



Politechnika Łódzka
Instytut Elektroniki

SIGNAL PROCESSING

Laboratory #1:

Introduction to Python and PyLab environment

M. Kociński, P. Strumiłło

Medical Electronics Division
Institute of Electronics

PURPOSE:

To get acquainted with PyLab environment – declaring variables, arrays and array operations

TASKS:

1. Create your directory on the hard drive, eg. `'D:/Biomed2012_1'`. All the scripts, functions and files are to be saved in this directory.
2. Start PyLab
3. Change the current working directory of PyLab environment to the directory you created. (In the main command window, type `>>>cd D:/Biomed2012_1;`)
4. To double-check what is your current directory type `>>>pwd`
5. In PyLab window, declare the following variables (**hint**: use [www.scipy.org/Tentative NumPy Tutorial](http://www.scipy.org/Tentative_NumPy_Tutorial) and go to 'Array creation')

- $a = 5$
- $b = \begin{bmatrix} 1 & -2 & 4 \end{bmatrix}$
- $c = \begin{bmatrix} 2. \\ 0 \\ -1 \end{bmatrix}$
- $d = \begin{bmatrix} 1 & 0 & 2 \\ 4 & -3 & 1 \\ 2 & 2 & 3 \end{bmatrix}$
- $e = \begin{bmatrix} 1+1j \\ 1 \end{bmatrix}$

Check type of each of the defined matrices by entering `variable_name.ndim`, `variable_name.shape`, `variable_name.size`, `variable_name.dtype`, `variable_name.itemsize`,

Type `f=zeros_like(d)` to create a new array `f` of the same size and data type as array `d` but filled with zeros.

Create array `b1` with the same size and values as for array `b`, but of `dtype='uint8'`

6. Creating vectors:

Type in `help(arange)`

Type in the commands: `g=arange(10); h=arange(10.); i=arange(5,15,3)`

Create the following vectors:

- $j = [1 \ 2 \ 3 \ 4 \ \dots \ 101]$
- $k = [500 \ 490 \ 480 \ \dots \ -890 \ -900]$
- $l = [0 \ 0.1 \ 0.2 \ 0.3 \ \dots \ 10]$
- $m = [0 \ 0 \ 0 \ 0 \ \dots \ 0]_{500}$
- $n = [1 \ 1 \ 1 \ 1 \ \dots \ 1]_{500}$
- $p = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$

Hints: check PyLab help for the following functions:

zeros, ones (to print out the help content type `>>help(function_name)`)

7. Type in `%whos` to see the defined variables in PyLab workspace, use `%del` command to delete some of the defined variables. Note that `%reset` command clears all the variables, imported modules and defined functions.
8. Create vectors by using the **array()** commands: $r = [1 \ -2 \ 4]$, $s = [7 \ 2 \ 3]$ and compute: $r+s$, $r*s$, $r**s$, **dot(r,s)**
9. Add, multiply, divide by 2 and compute the power of 2 of vector r by using commands: $r+=2$, $r*=2$, $r/=2$, $r**=2$

10. Define array:

$$t = \begin{bmatrix} 1.1 & 4.56 & 8.999 \\ 2 & 3 & 4 \\ 6.78 & 2.44 & 5.55 \end{bmatrix}$$

and compute: `t.min()`, `t.max()`, `t.min(axis=0)`, `t.min(axis=1)`, `t.max(axis=0)`, `t.max(axis=1)`. Consult **help prod, average, std, var, round, clip, ptp, floor, ceil, flipud, pliplr, rot90** and use these commands for array t

□ 10/13/2012