Albert-Ludwigs-Universität Freiburg
Institut für Informatik
Lecture: Introduction to Mobile Robotics
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Prof. Dr. Wolfram Burgard
Dr. Daniel Büscher
Marina Kollmitz
mobilerobotics@informatik.uni-freiburg.de
Oier Mees

Sheet 1

Topic: Setup

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General Notice

Solving the exercise sheets is recommended but not mandatory to be admitted to the final exam. There are no bonus points.

Exercise sheets will be published on Fridays and will be discussed in class one week later. We strongly encourage you to solve the exercise sheets beforehand to benefit from the discussions in class.

We will be using Python for the programming exercises. Python can be used both interactively in command line or by executing scripts, e.g. from within an IDE, for solving numerical computations. Python is freely available for Linux, Mac OS, and Windows at `https://www.python.org/downloads/`. A quick guide on Python is given in the Python cheat sheet, which is available on the website of this lecture.

Recommended for Windows:

You can find the Python modules and editors integrated in one installer at `https://winpython.github.io/`. It includes all the important Python modules and IDEs for interactive debugging. Once installed, you can open the interactive debugger 'Spyder' and start writing your code.

Recommended for Linux:

You can use the `python` package that is most probably included in your distribution. In addition, you might need to install the `python-scipy` package or alike.

Exercise 1: Defining functions

Functions in Python are usually defined inside a file. Create a file named `myfirstscript.py` and implement the following function:

$$f(x) = \cos(x)\exp(x)$$

Next, launch your script as python `myfirstscript.py` in the command line. In Python multiple functions can be defined in the same file and the filename is independent of the function names used in the file.

Exercise 2: Plotting data

Every python file is a script which can be evaluated later. It can contain multiple functions and other numerical computations all in one file. The `matplotlib.pyplot` module can be used for plotting.

a) In the same python script write commands which plot the graph of the function f in the interval $[-2\pi, 2\pi]$. Hint: python's `numpy` module has as a special variable for π: `numpy.pi`

b) Save the resulting plot as a PNG-file to your hard disk.

Exercise 3: Generating random numbers

Random numbers are important in probabilistic robotics so it is preferable to know what kind of random variables are provided by Python and how to use them. Hint: use `numpy`.

a) Create a vector with 100000 random variables which are normally distributed with a mean of 5.0 and a standard deviation of 2.0.

b) Create a vector with 100000 uniformly distributed random variables between 0 and 10.

c) Compute the mean and standard deviation of the two vectors with random variables. Are the results what you would expect?

d) Plot histograms of the random variables you generated. The `hist` command can be used to plot histograms. Take a look at `help(matplotlib.pyplot.hist)` for more information about how to use it.

e) Modify your script so that the generated distributions are exactly the same each time you call it.