

Packages (1A)

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Package (1)

modules are
files containing Python statements and definitions,
like function and class definitions.

to bundle multiple **modules** together,
create a **package**.

a **package** is
basically a **directory**
with several **Python files** (**modules**)
and a special file **`__init__.py`**

inside of the **Python path**,
every **directory** contains **`__init__.py`**,
will be treated as a **package** by Python.

<https://python-course.eu/python-tutorial/packages.php>

Submodules in a package

packages are a way of structuring Python's **module namespace** by using "**dotted module names**".

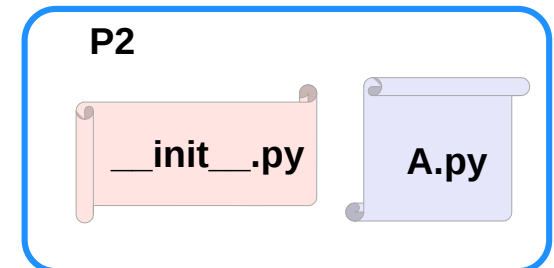
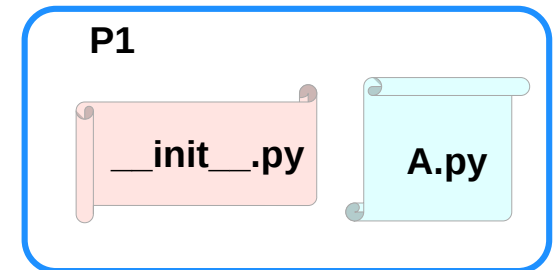
A.B stands for a **submodule** named **B** in a **package** named **A**.

two different **packages** like **P1** and **P2** can both have **modules** with the same name, let's say **A**, for example.

The **submodule A** of the **package P1** and the **submodule A** of the **package P2** can be totally different.

P1.A
P2.A

A **package** is imported like a "normal" **module**.



<https://python-course.eu/python-tutorial/packages.php>

Creating a package

to create a **package**, we need a **directory**.

the **name** of this **directory** will be the **name** of the **package**,

assume we want to create "**simple_package**" package

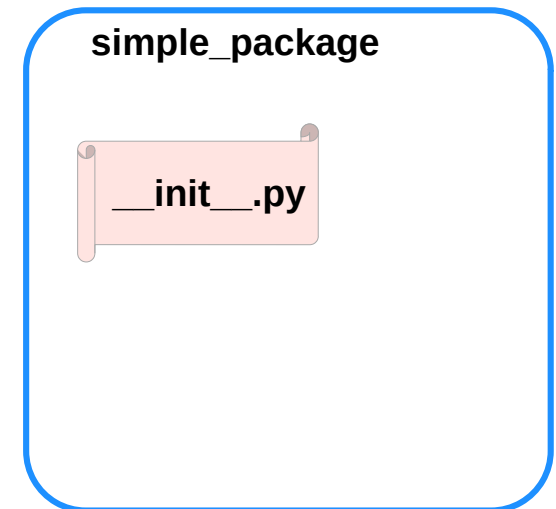
must create directory "**simple_package**" and this directory needs to contain the "**`__init__.py`**" file

this file can be **empty**, or can contain valid **Python code**.

this **code** will be **executed** when a **package** is **imported**,

so it can be used to **initialize** a **package**,

e.g. to make sure that some other modules are **imported** or some values **set**.



<https://python-course.eu/python-tutorial/packages.php>

Examples of creating a package (1)

put all of the **Python files** which will be the **submodules** into the **directory** for a **package**.

create two simple files **a.py** and **b.py**

a.py: → **submodule a**

```
def bar():  
    print("Hello, function 'bar' from module 'a' calling")
```

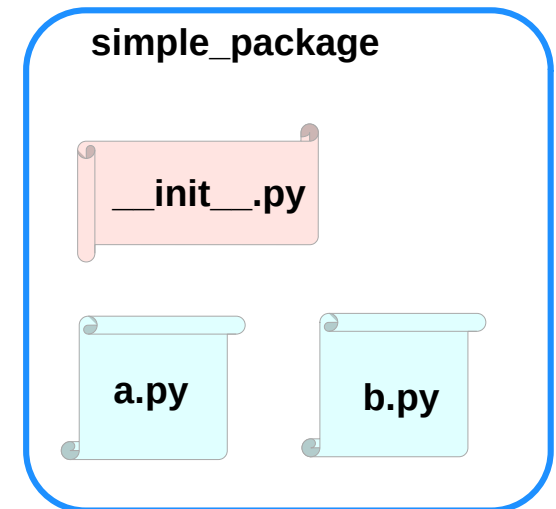
b.py: → **submodule b**

```
def foo():  
    print("Hello, function 'foo' from module 'b' calling")
```

an empty file with the name **__init__.py** inside of `simple_package` directory

__init__.py:

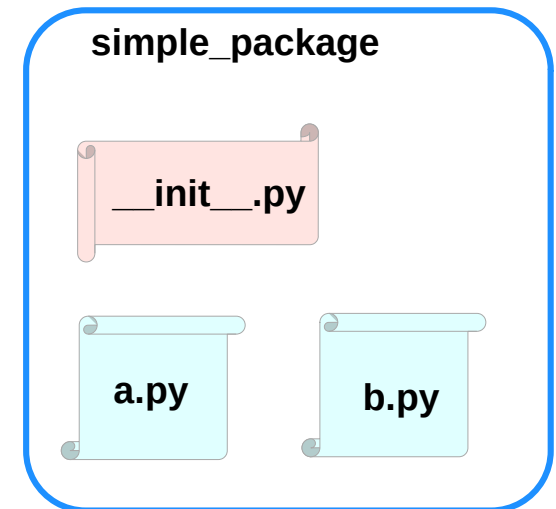
empty file



<https://python-course.eu/python-tutorial/packages.php>

Examples of creating a package (2)

`import simple_package` from the interactive Python shell,
assuming that the directory `simple_package` is
either in the directory from which you call the shell or
that it is contained in the search path or
environment variable "`PYTHONPATH`" (from your operating system):



<https://python-course.eu/python-tutorial/packages.php>

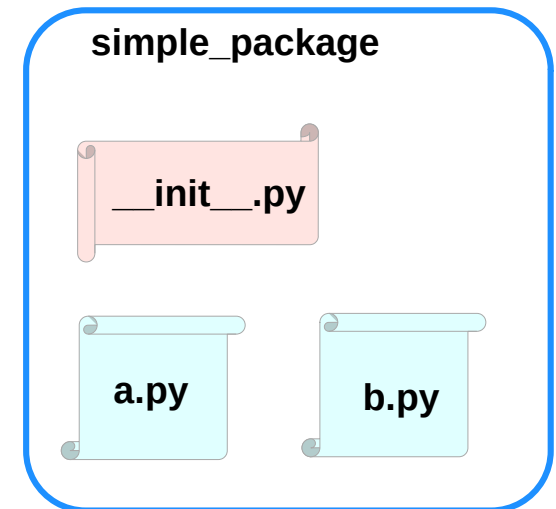
Examples of creating a package (3)

```
import simple_package
simple_package/a
```

```
-----
NameError                                Traceback (most recent call last)
<ipython-input-3-347df8a711cc> in <module>
----> 1 simple_package/a
NameError: name 'a' is not defined
```

```
simple_package/b
```

```
-----
NameError                                Traceback (most recent call last)
<ipython-input-4-e71d2904d2bd> in <module>
----> 1 simple_package/b
NameError: name 'b' is not defined
```



<https://python-course.eu/python-tutorial/packages.php>

Examples of creating a package (4)

the **package** `simple_package` has been loaded
but neither the **module** `"a"` nor the **module** `"b"` has been loaded

can't access neither `"a"` nor `"b"`
by solely importing `simple_package`.

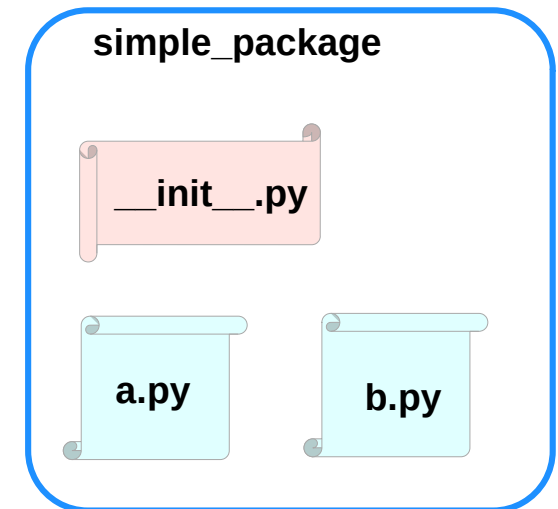
must import the **modules** `a` and `b` as follows

```
from simple_package import a, b
```

```
a.bar()
```

```
b.foo()
```

Hello, function 'bar' from module 'a' calling
Hello, function 'foo' from module 'b' calling



<https://python-course.eu/python-tutorial/packages.php>

Examples of creating a package (5)

to automatically load these **modules**.

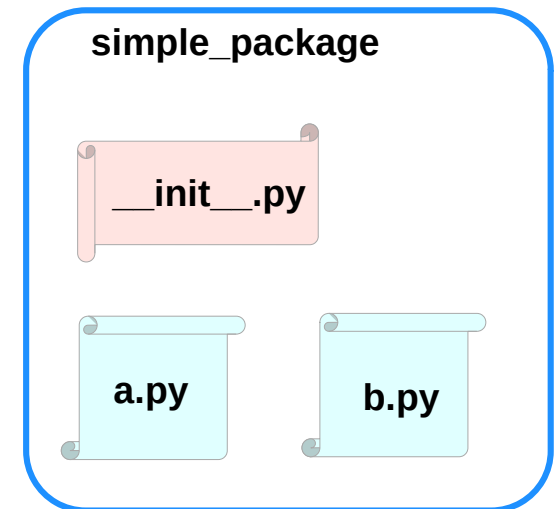
add the following lines to the file `__init__.py`:

```
import simple_package.a
import simple_package.b
```

Then

```
import simple_package
simple_package.a.bar()
simple_package.b.foo()
```

Hello, function 'bar' from module 'a' calling
Hello, function 'foo' from module 'b' calling



<https://python-course.eu/python-tutorial/packages.php>

Package Examples (1)

```
sound
|-- effects
|   |-- __init__.py
|   |-- echo.py
|   |-- reverse.py
|   \-- surround.py
|-- filters
|   |-- __init__.py
|   |-- equalizer.py
|   |-- karaoke.py
|   \-- vocoder.py
|-- formats
|   |-- __init__.py
|   |-- aiffread.py
|   |-- aiffwrite.py
|   |-- auread.py
|   |-- auwrite.py
|   |-- wavread.py
|   \-- wavwrite.py
\-- __init__.py
```

sound

__init__.py

effects

__init__.py

echo.py
reverse.py
surround.py

filters

__init__.py

equalizer.py
karaoke.py
vocoder.py

formats

__init__.py

aiffread.py aurwrite.py
aiffwrite.py wavred.py
auread.py wavwrite.py

<https://python-course.eu/python-tutorial/packages.php>

Package Examples **sound1**

sound1

`__init__.py`

effects

`__init__.py`

`echo.py`
`reverse.py`
`surround.py`

formats

`__init__.py`

`aiffread.py` `aurwrite.py`
`aifwrite.py` `wavred.py`
`auread.py` `wavwrite.py`

filters

`__init__.py`

`equalizer.py`
`karaoke.py`
`vocoder.py`

```
import sound1
print(sound1)           ... OK
print(sound1.effects)  ... Error
```

<https://python-course.eu/python-tutorial/packages.php>

Package Examples sound2

sound2

`__init__.py` `import sound2.effects`

effects

`__init__.py`
`echo.py`
`reverse.py`
`surround.py`

filters

`__init__.py`
`equalizer.py`
`karaoke.py`
`vocoder.py`

formats

`__init__.py`
`aifread.py` `aurwrite.py`
`aifwrite.py` `wavred.py`
`auread.py` `wavwrite.py`

```
import sound1
print(sound1)           ... OK
print(sound1.effects)  ... Error
```

<https://python-course.eu/python-tutorial/packages.php>

Package sound1 (1)

```
__init__.py
print("sound1 package is getting imported!")
```

```
effects/__init__.py
print("effects package is getting imported!")
```

```
effects/echo.py
def func1():
    print("Function func1 has been called!")
    print("Module echo.py has been loaded!")
```

```
effects/reverse.py
def func1():
    print("Function func1 has been called!")
    print("Module reverse.py has been loaded!")
```

```
effects/surround.py
def func1():
    print("Function func1 has been called!")
```

```
sound
|-- effects
|-- filters
|-- formats
|-- __init__.py
```

```
filters/__init__.py
print("filters package is getting imported!")
```

```
filters/equalizer.py
def func1():
    print("Function func1 has been called!")
    print("Module equalizer.py has been loaded!")
```

```
filters/karaoke.py
def func1():
    print("Function func1 has been called!")
    print("Module karaoke.py has been loaded!")
```

```
filters/vocoder.py
def func1():
    print("Function func1 has been called!")
    print("Module vocoder.py has been loaded!")
```

If we import the package `sound1` by using the statement `import sound1`, Only the package `sound1` is imported but none of the subpackages will be imported `effects`, `filters` and `formats`

because the file `__init__.py` doesn't contain any code for importing subpackages:

```
import sound1
print(sound1)           ... OK
print(sound1.effects)  ... Error
```

```
formats/__init__.py
print("formats package is getting imported!")
```

```
formats/aiffread.py
def func1():
    print("Function func1 has been called!")
    print("Module aiffread.py has been loaded!")
```

```
formats/aiffwrite.py
def func1():
    print("Function func1 has been called!")
    print("Module aiffwrite.py has been loaded!")
```

```
formats/auread.py
def func1():
    print("Function func1 has been called!")
    print("Module auread.py has been loaded!")
```

```
formats/auwrite.py
def func1():
    print("Function func1 has been called!")
    print("Module auwrite.py has been loaded!")
```

```
formats/wavread.py
def func1():
    print("Function func1 has been called!")
    print("Module wavread.py has been loaded!")
```

```
formats/wavwrite.py
def func1():
    print("Function func1 has been called!")
    print("Module wavwrite.py has been loaded!")
```

<https://python-course.eu/python-tutorial/packages.php>

Package sound1 (2)

```
import sound1
print(sound1)
print(sound1.effects)
```

OUTPUT:

```
<module 'sound1' from '/data/Dropbox (Bodenseo)/
Bodenseo Team Folder/melisa/notebooks_en/
sound1/__init__.py'>
```

```
AttributeError                                Traceback (most recent call last)
<ipython-input-2-0b6d7fed3b24> in <module>
      3 print(sound1)
      4
----> 5 print(sound1.effects)
AttributeError: module 'sound1' has no attribute 'effects'
```

print(sound1)

print(sound1.effects)

If you also want to use the package **effects**, you have to import it explicitly with `import sound.effects`:

```
import sound1.effects
print(sound1.effects)
```

```
<module 'sound1.effects' from '/data/Dropbox (Bodenseo)/
Bodenseo Team Folder/melisa/notebooks_en/
sound1/effects/__init__.py'>
```

It is possible to have the submodule importing done automatically when importing the sound1 module.

We will change now to **sound2** to demonstrate how to do this.

We use the same files as in **sound1**, but we will add the code line `import sound2.effects` into the file `__init__.py` of the directory **sound2**.

```
"""An empty sound package
This is the sound package, providing hardly anything!"""
import sound2.effects
print("sound2.effects package is getting imported!")
)
```

<https://python-course.eu/python-tutorial/packages.php>

Package sound2

```
__init__.py  
print("sound2 package is getting imported!")  
import sound2.effects
```

```
effects/__init__.py  
print("effects package is getting imported!")
```

```
effects/echo.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module echo.py has been loaded!")
```

```
effects/reverse.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module reverse.py has been loaded!")
```

```
effects/surround.py  
def func1():  
    print("Function func1 has been called!")
```

```
sound  
|-- effects  
|-- filters  
|-- formats  
|-- __init__.py
```

```
filters/__init__.py  
print("filters package is getting imported!")
```

```
filters/equalizer.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module equalizer.py has been loaded!")
```

```
filters/karaoke.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module karaoke.py has been loaded!")
```

```
filters/vocoder.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module vocoder.py has been loaded!")
```

```
import sound2.effects  
in __init__.py of the package sound2
```

when the package **sound2** is imported,
the subpackage **effects** will also
be automatically loaded:

```
import sound2  
sound2 package is getting imported!  
effects package is getting imported!
```

```
formats/__init__.py  
print("formats package is getting imported!")
```

```
formats/aiffread.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module aiffread.py has been loaded!")
```

```
formats/aiffwrite.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module aiffwrite.py has been loaded!")
```

```
formats/auread.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module auread.py has been loaded!")
```

```
formats/auwrite.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module auwrite.py has been loaded!")
```

```
formats/wavread.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module wavread.py has been loaded!")
```

```
formats/wavwrite.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module wavwrite.py has been loaded!")
```

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Package sound3

```
__init__.py  
print("sound3 package is getting imported!")  
from . import effects
```

```
effects/__init__.py  
print("effects package is getting imported!")
```

```
effects/echo.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module echo.py has been loaded!")
```

```
effects/reverse.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module reverse.py has been loaded!")
```

```
effects/surround.py  
def func1():  
    print("Function func1 has been called!")
```

```
sound  
|-- effects  
|-- filters  
|-- formats  
|-- __init__.py
```

```
filters/__init__.py  
print("filters package is getting imported!")
```

```
filters/equalizer.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module equalizer.py has been loaded!")
```

```
filters/karaoke.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module karaoke.py has been loaded!")
```

```
filters/vocoder.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module vocoder.py has been loaded!")
```

Instead of using an **absolute path** we could have imported the **effects** package **relative** to the **sound2** package.

```
import sound2.effects # absolute path
```

```
from . import effects # relative path
```

```
import sound3  
sound3 package is getting imported!  
effects package is getting imported!
```

```
formats/__init__.py  
print("formats package is getting imported!")
```

```
formats/aiffread.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module aiffread.py has been loaded!")
```

```
formats/aiffwrite.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module aiffwrite.py has been loaded!")
```

```
formats/auread.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module auread.py has been loaded!")
```

```
formats/auwrite.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module auwrite.py has been loaded!")
```

```
formats/wavread.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module wavread.py has been loaded!")
```

```
formats/wavwrite.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module wavwrite.py has been loaded!")
```

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Package sound4

```
__init__.py  
print("sound4 package is getting imported!")  
from . import effects
```

```
effects/__init__.py  
print("effects package is getting imported!")  
from .. import formats
```

```
effects/__init__.py  
print("effects package is getting imported!")
```

```
effects/echo.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module echo.py has been loaded!")
```

```
effects/reverse.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module reverse.py has been loaded!")
```

```
effects/surround.py  
def func1():  
    print("Function func1 has been called!")
```

```
sound  
|-- effects  
|-- filters  
|-- formats  
|-- __init__.py
```

```
filters/__init__.py  
print("filters package is getting imported!")
```

```
filters/equalizer.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module equalizer.py has been loaded!")
```

```
filters/karaoke.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module karaoke.py has been loaded!")
```

```
filters/vocoder.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module vocoder.py has been loaded!")
```

```
import sound4  
sound4 package is getting imported!  
effects package is getting imported!  
formats package is getting imported!
```

in the `__init__.py` file of `sound4` directory

```
from . import effects
```

in the `__init__.py` file of `effects` directory

```
from .. import formats
```

```
formats/__init__.py  
print("formats package is getting imported!")
```

```
formats/aiffread.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module aiffread.py has been loaded!")
```

```
formats/aiffwrite.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module aiffwrite.py has been loaded!")
```

```
formats/auread.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module auread.py has been loaded!")
```

```
formats/auwrite.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module auwrite.py has been loaded!")
```

```
formats/wavread.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module wavread.py has been loaded!")
```

```
formats/wavwrite.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module wavwrite.py has been loaded!")
```

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Package sound5

```
__init__.py  
print("sound5 package is getting imported!")  
from . import effects
```

```
effects/__init__.py  
print("effects package is getting imported!")  
from .. import formats
```

```
effects/__init__.py  
print("effects package is getting imported!")
```

```
effects/echo.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module echo.py has been loaded!")
```

```
effects/reverse.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module reverse.py has been loaded!")
```

```
effects/surround.py  
def func1():  
    print("Function func1 has been called!")
```

```
sound  
|-- effects  
|-- filters  
|-- formats  
|-- __init__.py
```

```
filters/__init__.py  
print("filters package is getting imported!")
```

```
filters/equalizer.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module equalizer.py has been loaded!")
```

```
filters/karaoke.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module karaoke.py has been loaded!")
```

```
filters/vocoder.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module vocoder.py has been loaded!")
```

```
import karaoke module  
from filters package  
when we import the effects package.
```

```
from ..filters import karaoke  
into the __init__.py file of formats directory
```

```
can access the functions of karaoke :
```

```
sound5.filters.karaoke.func1()
```

```
Function func1 has been called!
```

```
formats/__init__.py  
print("formats package is getting imported!")  
from ..filters import karaoke
```

```
formats/aiffread.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module aiffread.py has been loaded!")
```

```
formats/aiffwrite.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module aiffwrite.py has been loaded!")
```

```
formats/auread.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module auread.py has been loaded!")
```

```
formats/auwrite.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module auwrite.py has been loaded!")
```

```
formats/wavread.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module wavread.py has been loaded!")
```

```
formats/wavwrite.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module wavwrite.py has been loaded!")
```

<https://python-course.eu/python-tutorial/packages.php>

Package sound6

```
__init__.py  
print("sound5 package is getting imported!")  
from . import effects
```

```
effects/__init__.py  
print("effects package is getting imported!")  
from .. import formats
```

```
effects/__init__.py  
print("effects package is getting imported!")
```

```
effects/echo.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module echo.py has been loaded!")
```

```
effects/reverse.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module reverse.py has been loaded!")
```

```
effects/surround.py  
def func1():  
    print("Function func1 has been called!")
```

```
sound  
|-- effects  
|-- filters  
|-- formats  
|-- __init__.py
```

```
filters/__init__.py  
print("filters package is getting imported!")
```

```
filters/equalizer.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module equalizer.py has been loaded!")
```

```
filters/karaoke.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module karaoke.py has been loaded!")
```

```
filters/vocoder.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module vocoder.py has been loaded!")
```

```
import karaoke module  
from filters package  
when we import the effects package.
```

```
from ..filters import karaoke  
into the __init__.py file of formats directory
```

```
can access the functions of karaoke :
```

```
sound5.filters.karaoke.func1()
```

```
Function func1 has been called!
```

```
formats/__init__.py  
print("formats package is getting imported!")  
from ..filters import karaoke
```

```
formats/aiffread.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module aiffread.py has been loaded!")
```

```
formats/aiffwrite.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module aiffwrite.py has been loaded!")
```

```
formats/auread.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module auread.py has been loaded!")
```

```
formats/auwrite.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module auwrite.py has been loaded!")
```

```
formats/wavread.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module wavread.py has been loaded!")
```

```
formats/wavwrite.py  
def func1():  
    print("Function func1 has been called!")  
    print("Module wavwrite.py has been loaded!")
```

<https://python-course.eu/python-tutorial/packages.php>

Package sound6 (1)

add a module (file) **foobar** (filename: **foobar.py**)
to the **sound** directory.

might expect to import this way
all the submodules and subpackages of the package.

```
from sound6 import *
```

sound package is getting imported!

Yet, if we check with the **dir** function, we see that
neither the module **foobar** nor the subpackages
effects, **filters** and **formats** have been imported:

```
for mod in ['foobar', 'effects', 'filters', 'formats']:  
    print(mod, mod in dir())
```

```
foobar False  
effects False  
filters False  
formats False
```

<https://python-course.eu/python-tutorial/packages.php>

Package sound7 (1)

to give an explicit index of the **subpackages** and **modules** of a packages, which should be imported.

can define a list named `__all__` as the list of **module** and **package names** to be imported when **from package import *** is encountered.

```
__all__ = ["formats", "filters", "effects", "foobar"]
```

to the `__init__.py` file of the **sound** directory.

```
from sound7 import *
```

```
sound package is getting imported!  
formats package is getting imported!  
filters package is getting imported!  
effects package is getting imported!  
foobar module is getting imported
```

Even though it is already apparent that all the modules have been imported, we can check with **dir** again:

```
for mod in ['foobar', 'effects', 'filters', 'formats']:  
    print(mod, mod in dir())
```

```
foobar True  
effects True  
filters True  
formats True
```

if we use `*` in a subpackage:

```
from sound.effects import *  
sound package is getting imported!  
effects package is getting imported!
```

```
dir()  
['__builtins__', '__doc__', '__loader__', '__name__',  
 '__package__', '__spec__']
```

Like expected the modules inside of effects have not been imported automatically.

<https://python-course.eu/python-tutorial/packages.php>

Package sound8 (1)

So we can add the following `__all__` list into the `__init__` file of the package `effects`:

We have to add to the `__init__.py` files of the directories `filters`, `formats` and `effects` correspondingly the following lines of code:

```
__all__ = ["equalizer", "__init__", "karaoke", "vocoder"]  
__all__ = ["aiffread", "aiffwrite", "auread", "auwrite",  
"wavread", "wavwrite"]  
__all__ = ["echo", "surround", "reverse"]
```

Now we get the intended result:

```
from sound8 import *
```

```
sound package is getting imported!  
formats package is getting imported!  
filters package is getting imported!  
effects package is getting imported!  
foobar module is getting imported
```

```
from sound8.effects import *
```

```
Module echo.py has been loaded!  
Module surround.py has been loaded!  
Module reverse.py has been loaded!
```

```
from sound8.filters import *
```

```
Module equalizer.py has been loaded!  
Module karaoke.py has been loaded!  
Module vocoder.py has been loaded!
```

```
from sound8.formats import *
```

```
Module aiffread.py has been loaded!  
Module aiffwrite.py has been loaded!  
Module auread.py has been loaded!  
Module auwrite.py has been loaded!  
Module wavread.py has been loaded!  
Module wavwrite.py has been loaded!
```

Although certain modules are designed to export only names that follow certain patterns when you use `import`, it is still considered bad practice. The recommended way is to import specific modules from a package instead of using

<https://python-course.eu/python-tutorial/packages.php>

Package sound6 (3)



<https://python-course.eu/python-tutorial/packages.php>