Practical Python

Input and Output

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Summary of I/O types

- Interactive Python environments for learning and testing
  - Python command line
  - Idle
  - IPython
  - Jupyter

    You can practise using these outside the tutorial.

- File editor, file saved as **`filename.py`**
  - In Python environment:

    `file import`
  - From command line:

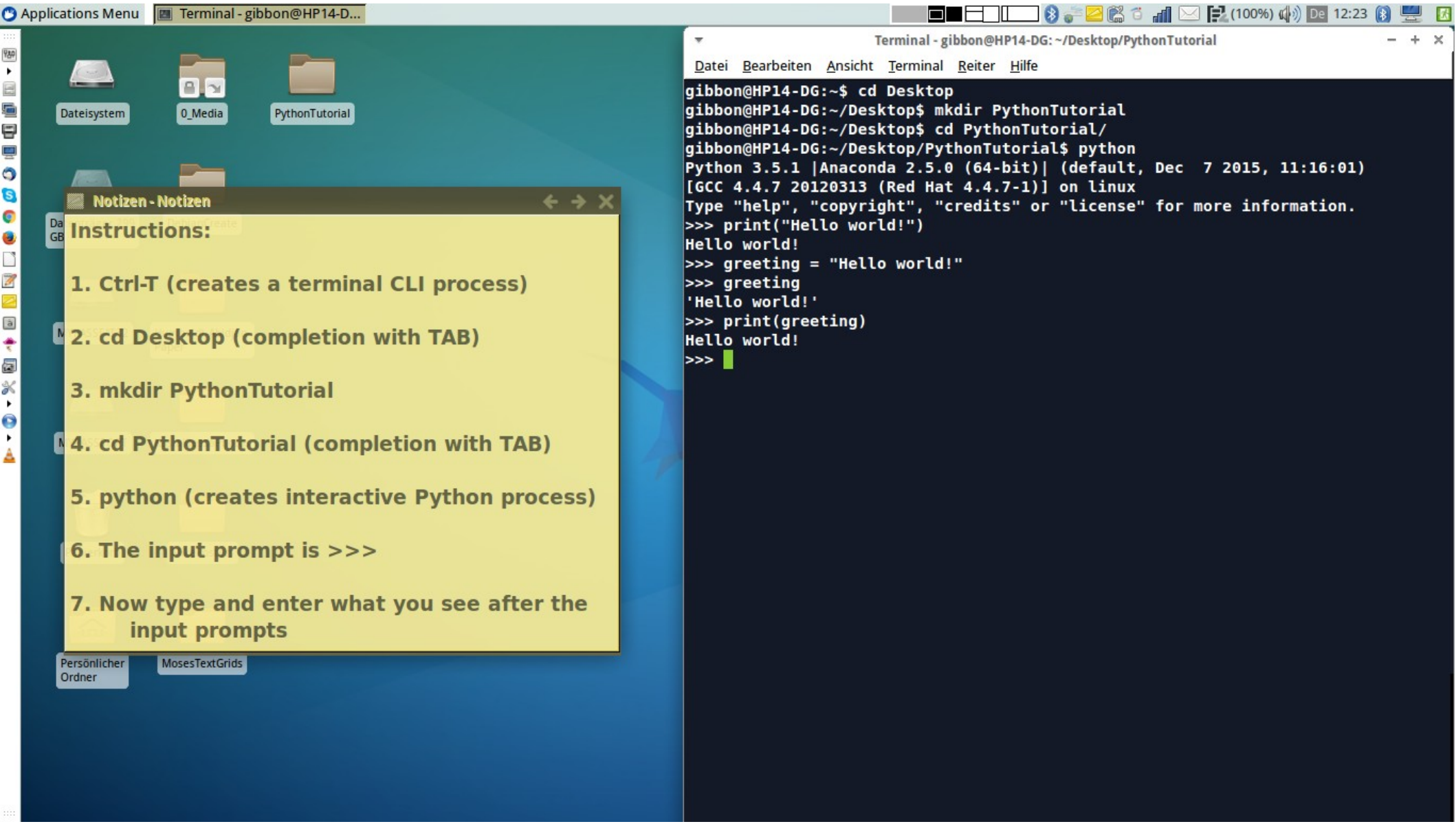
    `python filename.py`
  - Linux: from command line, executable with shebang line:

    `filename.py`

- SDK: PyCharm

Reminder: CLI with interactive Python environment (Linux)

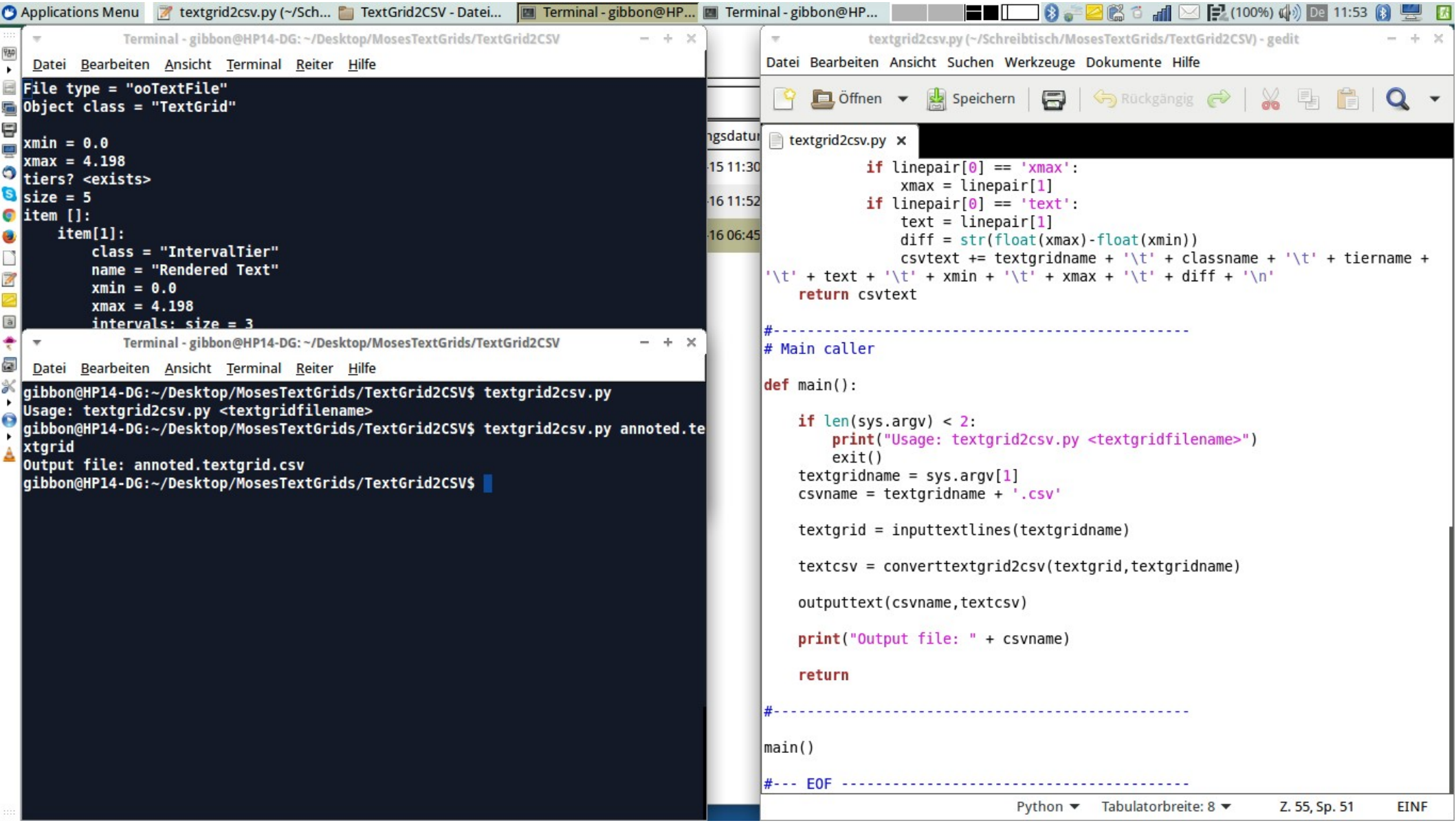
Interactive window



CLI workspace for slightly less retro work

Data window

Editor window

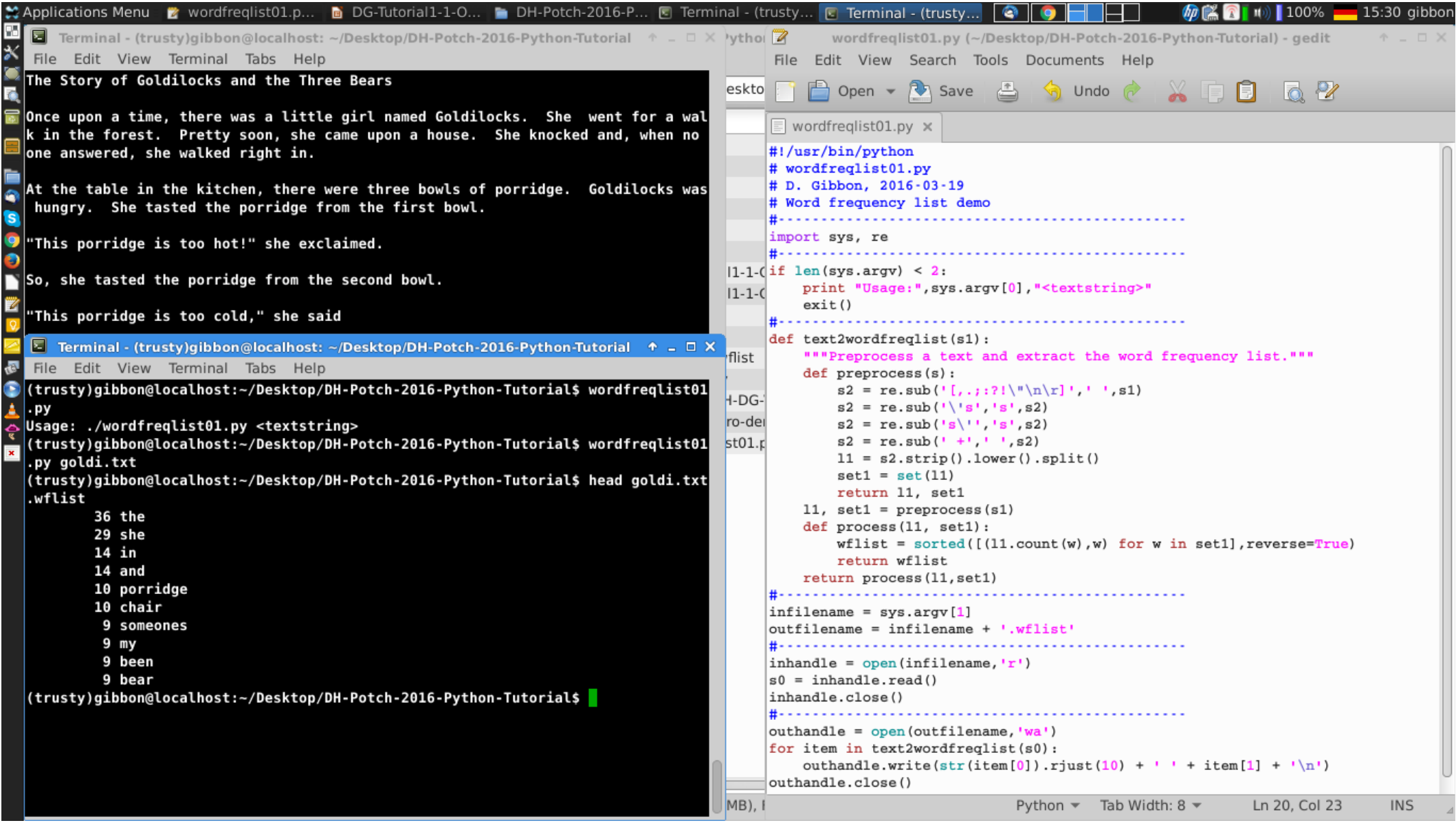


Runtime window

CLI workspace for slightly less retro work

Data window

Editor window



Runtime window

The `import` statements

- There are various import statements

```
import matplotlib
import matplotlib as mpl
import matplotlib.pyplot as plt
from matplotlib import pyplot
from matplotlib import *
import numpy as np
```

- Note:
  - Some libraries have standard abbreviations such as those given above

    ```
    import numpy as np
    ```

  - With a very large standard library such as matplotlib it is usually advisable not to import the whole module.
- With your own module files, e.g. **filename.py**, the filename without the `.py` extension is the module name:

```
import filename
from filename import *          .... etc.
```

Input and output of data

Official Python Tutorial:

https://docs.python.org/2/tutorial/

- Interactive input:
  - raw input: input an arbitrary string of characters:

```
mystring = raw_input('Input anything: ')
mystring.upper()
mystring.lower()
```

  - structured Python data input:

```
mynumber = input(‘Input Python number: ‘)
mylist = input(‘Input Python list:’)
```

- Output:
  - printing with and without newline:

```
print pythondata, pythondata
print pythondata, pythondata,
```

Input and output of data

Official Python Tutorial:

https://docs.python.org/2/tutorial/

- Input from text file as text string:

```
filehandle = open(filename.txt,'r')
mytext = filehandle.read()

mytext = open(filename.txt,'r').read()
```

- Input from text file as list of strings

```
filehandle = open(filename,'r')
mystringlist = filehandle.readlines()

mystringlist = open(filename,'r').readlines()
```

Input and output of data

Official Python Tutorial:

https://docs.python.org/2/tutorial/

- Input from text file as text string:

```
filehandle = open(filename.txt,'r')
mytext = filehandle.read()
```

  - or directly:

```
mytext = open(filename.txt,'r').read()
```

- Creating a list of strings from the input string:

```
textlist =  mytext.split('\n')
splitlist =  [ x.split() for x in
mytextlist ]
```

- Exercise: simple word list

```
swl = ???
```

Input and output of data

Official Python Tutorial:

https://docs.python.org/2/tutorial/

- Input from text file as text string:

```
filehandle = open(filename.txt,'r')
mytext = filehandle.read()
```

  - or directly:

```
mytext = open(filename.txt,'r').read()
```

- Next step: list of strings from the input string:

```
textlist =  mytext.split('\n')
splitlist =  [ x.split() for x in
mytextlist ]
```

- Exercise: simple word list

```
swl = sorted(set( [ x.lower() for y in
splitlist for x in y ] ))
```

Input and output of data

Official Python Tutorial:
https://docs.python.org/2/tutorial/

- Input from file as list of strings (savi

```
filehandle = open(filename,'r')
textlist = filehandle.readlines()

textlist = open(filename,'r').readlines()
```

  - Remove trailing whitespace (e.g. newlines):
    ```
    textlist = [x.rstrip() for x in textlist ]
    ```

  - If the textlist also contains leading whitespace, you can combine methods to remove leading whitespace, too:
    ```
    textlist = [x.rstrip().lstrip() for x in
    textlist]
    ```

Input and output of data

Official Python Tutorial:

https://docs.python.org/2/tutorial/

- Output string to file:
  - first construct your string according to your requ

```
textstring = 'Once upon a time\nThere were
three bears.'
```

  - then

```
filehandle = open(filename,'w')
filehandle.write(textstring)
```

  - or:

```
open(filename,'w').write(textstring)
```

Input and output exercises

Official Python Tutorial:

https://docs.python.org/2/tutorial/

- Write a Python script which will do t
  - input a text (which you will write first)
  - make a word list (including punctuation symbols)
  - save the word list in a file, using the conventions:

    textfilename.txt

    wordlistfilename.wl.txt

- Use the CLI technique rather than the interactive Python environment technique (see next slide)

- Do the same but instead of a wordlist make a concordance and save the concordance.

Making the Python file into a standalone script

Add the ‘shebang line’ (a Unix / Linux feature) as first line, and (at least) minimal documentation (sometimes works with Windows):

```
#!/usr/bin/python
# banana.py
# D. Gibbon 2016.03.19
# Word frequency list demo

a = 'a red one a blue one a yellow one and a banana'

b = a.strip().split()

c = sorted([(b.count(p),p) for p in set(b)],reverse=True)

print c
```

Make the file executable, run the code directly, no python call:

```
chmod 755 banana.py
banana.py
[(4, 'a'), (3, 'one'), (1, 'yellow'), (1, 'red'), (1,
'blue'), (1, 'banana'), (1, 'and')]
```

Advanced I/O: Interactive web input/output:

a very basic server-side Python app

First get access to a web server which supports CGI

- This assumes that you can (learn to) install and configure your own web server:
  - A widely used web server is Apache2
    - To install this on Windows, just download the install file and run the file.
  - Using Ubuntu Linux: you can install Apache2 from the CLI:

    sudo apt-get install apache2
  - Actually I use Lighty (lighttpd):

    sudo apt-get install lighttpd

- Second, test the webserver with a browser:

  http://localhost

- You will need to inspect and maybe edit the configuration file to ensure that `.py` files will be recognised as scripts and not simply as text.
  - Can be tricky, but we can discuss this...

Next step: design an ultra-simply dialogue

Computer: ‘Please input your name:’

User: ‘Joe Bloggs’

Computer: ‘Hi there, Joe Bloggs!’

Next step: create an HTML form with filename `dialogue.html`

```
<html>
  <head><title>Dialogue</title></head>
  <body>
    <h1>Dialogue test application</h1>
    <form method="post" action="/cgi-bin/dialogue.py">
      Please enter your name:
      <input name="name" size="20" maxlength="20"
value="" type="text">
      <input value="Reset" type="reset">
      <input value="Submit" type="submit">
    </form>
  </body>
</html>
```

Next step: create a Python script with filename `dialogue.py`

```
#!/usr/bin/python
# D. Gibbon, 2016-04-03
# dialogue.py CGI script
# Description: Test dialogue demo.

import cgi, cgitb
cgitb.enable()

fs = cgi.FieldStorage()
username = fs["name"].value

print "Content-type: text/html\n"
print "<html> <head> <title>Dialogue</title> </head>
<body>"
print "Hi there, " + username + "!"
print "</body></html>"
```

Install the HTML file and the Python script

- Put the HTML file and the Python script into the directories required by your web server. These are the directories used by the lighttpd server under Linux:
  - for HTML: **`/var/www/`**
  - for Python: **`/usr/lib/cgi-bin/`**

- Make the Python script executable; under Linux:

  `chmod 755 dialogue.py`

- Navigate your browser to

  `http://localhost/dialogue.html`

- Enter a name and submit the form. If the server is correctly configured, you should see the dialogue. If not, google for the correct configuration for your web server...

A text analysis application – `textanalysis.html`

```
<html>
  <head><title>Text analysis</title></head>
  <body>

    <h1>Text analysis application</h1>

    <form method="post" action="/cgi-bin/dialogue.py">

      Copy and paste a text here:
      <textarea name="text" cols="60" rows="20">

      <input value="Reset" type="reset">
      <input value="Submit" type="submit">

    </form>
  </body>
</html>
```

A text analysis application – `textanalysis.html`

```
<html>
  <head><title>Text analysis</title></head><body>

    <h1>Text analysis application</h1>

    <form method="post" action="/cgi-bin/textanalysis.py">

      <b>Copy and paste a text here:</b>
      <br>
      <textarea name="text" cols="60" rows="20">
      </textarea>
      <br>
      <input value="Reset" type="reset">
      <input value="Submit" type="submit">

    </form>

  </body>
</html>
```

A text analysis application – p.1 of `textanalysis.html`

- Shebang line and minimal metadata documentation:

```
#!/usr/bin/python
# textanalysis.py
# D. Gibbon, 2016-04-11
# Demo CGI script for text analysis
```

- Import Common Gateway Interface modules:

```
import cgi, cgitb
cgitb.enable()
```

- Decode form input:

```
fs = cgi.FieldStorage()
text = fs["text"].value
```

A text analysis application – p.2 of `textanalysis.html`

- Basic text normalisation to lower case:

```
text = text.lower()
```

- Removal of line breaks

```
text = text.replace('\n',' ')
```

- Normalisation of punctuation:

```
punct = '.,:;!?"\'=-_()[]{}$%&/\\+#<>|@^~'
clist = [' '+c+' ' if c in punct else c for c in text]
text = ''.join(clist)
```

A text analysis application – p.3 of `textanalysis.html`

- Tokenisation and vocabulary extraction:

```
tokenlist = text.split()
typeset = sorted(set(tokenlist))
```

- Check for existence of tokens before counting:

```
if len(tokenlist) == 0:
    tokens = types = ttr = 0
else:
    tokens = len(tokenlist)
    types = len(typeset)
    ttr = 1.0 * types/tokens
```

A text analysis application – p.2 of `textanalysis.html`

- Creation of output table:

```
table = [["Types",types]]
table += [["Tokens",tokens]]
table += [["TTR",ttr]]
table += [["Vocabulary:",' '.join(typeset)]]
table += [["Normalised text:",' '.join(tokenlist)]]
```

- Transformation and printing of output table as HTML:

```
def printtable(rows):
    print "<table>"
    for row in rows:
        print "<tr>"
        for cell in row:
            print "<td valign=top>",cell,"</td>"
        print "</tr>"
    print "</table>"
    return True
```

A text analysis application – p.2 of `textanalysis.html`

- HTML output:

```
print "Content-type: text/html\n"

print "<html>”
print “<head>”
print “<title>Text Analysis</title>”
print </head>”

print "<body>"

printtable(table)

print "</body>”
print “</html>"
```

End of Unit 5