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BSc Intro 2022 Python Tutorial

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Short Demo of Python

- The interpreter: A simple way of testing things out
- Variables in Python
- Indentation or how I learned to stop worrying and love C++'s Semicolons
- Control flow: The ifs and loops of programming
- Using functions and classes in Python
- Multiple files and imports

Now: It's your turn! We've prepared some exercises for you in the following. Try them out!

If anything is unclear or if you are stuck: Ask us.

Maybe also try using `git` to version control your code. That will also allow us to look at it together if you are stuck somewhere!

Python Virtual Environments

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- On `lxplus` (or most other clusters), you are presented with a certain selection of Python modules
  - Load as follows (on `lxplus`):
    `$ setupATLAS; lsetup "python <your version>"`
  - Look-up versions as discussed yesterday:
    `$ showVersions python`
- In general: OK, but often it would be nice to install some custom modules (e.g. `tensorflow` for Machine Learning), choose different versions (e.g. for `numpy`), or have multiple versions of Python for different purposes

⇒ Python virtual environments are your friend!

- For setting them up:
  - Create venv: `$ python3 -m venv <path/to/venv>`
  - Activate venv: `$ source <path/to/venv>/bin/activate`
    Notice how (`<venvname>`) should now be in front of your shell prompts!
  - Add modules: `$ pip install {-U} <module>` (`-U` for updates)
- Try it out! Build yourself a Python3 venv with the following modules (for tomorrow/Friday!):
  `ruamel.yaml`, `matplotlib`, `uproot`, `pandas`, `tensorflow`, `scikit-learn`, `tables`, `pydot`
  But: Start by updating `pip`: `$ pip install -U pip`

Python Interpreter and Macros

1. Open the python interpreter and print out 'Hello World!'
2. Now, do the same thing from a `macro.py` file
3. Probably, you needed to use the following for the last task:
   ```
   $ python macro.py
   ```
   There is also another way involving a so-called *shebang*. Try it out with that!
4. Use your file to print out the integers 1 to 20
5. Now only print the even integers from 1 to 20
6. Can you store these integers in a file?

Hints:

- Python has a concept similar to the main-method in C++. Try the following for that:
  ```
  if __name__ == "__main__":
  ```
- To make a file executable with Linux, you also have to change it's permissions. For that you can use `chmod +x <executable>`
- Try out what the following command does in the interpreter:
  ```
  range(20)
  ```

Summary

- Python is a very user-friendly programming language
- Now used extensively for Data Science → Connection with C++ based `ROOT` via `uproot` module
  ↪ More about that tomorrow
- Of course we could only give you a very brief overview of Python. If you are stuck during your thesis, just look online for help or ask your friendly PhD student!

Thanks for your attention