

Lecture 05

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Modular
Programming
Introduction
Python Modules
Python Packages
Modular
programming in
Lab3-4
The Eclipse IDE

Modular Programming

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Overview

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Modules

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Modular programming - a software design technique that increases the extent to which software is composed of independent, interchangeable components called **modules**, each of which accomplishes one aspect within the program and contains everything necessary to accomplish this.

Modules

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Modules are:

- Independent
- Interchangeable

Modules

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Discussion

Why is modular programming needed? Advantages and drawbacks...

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- Allows grouping related functionalities
- Allows easier delivery and deployment of related functionalities
- Helps with solving naming conflicts

Modules in Python

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A Python module¹ - a file containing Python statements and definitions (executable statements).

- **Name:** The file name is the module name with the suffix ".py" appended
- **Docstring:** triple-quoted module doc string that defines the contents of the module file. Provide summary of the module and a description about the module's contents, purpose and usage.
- **Executable statements:** function definitions, module variables, initialization code

¹<https://docs.python.org/3/tutorial/modules.html>

Importing modules

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In order to use a module it must be imported first. The import statement:

- 1 Searches the global namespace for the module. If the module exists, it is already imported and nothing more needs to be done.
- 2 Searches for the module.
- 3 Variables and functions defined in the module are inserted into a new symbol table (a new namespace). Only the module name is added to the current symbol table

Module search path

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Where does the **'import spam'** statement search for module *spam.py*?

- Built-in modules with the given name
- Directories in the *sys.path* variable:
 - Directory containing the input script
 - Directories specified by environment variable **PYTHONPATH**
 - Directories specified by the environment variable **PYTHONHOME**, an installation-dependent default path

If the module name can't be found anywhere, an **ImportError** exception is raised.

Demo

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Modules

ex10_modules.zip

Demo

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Environment Variables

This website has more info on accessing and changing environment variables in the Windows OS -
www.computerhope.com/issues/ch000549.htm

Learning more about modules

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- **dir(module_name)** can be used to examine the module's symbol tables.
- **help(module_name)** can be used to get help on the module, its data types and functions.
- **pydoc** - A module that allows you to save extracted documentation to HTML format. Best used in command line at the operating system prompt.

Packages

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- Packages² are a way of structuring Python's module namespace by using "dotted module names"
- **A.B** denotes submodule **B** found in package **A**.
- The same rules apply for importing packages as with modules
- On the drive, directory hierarchies represent packages, so **B.py** will be found in a directory called **A**
- Each package directory contains an `__init__.py` file, telling Python to interpret it as a collection of modules
- `__init__.py` can be empty, or include package initialization code.

²<https://docs.python.org/3/tutorial/modules.html#packages>

Required modules for Lab3-4

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Create modules for:

- **User interface** - Functions related to user interaction. Contains input and data validation, print operations. This is the only module where input/print operations are present.
- **Functions** - Contains functions required to implement program features
- **Domain** - Create and manage expenses, transactions, numbers (e.g. the **problem domain**).


The Eclipse IDE

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- Eclipse is an advanced IDE that is free (as in "free beer"³), configurable and easy to use
- Provides lots of plugins to allow development in many languages, including Java, C/C++, Python...
- What you should be familiar with
 - Setting it up for Python development
 - Working with projects, navigating and editing source files and program resources (e.g. text files)
 - Running project configurations, debugging, running tests

³<http://www.gnu.org/philosophy/free-sw.html> 

Eclipse + PyDev

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- By default, Eclipse can be used to develop Java software
- To develop in Python, you need the PyDev⁴ plugin
- PyDev links Eclipse to the installed Python interpreted and libraries, gives you wizards for project creation, syntax highlighting, code completion and Python-specific features

⁴<http://www.pydev.org/>

Installing Eclipse + PyDev

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- 1 Install the Java 8 (or later) JDK⁵
- 2 Install Eclipse IDE for Java Developers⁶
- 3 Start Eclipse for the first time, see it works
- 4 Install PyDev plugin⁷
- 5 Configure Eclipse with the installed version of Python
- 6 Start coding!

⁵<http://www.oracle.com/technetwork/java/javase/downloads/jdk8-downloads-2133151.html>

⁶<http://www.eclipse.org/downloads/eclipse-packages/>

⁷Section "Installing with the update site" -

http://www.pydev.org/manual_101_install.html

Demo

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Code review

The code in the following archive is a modular implementation of the calculator program for rational numbers:

ex11_calculatorModular.zip