An Introduction to Programming with Python

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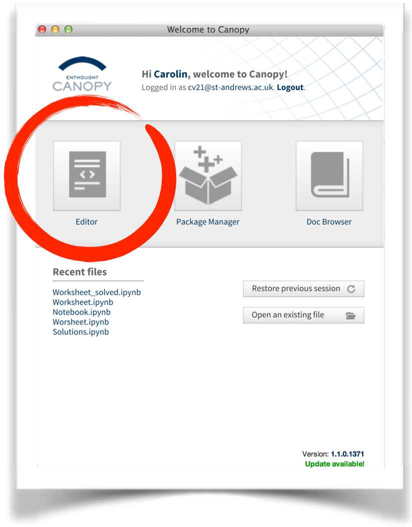
Getting started: opening Python!

- locate the Canopy software on the desktop, it should look something like this:

- double click and wait until you see a window looking like this:

- click on the ‘Editor’ button, which is located here



Welcome to Canopy

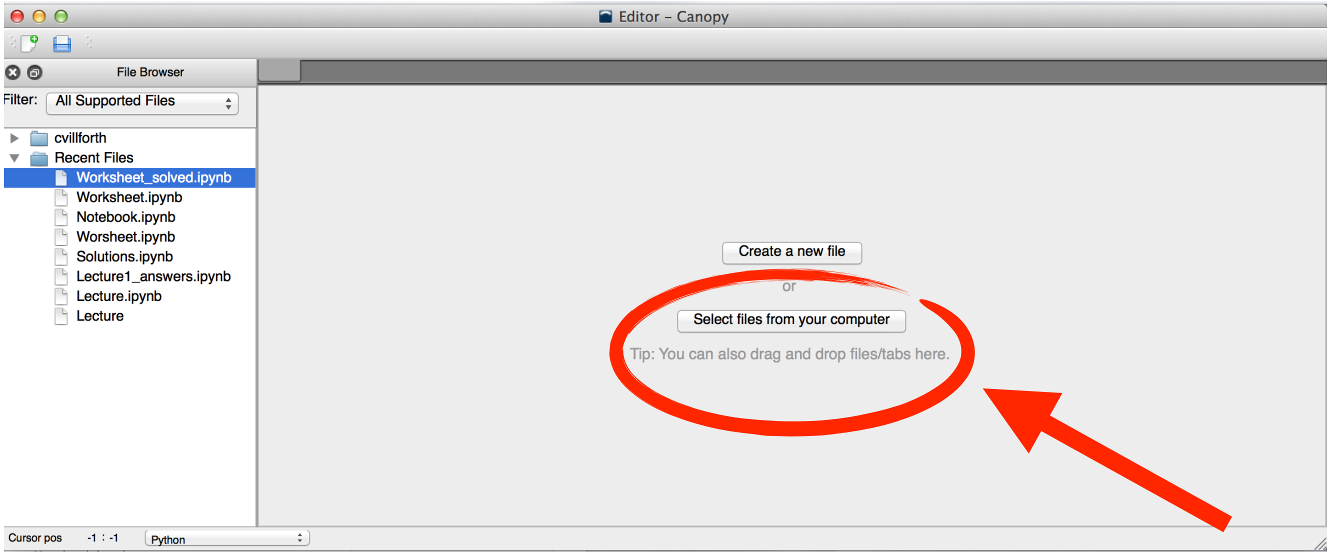
Hi Carolin, welcome to Canopy!
Logged in as cv21@st-andrews.ac.uk. Logout.

Recent files

Worksheet_solved.ipynb
Worksheet.ipynb
Notebook.ipynb
Worsheet.ipynb
Solutions.ipynb

Version: 1.1.0.1371
Update available!

- you’ll now see a window that looks like this



Editor – Canopy

Filter: All Supported Files

- cvillforth
- Recent Files
  - Worksheet_solved.ipynb
  - Worksheet.ipynb
  - Notebook.ipynb
  - Worsheet.ipynb
  - Solutions.ipynb
  - Lecture1_answers.ipynb
  - Lecture.ipynb
  - Lecture

Tip: You can also drag and drop files/tabs here.

Cursor pos -1 : -1 Python

- click here to open the file Worksheet.ipynb

Using the worksheet

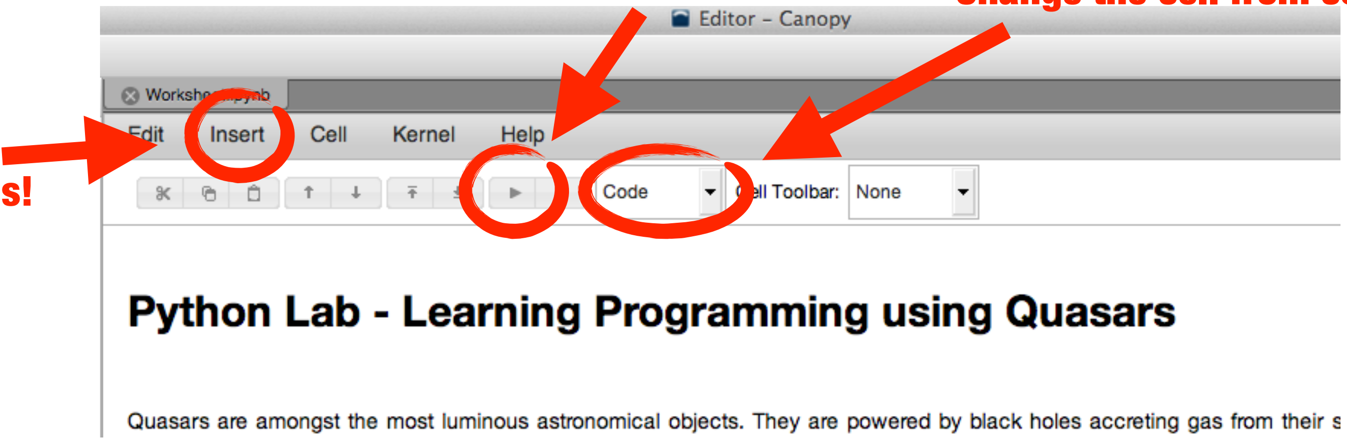
The worksheet is an ipython notebook. Here some tips for using it:

- type the code in the cells
- to run the code, press the play button in the toolbar (see below)
- to add more cells, choose 'insert cell below/above' (see below)
- if you want to add comments, change the type of the cell in the toolbar (see below)
- remember to save your notebook often!

Run the code!

Change the cell from code to comment!

Insert new cells!



Python Lab - Learning Programming using Quasars

Quasars are amongst the most luminous astronomical objects. They are powered by black holes accreting gas from their s

Cheat Sheet: Column Numbers

(0) MI_Z2: Absolute magnitude

(1) BAL_FLAG: flag indicating if signs of ultra-fast outflow from the black hole are detected. 0 means no outflows. >=1 means outflows are detected

(2) FIRST_FR_TYPE: morphology of large scale jets: -1: no radio data, 0: too faint, 1: dominated by emission from close to the black hole, 2: large radio jets

(3) R_6CM_2500A: strength of radio (jet emission) compared to optical emission

(4) LOGL3000: log luminosity at 3000 Angstroem in log(erg/s)

(5) LOGL5100: log luminosity at 5100 Angstroem in log(erg/s)

(6) FWHM_MGII: velocity dispersion of gas near the black hole in km/s, measured using MgII line

(7) redshift: redshift

(8) mag_g: apparent magnitude in the optical

Cheat Sheet - Block 1

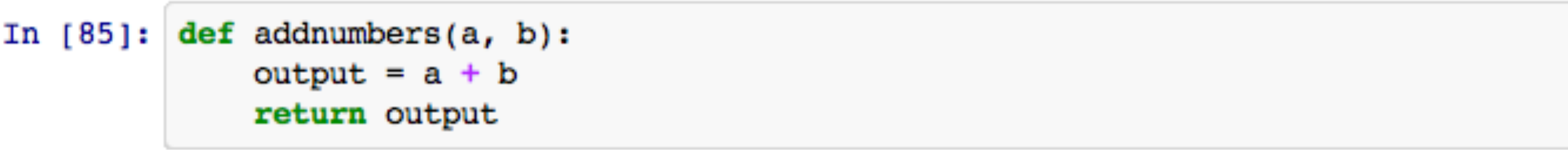
- to load data
    - **numpy.loadtxt('My Data File')**
- to access an array line
    - **array[line number]**
- to access an array column
    - **array[:, column number]**
- to access the nth entry in column m
    - **array[n,m]**
- Remember: python starts counting at 0, not 1!
- to get the minimum value in an array:
    - **numpy.min(array)**
- to get the maximum value in an array:
    - **numpy.max(array)**
- to calculate the mean of an array:
    - **numpy.mean(array)**

Cheat Sheet - Block 2

- to plot data
  - **pylab.plot(x, y, ls=*line style*, c=*colour*, marker=*marker style, label=label for data*)**
  - **line styles:** ***None: no line, ’-’ : solid line, ‘—’ dashed line, ‘:’ dotted line….***
  - **colours:** ***‘r’: red, ‘b’: blue, ‘k’: black, ‘g’: green….***
  - **marker styles:** ***‘o’: dot, ‘.’: smaller dot, ‘*’: star, ‘p’: pentagon, ‘^’: triangle….***
- to add a legend
  - **pylab.legend()**
- to label the x-axis and y-axis or add a title
  - **pylab.xlabel(“This is the x-axis label”)**
  - **pylab.ylabel(“This is the y-axis label”)**
  - **pylab.title(“This is the figure title”)**
- to plot a histogram:
  - **pylab.hist(data) or**
  - **pylab.hist(data, bins) where bins can be an array with the bin edges or the number of bins**
- to create arrays:
  - **numpy.arange(start, end, stepsize)**
  - **numpy.linspace(start, end, number of steps)**

Cheat Sheet - Block 3

- calculations with arrays
  - **array + 5: adds 5 to each entry of the array**
  - **array1 + array2: adds the ith entry of array 1 to the ith entry of array 2 (must have the same size)**
  - **other types of calculations: *: times, **: to the power of, /: division, -: subtraction**
  - **useful commands: numpy.log10(), numpy.sqrt(81), numpy.mean(), numpy.min(), numpy.max()**
- function definition basics:
  - **remember to add indents**
  - **remember to “return” your result in the last line of the function**

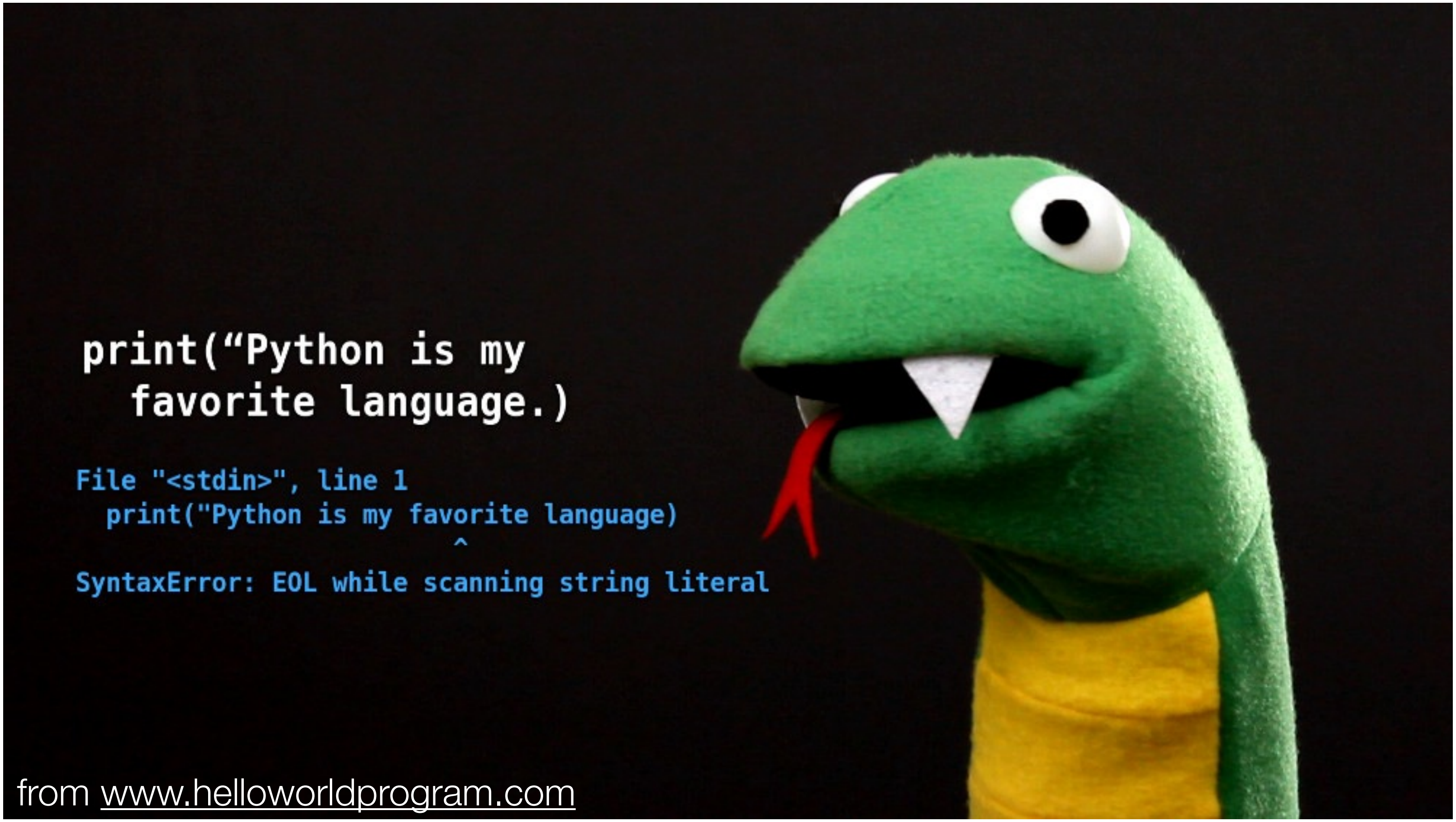


```
In [85]: def addnumbers(a, b):
             output = a + b
             return output
```

Cheat Sheet - Block 4

- fitting a line to data:
  - **numpy.polyfit(x, y, order)**
  - **order=1: line, order=2: quadratic function……**
  - **result is an array where the first entry is the slope and the second entry is the intercept**
- masking arrays:
  - **array[mask] masks an array**
  - **to create a mask, use expressions such as "array > 14", "array == 5", "array <= 25"…..**
  - **example: array[array > 5] creates an array that contains all entries from the array that are greater than 5**
- to calculate the correlation coefficient:
  - **import scipy.stats**
  - **scipy.stats.pearsonr(x, y), returns the correlation coefficient and the p-value**

Welcome to the world of programming!



```
print(“Python is my
   favorite language.)
```

```
File "<stdin>", line 1
  print("Python is my favorite language)
                         ^
SyntaxError: EOL while scanning string literal
```

from www.helloworldprogram.com