum version directly on the command line. When using comparator operators such as `>`, `<` or some other special character which get interpreted by shell, the package name and the version should be enclosed within double quotes:

```
python -m pip install SomePackage==1.0.4    # specific version
python -m pip install "SomePackage>=1.0.4"  # minimum version
```

Normally, if a suitable module is already installed, attempting to install it again will have no effect. Upgrading existing modules must be requested explicitly:

```
python -m pip install --upgrade SomePackage
```

More information and resources regarding `pip` and its capabilities can be found in the [Python Packaging User Guide](#).

Creation of virtual environments is done through the `venv` module. Installing packages into an active virtual environment uses the commands shown above.

### Lihat juga:

[Python Packaging User Guide: Installing Python Distribution Packages](#)



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## Bagaimana saya ...?

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Ini adalah jawaban cepat atau tautan untuk beberapa tugas umum.

### 3.1 ... install `pip` in versions of Python prior to Python 3.4?

Python only started bundling `pip` with Python 3.4. For earlier versions, `pip` needs to be “bootstrapped” as described in the Python Packaging User Guide.

**Lihat juga:**

[Python Packaging User Guide: Requirements for Installing Packages](#)

### 3.2 ... install packages just for the current user?

Passing the `--user` option to `python -m pip install` will install a package just for the current user, rather than for all users of the system.

### 3.3 ... memasang paket-paket Python saintifik?

A number of scientific Python packages have complex binary dependencies, and aren’t currently easy to install using `pip` directly. At this point in time, it will often be easier for users to install these packages by [other means](#) rather than attempting to install them with `pip`.

**Lihat juga:**

[Python Packaging User Guide: Installing Scientific Packages](#)

## 3.4 ... work with multiple versions of Python installed in parallel?

On Linux, Mac OS X, and other POSIX systems, use the versioned Python commands in combination with the `-m` switch to run the appropriate copy of `pip`:

```
python2 -m pip install SomePackage # default Python 2
python2.7 -m pip install SomePackage # specifically Python 2.7
python3 -m pip install SomePackage # default Python 3
python3.4 -m pip install SomePackage # specifically Python 3.4
```

Appropriately versioned `pip` commands may also be available.

On Windows, use the `py` Python launcher in combination with the `-m` switch:

```
py -2 -m pip install SomePackage # default Python 2
py -2.7 -m pip install SomePackage # specifically Python 2.7
py -3 -m pip install SomePackage # default Python 3
py -3.4 -m pip install SomePackage # specifically Python 3.4
```

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## Permasalahan umum pemasangan

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### 4.1 Installing into the system Python on Linux

On Linux systems, a Python installation will typically be included as part of the distribution. Installing into this Python installation requires root access to the system, and may interfere with the operation of the system package manager and other components of the system if a component is unexpectedly upgraded using `pip`.

On such systems, it is often better to use a virtual environment or a per-user installation when installing packages with `pip`.

### 4.2 Pip tidak terpasang

It is possible that `pip` does not get installed by default. One potential fix is:

```
python -m ensurepip --default-pip
```

There are also additional resources for [installing pip](#).

### 4.3 Memasang ekstensi biner

Python has typically relied heavily on source based distribution, with end users being expected to compile extension modules from source as part of the installation process.

With the introduction of support for the binary `wheel` format, and the ability to publish wheels for at least Windows and Mac OS X through the Python Packaging Index, this problem is expected to diminish over time, as users are more regularly able to install pre-built extensions rather than needing to build them themselves.

Some of the solutions for installing [scientific software](#) that are not yet available as pre-built `wheel` files may also help with obtaining other binary extensions without needing to build them locally.

**Lihat juga:**

[Python Packaging User Guide: Binary Extensions](#)



>>> Prompt Python bawaan dari *shell* interaktif. Sering terlihat untuk contoh kode yang dapat dieksekusi secara interaktif dalam *interpreter*.

. . . Prompt Python bawaan dari *shell* interaktif saat memasukkan kode untuk blok kode indentasi, ketika berada dalam sepasang pembatas kiri dan kanan yang cocok (tanda kurung, kurung kotak, kurung kurawal atau tanda kutip tiga), atau setelah menentukan *decorator*.

**2to3** A tool that tries to convert Python 2.x code to Python 3.x code by handling most of the incompatibilities which can be detected by parsing the source and traversing the parse tree.

2to3 is available in the standard library as `lib2to3`; a standalone entry point is provided as `Tools/scripts/2to3`. See [2to3-reference](#).

**kelas basis abstrak** Abstract base classes complement *duck-typing* by providing a way to define interfaces when other techniques like `hasattr()` would be clumsy or subtly wrong (for example with magic methods). ABCs introduce virtual subclasses, which are classes that don't inherit from a class but are still recognized by `isinstance()` and `issubclass()`; see the `abc` module documentation. 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). You can create your own ABCs with the `abc` module.

**anotasi** A label associated with a variable, a class attribute or a function parameter or return value, used by convention as a *type hint*.

Annotations of local variables cannot be accessed at runtime, but annotations of global variables, class attributes, and functions are stored in the `__annotations__` special attribute of modules, classes, and functions, respectively.

See [variable annotation](#), [function annotation](#), [PEP 484](#) and [PEP 526](#), which describe this functionality.

**argumen** A value passed to a *function* (or *method*) when calling the function. There are two kinds of argument:

- *keyword argument*: an argument preceded by an identifier (e.g. `name=`) in a function call or passed as a value in a dictionary preceded by `**`. For example, 3 and 5 are both keyword arguments in the following calls to `complex()`:

```
complex(real=3, imag=5)
complex(**{'real': 3, 'imag': 5})
```

- *positional argument*: an argument that is not a keyword argument. Positional arguments can appear at the beginning of an argument list and/or be passed as elements of an *iterable* preceded by `*`. For example, 3

and 5 are both positional arguments in the following calls:

```
complex(3, 5)
complex(*(3, 5))
```

Arguments are assigned to the named local variables in a function body. See the calls section for the rules governing this assignment. Syntactically, any expression can be used to represent an argument; the evaluated value is assigned to the local variable.

See also the *parameter* glossary entry, the FAQ question on the difference between arguments and parameters, and [PEP 362](#).

**manajer konteks asinkron** An object which controls the environment seen in an `async with` statement by defining `__aenter__()` and `__aexit__()` methods. Introduced by [PEP 492](#).

**pembangkit asinkron** A function which returns an *asynchronous generator iterator*. It looks like a coroutine function defined with `async def` except that it contains `yield` expressions for producing a series of values usable in an `async for` loop.

Usually refers to an asynchronous generator function, but may refer to an *asynchronous generator iterator* in some contexts. In cases where the intended meaning isn't clear, using the full terms avoids ambiguity.

An asynchronous generator function may contain `await` expressions as well as `async for`, and `async with` statements.

**iterator generator asinkron** Sebuah objek dibuat oleh fungsi *asynchronous generator*.

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 location 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](#).

**asynchronous iterable** An object, that can be used in an `async for` statement. Must return an *asynchronous iterator* from its `__aiter__()` method. Introduced by [PEP 492](#).

**iterator asinkron** 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](#).

**atribut** A value associated with an object which is referenced by name using dotted expressions. For example, if an object *o* has an attribute *a* it would be referenced as *o.a*.

**menunggu** 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, a.k.a. [Guido van Rossum](#), Python's creator.

**berkas biner** 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`.

See also *text file* for a file object able to read and write `str` objects.

**bytes-like object** An object that supports the bufferobjects and can export a *C-contiguous* buffer. This includes all `bytes`, `bytearray`, and `array.array` objects, as well as many common `memoryview` objects. Bytes-like objects can be used for various operations that work with binary data; these include compression, saving to a binary file, and sending over a socket.

Some operations need the binary data to be mutable. The documentation often refers to these as "read-write bytes-like objects". Example mutable buffer objects include `bytearray` and a `memoryview` of a `bytearray`. Other operations require the binary data to be stored in immutable objects ("read-only bytes-like objects"); examples of these include `bytes` and a `memoryview` of a `bytes` object.

**bytecode** Python source code is compiled into bytecode, the internal representation of a Python program in the CPython interpreter. The bytecode is also cached in `.pyc` files so that executing the same file is faster the



second time (recompilation from source to bytecode can be avoided). This "intermediate language" is said to run on a *virtual machine* that executes the machine code corresponding to each bytecode. Do note that bytecodes are not expected to work between different Python virtual machines, nor to be stable between Python releases.

Daftar instruksi-instruksi bytecode dapat ditemukan di dokumentasi pada the dis module.

**kelas** A template for creating user-defined objects. Class definitions normally contain method definitions which operate on instances of the class.

**class variable** A variable defined in a class and intended to be modified only at class level (i.e., not in an instance of the class).

**paksaan** The implicit conversion of an instance of one type to another during an operation which involves two arguments of the same type. For example, `int(3.15)` converts the floating point number to the integer 3, but in `3+4.5`, each argument is of a different type (one int, one float), and both must be converted to the same type before they can be added or it will raise a `TypeError`. Without coercion, all arguments of even compatible types would have to be normalized to the same value by the programmer, e.g., `float(3)+4.5` rather than just `3+4.5`.

**bilangan kompleks** An extension of the familiar real number system in which all numbers are expressed as a sum of a real part and an imaginary part. Imaginary numbers are real multiples of the imaginary unit (the square root of  $-1$ ), often written *i* in mathematics or *j* in engineering. Python has built-in support for complex numbers, which are written with this latter notation; the imaginary part is written with a *j* suffix, e.g., `3+1j`. To get access to complex equivalents of the `math` module, use `cmath`. Use of complex numbers is a fairly advanced mathematical feature. If you're not aware of a need for them, it's almost certain you can safely ignore them.

**manajer konteks** An object which controls the environment seen in a `with` statement by defining `__enter__()` and `__exit__()` methods. See [PEP 343](#).

**context variable** A variable which can have different values depending on its context. This is similar to Thread-Local Storage in which each execution thread may have a different value for a variable. However, with context variables, there may be several contexts in one execution thread and the main usage for context variables is to keep track of variables in concurrent asynchronous tasks. See `contextvars`.

**contiguous** A buffer is considered contiguous exactly if it is either *C-contiguous* or *Fortran contiguous*. Zero-dimensional buffers are C and Fortran contiguous. In one-dimensional arrays, the items must be laid out in memory next to each other, in order of increasing indexes starting from zero. In multidimensional C-contiguous arrays, the last index varies the fastest when visiting items in order of memory address. However, in Fortran contiguous arrays, the first index varies the fastest.

**coroutine** Coroutines are a more generalized form of subroutines. Subroutines are entered at one point and exited at another point. Coroutines can be entered, exited, and resumed at many different points. They can be implemented with the `async def` statement. See also [PEP 492](#).

**coroutine function** A function which returns a *coroutine* object. A coroutine function may be defined with the `async def` statement, and may contain `await`, `async for`, and `async with` keywords. These were introduced by [PEP 492](#).

**CPython** The canonical implementation of the Python programming language, as distributed on [python.org](#). The term "CPython" is used when necessary to distinguish this implementation from others such as Jython or IronPython.

**penghias** A function returning another function, usually applied as a function transformation using the `@wrapper` syntax. Common examples for decorators are `classmethod()` and `staticmethod()`.

The decorator syntax is merely syntactic sugar, the following two function definitions are semantically equivalent:

```
def f(...):
    ...
f = staticmethod(f)

@staticmethod
```

(berlanjut ke halaman berikutnya)

(lanjutan dari halaman sebelumnya)

```
def f(...):  
    ...
```

The same concept exists for classes, but is less commonly used there. See the documentation for function definitions and class definitions for more about decorators.

**descriptor** 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.

For more information about descriptors' methods, see descriptors.

**kamus** 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.

**dictionary view** The objects returned from `dict.keys()`, `dict.values()`, and `dict.items()` are called dictionary views. They provide a dynamic view on the dictionary's entries, which means that when the dictionary changes, the view reflects these changes. To force the dictionary view to become a full list use `list(dictview)`. See dict-views.

**docstring** 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.

**duck-typing** A programming style which does not look at an object's type to determine if it has the right interface; instead, the method or attribute is simply called or used ("If it looks like a duck and quacks like a duck, it must be a duck.") By emphasizing interfaces rather than specific types, well-designed code improves its flexibility by allowing polymorphic substitution. Duck-typing avoids tests using `type()` or `isinstance()`. (Note, however, that duck-typing can be complemented with *abstract base classes*.) Instead, it typically employs `hasattr()` tests or *EAFP* programming.

**EAFP** Easier to ask for forgiveness than permission. This common Python coding style assumes the existence of valid keys or attributes and catches exceptions if the assumption proves false. This clean and fast style is characterized by the presence of many `try` and `except` statements. The technique contrasts with the *LBYL* style common to many other languages such as C.

**ekspresi** A piece of syntax which can be evaluated to some value. In other words, an expression is an accumulation of expression elements like literals, names, attribute access, operators or function calls which all return a value. In contrast to many other languages, not all language constructs are expressions. There are also *statements* which cannot be used as expressions, such as `while`. Assignments are also statements, not expressions.

**modul tambahan** A module written in C or C++, using Python's C API to interact with the core and with user code.

**f-string** String literals prefixed with `'f'` or `'F'` are commonly called "f-strings" which is short for formatted string literals. See also [PEP 498](#).

**objek berkas** 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*.

There are actually three categories of file objects: raw *binary files*, buffered *binary files* and *text files*. Their interfaces are defined in the `io` module. The canonical way to create a file object is by using the `open()` function.

**file-like object** A synonym for *file object*.

**finder** An object that tries to find the *loader* for a module that is being imported.

Since Python 3.3, 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 [PEP 302](#), [PEP 420](#) and [PEP 451](#) for much more detail.

**floor division** Mathematical division that rounds down to nearest integer. The floor division operator is `//`. For example, the expression `11 // 4` evaluates to 2 in contrast to the 2.75 returned by float true division. Note that `(-11) // 4` is -3 because that is -2.75 rounded *downward*. See [PEP 238](#).

**fungsi** A series of statements which returns some value to a caller. It can also be passed zero or more *arguments* which may be used in the execution of the body. See also *parameter*, *method*, and the function section.

**anotasi fungsi** An *annotation* of a function parameter or return value.

Function annotations are usually used for *type hints*: for example, this function is expected to take two `int` arguments and is also expected to have an `int` return value:

```
def sum_two_numbers(a: int, b: int) -> int:
    return a + b
```

Function annotation syntax is explained in section function.

See *variable annotation* and [PEP 484](#), which describe this functionality.

**\_\_future\_\_** A pseudo-module which programmers can use to enable new language features which are not compatible with the current interpreter.

By importing the `__future__` module and evaluating its variables, you can see when a new feature was first added to the language and when it becomes the default:

```
>>> import __future__
>>> __future__.division
_Feature((2, 2, 0, 'alpha', 2), (3, 0, 0, 'alpha', 0), 8192)
```

**pengumpulan sampah** The process of freeing memory when it is not used anymore. Python performs garbage collection via reference counting and a cyclic garbage collector that is able to detect and break reference cycles. The garbage collector can be controlled using the `gc` module.

**pembangkit** A function which returns a *generator iterator*. It looks like a normal function except that it contains `yield` expressions for producing a series of values usable in a for-loop or that can be retrieved one at a time with the `next()` function.

Usually refers to a generator function, but may refer to a *generator iterator* in some contexts. In cases where the intended meaning isn't clear, using the full terms avoids ambiguity.

**generator iterator** An object created by a *generator* function.

Each `yield` temporarily suspends processing, remembering the location 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).

**generator expression** 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
```

**fungsi generik** A function composed of multiple functions implementing the same operation for different types. Which implementation should be used during a call is determined by the dispatch algorithm.

See also the *single dispatch* glossary entry, the `functools.singledispatch()` decorator, and [PEP 443](#).

**GIL** Lihat *global interpreter lock*.

**kunci interpreter global** The mechanism used by the *CPython* interpreter to assure that only one thread executes Python *bytecode* at a time. This simplifies the CPython implementation by making the object model (including critical built-in types such as `dict`) implicitly safe against concurrent access. Locking the entire interpreter makes it easier for the interpreter to be multi-threaded, at the expense of much of the parallelism afforded by multi-processor machines.

However, some extension modules, either standard or third-party, are designed so as to release the GIL when doing computationally-intensive tasks such as compression or hashing. Also, the GIL is always released when doing I/O.

Past efforts to create a "free-threaded" interpreter (one which locks shared data at a much finer granularity) have not been successful because performance suffered in the common single-processor case. It is believed that overcoming this performance issue would make the implementation much more complicated and therefore costlier to maintain.

**hash-based pyc** A bytecode cache file that uses the hash rather than the last-modified time of the corresponding source file to determine its validity. See `pyc-invalidation`.

**hashable** 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 makes an object usable as a dictionary key and a set member, because these data structures use the hash value internally.

Most of Python's immutable built-in objects are hashable; mutable containers (such as lists or dictionaries) are not; immutable containers (such as tuples and frozensets) are only hashable if their elements are hashable. Objects which are instances of user-defined classes are hashable by default. They all compare unequal (except with themselves), and their hash value is derived from their `id()`.

**IDLE** Sebuah Lingkungan Pengembangan Terpadu untuk Python. IDLE adalah editor dasar dan lingkungan interpreter yang digabungkan dengan distribusi standar dari Python.

**immutable** An object with a fixed value. Immutable objects include numbers, strings and tuples. Such an object cannot be altered. A new object has to be created if a different value has to be stored. They play an important role in places where a constant hash value is needed, for example as a key in a dictionary.

**import path** A list of locations (or *path entries*) that are searched by the *path based finder* for modules to import. During import, this list of locations usually comes from `sys.path`, but for subpackages it may also come from the parent package's `__path__` attribute.

**importing** The process by which Python code in one module is made available to Python code in another module.

**importer** An object that both finds and loads a module; both a *finder* and *loader* object.

**interaktif** 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)`).

**diinterpretasi** Python is an interpreted language, as opposed to a compiled one, though the distinction can be blurry because of the presence of the bytecode compiler. This means that source files can be run directly without explicitly creating an executable which is then run. Interpreted languages typically have a shorter development/debug cycle than compiled ones, though their programs generally also run more slowly. See also *interactive*.

**interpreter shutdown** When asked to shut down, the Python interpreter enters a special phase where it gradually releases all allocated resources, such as modules and various critical internal structures. It also makes several calls to the *garbage collector*. This can trigger the execution of code in user-defined destructors or weakref callbacks. Code executed during the shutdown phase can encounter various exceptions as the resources it relies on may not function anymore (common examples are library modules or the warnings machinery).

The main reason for interpreter shutdown is that the `__main__` module or the script being run has finished executing.

**iterable** 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*.

**iterator** 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.

Informasi lebih lanjut dapat ditemukan di *typeiter*.

**fungsi kunci** A key function or collation function is a callable that returns a value used for sorting or ordering. For example, `locale.strxfrm()` is used to produce a sort key that is aware of locale specific sort conventions.

A number of tools in Python accept key functions to control how elements are ordered or grouped. They include `min()`, `max()`, `sorted()`, `list.sort()`, `heapq.merge()`, `heapq.nsmallest()`, `heapq.nlargest()`, and `itertools.groupby()`.

There are several ways to create a key function. For example, the `str.lower()` method can serve as a key function for case insensitive sorts. Alternatively, a key function can be built from a `lambda` expression such as `lambda r: (r[0], r[2])`. Also, the `operator` module provides three key function constructors: `attrgetter()`, `itemgetter()`, and `methodcaller()`. See the *Sorting HOW TO* for examples of how to create and use key functions.

**argumen kata kunci** Lihat *argument*.

**lambda** An anonymous inline function consisting of a single *expression* which is evaluated when the function is called. The syntax to create a lambda function is `lambda [parameters]: expression`

**LBYL** Look before you leap. This coding style explicitly tests for pre-conditions before making calls or lookups. This style contrasts with the *EAFP* approach and is characterized by the presence of many `if` statements.

In a multi-threaded environment, the LBYL approach can risk introducing a race condition between "the looking" and "the leaping". For example, the code, `if key in mapping: return mapping[key]` can fail if another thread removes `key` from `mapping` after the test, but before the lookup. This issue can be solved with locks or by using the *EAFP* approach.

**daftar** 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  $O(1)$ .

**list comprehension** A compact way to process all or part of the elements in a sequence and return a list with the results. `result = ['{:04x}'.format(x) for x in range(256) if x % 2 == 0]` generates a list of strings containing even hex numbers (0x..) in the range from 0 to 255. The `if` clause is optional. If omitted, all elements in `range(256)` are processed.

**loader** An object that loads a module. It must define a method named `load_module()`. A loader is typically returned by a *finder*. See **PEP 302** for details and `importlib.abc.Loader` for an *abstract base class*.

**magic method** An informal synonym for *special method*.

**pemetaan** A container object that supports arbitrary key lookups and implements the methods specified in the *Mapping* or *MutableMapping* abstract base classes. Examples include `dict`, `collections.defaultdict`, `collections.OrderedDict` and `collections.Counter`.

**meta path finder** A *finder* returned by a search of `sys.meta_path`. Meta path finders are related to, but different from *path entry finders*.

See `importlib.abc.MetaPathFinder` for the methods that meta path finders implement.

**metaclass** The class of a class. Class definitions create a class name, a class dictionary, and a list of base classes. The metaclass is responsible for taking those three arguments and creating the class. Most object oriented programming languages provide a default implementation. What makes Python special is that it is possible to create custom metaclasses. Most users never need this tool, but when the need arises, metaclasses can provide powerful, elegant solutions. They have been used for logging attribute access, adding thread-safety, tracking object creation, implementing singletons, and many other tasks.

Informasi lebih lanjut dapat ditemukan di metaclasses.

**method** A function which is defined inside a class body. If called as an attribute of an instance of that class, the method will get the instance object as its first *argument* (which is usually called `self`). See *function* and *nested scope*.

**method resolution order** Method Resolution Order is the order in which base classes are searched for a member during lookup. See [The Python 2.3 Method Resolution Order](#) for details of the algorithm used by the Python interpreter since the 2.3 release.

**modul** An object that serves as an organizational unit of Python code. Modules have a namespace containing arbitrary Python objects. Modules are loaded into Python by the process of *importing*.

Lihat juga *package*.

**module spec** A namespace containing the import-related information used to load a module. An instance of `importlib.machinery.ModuleSpec`.

**MRO** Lihat *method resolution order*.

**mutable** Mutable objects can change their value but keep their `id()`. See also *immutable*.

**named tuple** The term "named tuple" applies to any type or class that inherits from `tuple` and whose indexable elements are also accessible using named attributes. The type or class may have other features as well.

Several built-in types are named tuples, including the values returned by `time.localtime()` and `os.stat()`. Another example is `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 with the factory function `collections.namedtuple()`. The latter technique also adds some extra methods that may not be found in hand-written or built-in named tuples.

**namespace** The place where a variable is stored. Namespaces are implemented as dictionaries. There are the local, global and built-in namespaces as well as nested namespaces in objects (in methods). Namespaces support modularity by preventing naming conflicts. For instance, the functions `builtins.open` and `os.open()` are distinguished by their namespaces. Namespaces also aid readability and maintainability by making it clear which module implements a function. For instance, writing `random.seed()` or `itertools.islice()` makes it clear that those functions are implemented by the `random` and `itertools` modules, respectively.

**namespace package** A [PEP 420 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.

Lihat juga *module*.

**nested scope** The ability to refer to a variable in an enclosing definition. For instance, a function defined inside another function can refer to variables in the outer function. Note that nested scopes by default work only for



reference and not for assignment. Local variables both read and write in the innermost scope. Likewise, global variables read and write to the global namespace. The `nonlocal` allows writing to outer scopes.

**new-style class** 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, `__getattr__()`, class methods, and static methods.

**objek** Any data with state (attributes or value) and defined behavior (methods). Also the ultimate base class of any *new-style class*.

**paket** A Python *module* which can contain submodules or recursively, subpackages. Technically, a package is a Python module with an `__path__` attribute.

See also *regular package* and *namespace package*.

**parameter** A named entity in a *function* (or method) definition that specifies an *argument* (or in some cases, arguments) that the function can accept. There are five kinds of parameter:

- *positional-or-keyword*: specifies an argument that can be passed either *positionally* or as a *keyword argument*. This is the default kind of parameter, for example *foo* and *bar* in the following:

```
def func(foo, bar=None): ...
```

- *positional-only*: specifies an argument that can be supplied only by position. Python has no syntax for defining positional-only parameters. However, some built-in functions have positional-only parameters (e.g. `abs()`).
- *keyword-only*: specifies an argument that can be supplied only by keyword. Keyword-only parameters can be defined by including a single var-positional parameter or bare `*` in the parameter list of the function definition before them, for example *kw\_only1* and *kw\_only2* in the following:

```
def func(arg, *, kw_only1, kw_only2): ...
```

- *var-positional*: specifies that an arbitrary sequence of positional arguments can be provided (in addition to any positional arguments already accepted by other parameters). Such a parameter can be defined by prepending the parameter name with `*`, for example *args* in the following:

```
def func(*args, **kwargs): ...
```

- *var-keyword*: specifies that arbitrarily many keyword arguments can be provided (in addition to any keyword arguments already accepted by other parameters). Such a parameter can be defined by prepending the parameter name with `**`, for example *kwargs* in the example above.

Parameters can specify both optional and required arguments, as well as default values for some optional arguments.

See also the *argument* glossary entry, the FAQ question on the difference between arguments and parameters, the `inspect.Parameter` class, the function section, and [PEP 362](#).

**path entry** A single location on the *import path* which the *path based finder* consults to find modules for importing.

**path entry finder** A *finder* returned by a callable on `sys.path_hooks` (i.e. a *path entry hook*) which knows how to locate modules given a *path entry*.

See `importlib.abc.PathEntryFinder` for the methods that path entry finders implement.

**path entry hook** A callable on the `sys.path_hook` list which returns a *path entry finder* if it knows how to find modules on a specific *path entry*.

**path based finder** One of the default *meta path finders* which searches an *import path* for modules.

**path-like object** An object representing a file system path. A path-like object is either a `str` or `bytes` object representing a path, or an object implementing the `os.PathLike` protocol. An object that supports the `os.PathLike` protocol can be converted to a `str` or `bytes` file system path by calling the `os.fspath()` function; `os.fsdecode()` and `os.fsencode()` can be used to guarantee a `str` or `bytes` result instead, respectively. Introduced by [PEP 519](#).

**PEP** Python Enhancement Proposal. A PEP is a design document providing information to the Python community, or describing a new feature for Python or its processes or environment. PEPs should provide a concise technical specification and a rationale for proposed features.

PEPs are intended to be the primary mechanisms for proposing major new features, for collecting community input on an issue, and for documenting the design decisions that have gone into Python. The PEP author is responsible for building consensus within the community and documenting dissenting opinions.

Lihat [PEP 1](#).

**porisi** A set of files in a single directory (possibly stored in a zip file) that contribute to a namespace package, as defined in [PEP 420](#).

**positional argument** Lihat [argument](#).

**provisional API** A provisional API is one which has been deliberately excluded from the standard library's backwards compatibility guarantees. While major changes to such interfaces are not expected, as long as they are marked provisional, backwards incompatible changes (up to and including removal of the interface) may occur if deemed necessary by core developers. Such changes will not be made gratuitously -- they will occur only if serious fundamental flaws are uncovered that were missed prior to the inclusion of the API.

Even for provisional APIs, backwards incompatible changes are seen as a "solution of last resort" - every attempt will still be made to find a backwards compatible resolution to any identified problems.

This process allows the standard library to continue to evolve over time, without locking in problematic design errors for extended periods of time. See [PEP 411](#) for more details.

**provisional package** Lihat [provisional API](#).

**Python 3000** Nickname for the Python 3.x release line (coined long ago when the release of version 3 was something in the distant future.) This is also abbreviated "Py3k".

**Pythonic** An idea or piece of code which closely follows the most common idioms of the Python language, rather than implementing code using concepts common to other languages. For example, a common idiom in Python is to loop over all elements of an iterable using a `for` statement. Many other languages don't have this type of construct, so people unfamiliar with Python sometimes use a numerical counter instead:

```
for i in range(len(food)) :
    print (food[i])
```

As opposed to the cleaner, Pythonic method:

```
for piece in food:
    print (piece)
```

**nama yang memenuhi syarat** A dotted name showing the "path" from a module's global scope to a class, function or method defined in that module, as defined in [PEP 3155](#). For top-level functions and classes, the qualified name is the same as the object's name:

```
>>> class C:
...     class D:
...         def meth(self):
...             pass
...
>>> C.__qualname__
'C'
>>> C.D.__qualname__
'C.D'
>>> C.D.meth.__qualname__
'C.D.meth'
```

When used to refer to modules, the *fully qualified name* means the entire dotted path to the module, including any parent packages, e.g. `email.mime.text`:



```
>>> import email.mime.text
>>> email.mime.text.__name__
'email.mime.text'
```

**jumlah referensi** The number of references to an object. When the reference count of an object drops to zero, it is deallocated. Reference counting is generally not visible to Python code, but it is a key element of the *CPython* implementation. The `sys` module defines a `getrefcount()` function that programmers can call to return the reference count for a particular object.

**paket biasa** A traditional *package*, such as a directory containing an `__init__.py` file.

Lihat juga *namespace package*.

**\_\_slots\_\_** A declaration inside a class that saves memory by pre-declaring space for instance attributes and eliminating instance dictionaries. Though popular, the technique is somewhat tricky to get right and is best reserved for rare cases where there are large numbers of instances in a memory-critical application.

**urutan** 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 *immutable* 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()`.

**single dispatch** A form of *generic function* dispatch where the implementation is chosen based on the type of a single argument.

**slice** An object usually containing a portion of a *sequence*. A slice is created using the subscript notation, `[]` with colons between numbers when several are given, such as in `variable_name[1:3:5]`. The bracket (subscript) notation uses `slice` objects internally.

**special method** A method that is called implicitly by Python to execute a certain operation on a type, such as addition. Such methods have names starting and ending with double underscores. Special methods are documented in `specialnames`.

**pernyataan** A statement is part of a suite (a "block" of code). A statement is either an *expression* or one of several constructs with a keyword, such as `if`, `while` or `for`.

**text encoding** A codec which encodes Unicode strings to bytes.

**berkas teks** A *file object* able to read and write `str` objects. Often, a text file actually accesses a byte-oriented datastream and handles the *text encoding* automatically. Examples of text files are files opened in text mode ('r' or 'w'), `sys.stdin`, `sys.stdout`, and instances of `io.StringIO`.

See also *binary file* for a file object able to read and write *bytes-like objects*.

**teks tiga-kutip** A string which is bound by three instances of either a quotation mark (") or an apostrophe ('). While they don't provide any functionality not available with single-quoted strings, they are useful for a number of reasons. They allow you to include unescaped single and double quotes within a string and they can span multiple lines without the use of the continuation character, making them especially useful when writing docstrings.

**type** 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)`.

**type alias** A synonym for a type, created by assigning the type to an identifier.

Type aliases are useful for simplifying *type hints*. For example:

```
from typing import List, Tuple

def remove_gray_shades(
```

(berlanjut ke halaman berikutnya)

(lanjutan dari halaman sebelumnya)

```
colors: List[Tuple[int, int, int]]) -> List[Tuple[int, int, int]]:
    pass
```

could be made more readable like this:

```
from typing import List, Tuple

Color = Tuple[int, int, int]

def remove_gray_shades(colors: List[Color]) -> List[Color]:
    pass
```

See `typing` and [PEP 484](#), which describe this functionality.

**type hint** An *annotation* that specifies the expected type for a variable, a class attribute, or a function parameter or return value.

Type hints are optional and are not enforced by Python but they are useful to static type analysis tools, and aid IDEs with code completion and refactoring.

Type hints of global variables, class attributes, and functions, but not local variables, can be accessed using `typing.get_type_hints()`.

See `typing` and [PEP 484](#), which describe this functionality.

**universal newlines** A manner of interpreting text streams in which all of the following are recognized as ending a line: the Unix end-of-line convention `'\n'`, the Windows convention `'\r\n'`, and the old Macintosh convention `'\r'`. See [PEP 278](#) and [PEP 3116](#), as well as `bytes.splitlines()` for an additional use.

**anotasi variabel** An *annotation* of a variable or a class attribute.

When annotating a variable or a class attribute, assignment is optional:

```
class C:
    field: 'annotation'
```

Variable annotations are usually used for *type hints*: for example this variable is expected to take `int` values:

```
count: int = 0
```

Variable annotation syntax is explained in section `annassign`.

See *function annotation*, [PEP 484](#) and [PEP 526](#), which describe this functionality.

**lingkungan virtual** Lingkungan runtime kooperatif yang memungkinkan pengguna dan aplikasi Python untuk menginstal dan memperbarui paket distribusi Python tanpa mengganggu perilaku aplikasi Python lain yang berjalan pada sistem yang sama.

Lihat juga `venv`.

**mesin virtual** A computer defined entirely in software. Python's virtual machine executes the *bytecode* emitted by the bytecode compiler.

**Zen of Python** Listing of Python design principles and philosophies that are helpful in understanding and using the language. The listing can be found by typing `"import this"` at the interactive prompt.

---

### Tentang dokumen-dokumen ini

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Dokumen-dokumen ini dihasilkan dari [reStructuredText](#) dengan [Sphinx](#), sebuah pemroses dokumen yang khusus ditulis untuk dokumentasi Python.

Pengembangan dokumentasi dan perangkat pengembangannya sepenuhnya upaya sukarela, seperti halnya Python. Jika anda ingin berkontribusi, silakan lihat halaman [reporting-bugs](#) untuk informasi cara melakukannya. Relawan baru selalu diterima!

Terima kasih banyak untuk:

- Fred L. Drake, Jr., pembuat awal kumpulan alat dokumentasi Python dan penulis banyak konten;
- [Docutils](#) proyek untuk membuat [reStructuredText](#) dan [Docutils](#) suite;
- Fredrik Lundh untuk [Alternative Python Reference](#) proyek dimana Sphinx mendapatkan banyak ide bagus.

### B.1 Kontributor untuk dokumentasi Python

Banyak orang telah berkontribusi ke bahasa Python, pustaka standar Python, dan dokumentasi Python. Lihat [Misc/ACKS](#) di distribusi kode sumber Python untuk sebagian daftar kontributor-kontributor.

Hanya dengan masukan dan kontribusi dari komunitas Python sehingga Python memiliki dokumentasi yang sangat baik. Terima kasih!



---

## Sejarah dan Lisensi

---

### C.1 Sejarah perangkat lunak

Python diciptakan pada awal 1990-an oleh Guido van Rossum di Stichting Mathematisch Centrum (CWI, lihat <https://www.cwi.nl/>) di Belanda sebagai penerus bahasa yang disebut ABC. Guido tetap menjadi penulis utama Python, meskipun ia memasukkan banyak kontribusi dari orang lain.

Pada tahun 1995, Guido melanjutkan karyanya tentang Python di Corporation for National Research Initiatives (CNRI, lihat <https://www.cnri.reston.va.us/>) di Reston, Virginia di mana ia merilis beberapa versi perangkat lunak.

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 (now Zope Corporation; see <https://www.zope.org/>). 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 is a sponsoring member of the PSF.

Semua rilis Python adalah Sumber Terbuka (lihat <https://opensource.org/> untuk Definisi Sumber Terbuka). Secara historis, sebagian besar, tetapi tidak semua, rilis Python juga kompatibel dengan GPL; tabel di bawah ini merangkum berbagai rilis.

Rilis	Berasal dari	Tahun	Pemilik	GPL compatible?
0.9.0 hingga 1.2	t/a	1991-1995	CWI	ya
1.3 hingga 1.5.2	1.2	1995-1999	CNRI	ya
1.6	1.5.2	2000	CNRI	tidak
2.0	1.6	2000	BeOpen.com	tidak
1.6.1	1.6	2001	CNRI	tidak
2.1	2.0+1.6.1	2001	PSF	tidak
2.0.1	2.0+1.6.1	2001	PSF	ya
2.1.1	2.1+2.0.1	2001	PSF	ya
2.1.2	2.1.1	2002	PSF	ya
2.1.3	2.1.2	2002	PSF	ya
2.2 dan ke atas	2.1.1	2001-sekarang	PSF	ya

---

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---

Terima kasih kepada banyak sukarelawan eksternal yang telah bekerja di bawah arahan Guido untuk mewujudkan rilis-rilis ini.

## C.2 Syarat dan ketentuan untuk mengakses atau menggunakan Python

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Bagian ini tidak lengkap, tetapi daftar lisensi dan ucapan terima kasih yang terus bertambah untuk perangkat lunak pihak ketiga yang tergabung dalam distribusi Python.

### C.3.1 Mersenne Twister

The `_random` module includes code based on a download from <http://www.math.sci.hiroshima-u.ac.jp/~m-mat/MT/MT2002/emt19937ar.html>. The following are the verbatim comments from the original code:

```
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)
or init_by_array(init_key, key_length).

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<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 Soket

The socket module uses the functions, `getaddrinfo()`, and `getnameinfo()`, which are coded in separate source files from the WIDE Project, <http://www.wide.ad.jp/>.

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```

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```

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```

```
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```

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```

### C.3.4 Pengelolaan *Cookie*

Modul `http.cookies` berisi pemberitahuan berikut:

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```

### C.3.5 Pelacakan eksekusi

Modul `trace` berisi pemberitahuan berikut:

```
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Author: Zooko O'Whielacronx
http://zooko.com/
mailto:zooko@zooko.com

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```

### C.3.6 UUencode and UUdecode functions

Modul `uu` berisi pemberitahuan berikut:

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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 Remote Procedure Calls

Modul `xmlrpc.client` berisi pemberitahuan berikut:

```
The XML-RPC client interface is

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```

### C.3.8 test\_epoll

Modul `test_epoll` berisi pemberitahuan berikut:

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```

### C.3.9 Pilih kqueue

Modul select berisi pemberitahuan berikut untuk antarmuka kqueue:

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```

### C.3.10 SipHash24

The file `Python/pyhash.c` contains Marek Majkowski's implementation of Dan Bernstein's SipHash24 algorithm. It contains the following note:

```
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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 dan dtoa

The file `Python/dtoa.c`, which supplies C functions `dtoa` and `strtod` for conversion of C doubles to and from strings, is derived from the file of the same name by David M. Gay, currently available from <http://www.netlib.org/fp/>. The original file, as retrieved on March 16, 2009, contains the following copyright and licensing notice:

```

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 *****/

```

### C.3.12 OpenSSL

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```

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Jean-loup Gailly      Mark Adler  
jloup@gzip.org        madler@alumni.caltech.edu
```

### C.3.16 cfuhash

The implementation of the hash table used by the `tracemalloc` is based on the `cfuhash` project:

```
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```

### C.3.17 libmpdec

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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## LAMPIRAN D

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