Python - Modules

```
Module Code: ELEE1147

Module Name: Programming for Engineers

Credits: 15

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```

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Modules in Python

- Modules are reusable pieces of code in Python
- They help organize and manage code by splitting it into separate files
- Modules can be imported into other Python files

Why Use Modules?

- Code reusability: Write once, use many times
- Maintainability: Easier to manage and update code
- Namespace management: Avoids name conflicts by separating code logically

```python
# math_utils.py
def mean(numbers):
    """Calculate the arithmetic mean."""
    return sum(numbers) / len(numbers)

# stats_utils.py
def mean(numbers):
    """Calculate the geometric mean."""
    product = 1
    for number in numbers:
        product *= number
    return product ** (1 / len(numbers))
```

```python
import math_utils
import stats_utils

numbers = [1, 2, 3, 4, 5]

# Using the arithmetic mean from math_utils
arithmetic_mean = math_utils.mean(numbers)
print("Arithmetic Mean:", arithmetic_mean)

# Using the geometric mean from stats_utils
geometric_mean = stats_utils.mean(numbers)
print("Geometric Mean:", geometric_mean)
```

Types of Modules

1. **Built-in Modules**: Pre-installed with Python (e.g., `math`, `datetime`, `sys`)
2. **User-Defined Modules**: Custom modules created by programmers
3. **Third-Party Modules**: Modules that can be installed from the Python Package Index (PyPI) using `pip`

Importing Modules

- Use the `import` statement to bring in a module

```
import math
print(math.sqrt(16))  # Output: 4.0
```

- You can also import specific functions or variables

```
from math import pi, sqrt
print(pi)             # Output: 3.14159...
print(sqrt(16))       # Output: 4.0
```

Creating a Module

1. Write functions and variables in a `.py` file, e.g., `mymodule.py`
2. Import it in another script using `import mymodule`

Example: `mymodule.py`

```
# mymodule.py
def greet(name):
    return f"Hello, {name}!"
```

Example Usage

```
import mymodule
print(mymodule.greet("Python"))  # Output: Hello, Python!
```

Renaming a Module

- The module name is long or cumbersome to type repeatedly.
- There's a naming conflict with another module or variable.
- You want a shorter or more intuitive name for readability.
- Use `as` to give a module a different name in your code

```
import math as m
print(m.sqrt(25))  # Output: 5.0
```

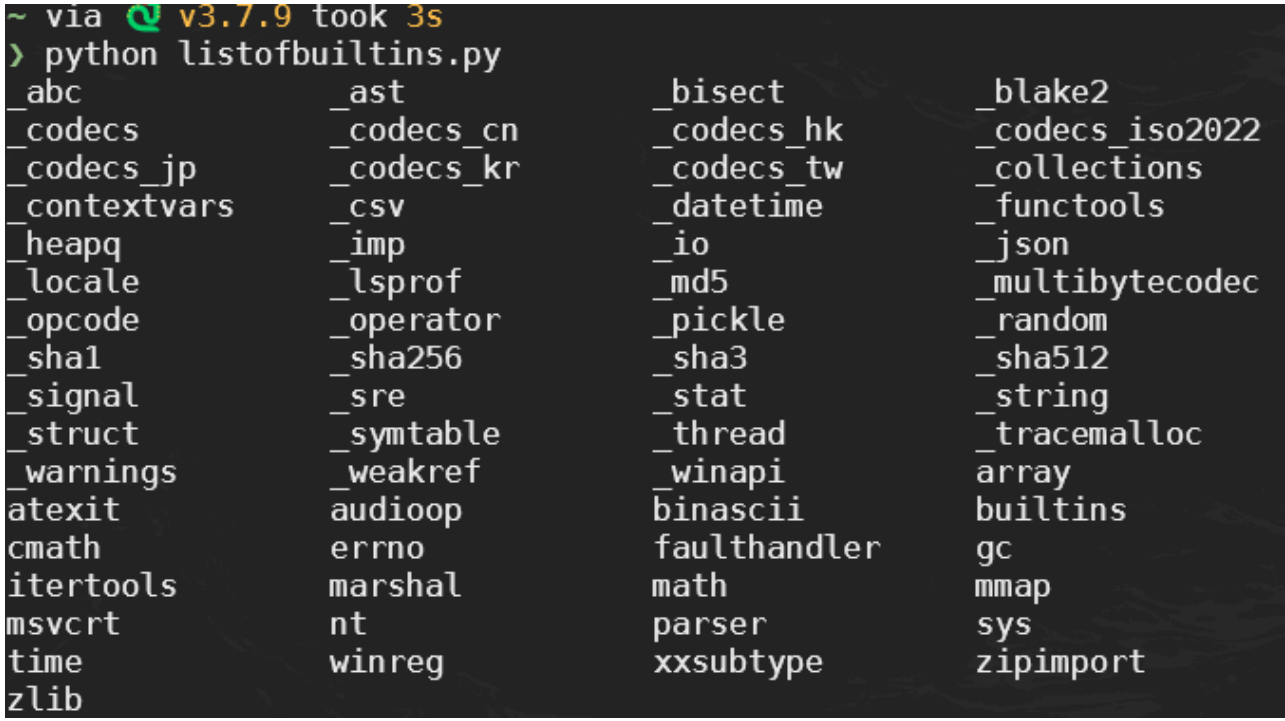
```
import matplotlib.pyplot as plt

# Now you can use 'plt' instead of 'matplotlib.pyplot'
plt.plot([1, 2, 3], [4, 5, 6])
plt.show()
```

Commonly Used Built-in Modules

To get a list of all 65 Built-in modules:

```
>>> import sys
>>> print(*sys.builtin_module_names, sep="/n")
```



Installing Third-Party Modules

- `pip` - Pip Installs Packages
  - looks locally first
  - then looks at https://pypi.org/{package}
- ~584k packages!

```
curl https://pypi.org/simple/ | sed -E 's/<[^>]+>//g' > packages.txt && wc -l packages.txt
```

- Use `pip`, the package installer for Python

```
pip --help
pip install <package>
pip install <package>==<version>
```

Checking Installed Modules

- Use the following command to see installed packages

```
pip list
```

- Or check specific package information

```
$ pip show requests

Name: requests
Version: 2.31.0
Summary: Python HTTP for Humans.
Home-page: https://requests.readthedocs.io
Author: Kenneth Reitz
Author-email: me@kennethreitz.org
License: Apache 2.0
Location: path/to/file
Requires: idna, charset-normalizer, certifi, urllib3
Required-by:
```

Installing packages from a file

```
pip install -r requirements.txt
```

- `-r`: Install from the given requirements file. This option can be used multiple times.
- `requirements.txt`: could be any name but the file holds your packages to be installed

```
# requirements.txt
requests==2.25.1
numpy>=1.21.0
pandas
flask==2.0.1
```