WHY USE PYTHON PROGRAMMING IN GIS?

• Workflow automation
• Downloading data
• Geoprocessing
• Automation of repetitive tasks
• Functionality that would otherwise be unavailable
WHY PYTHON?

• Interpreted programming language
• Built from C
• Platform Independent
• No need to compile
• Many different versions
• ArcGIS and QGIS already installed it!
• Execute tools inside ArcMap and QGIS
• Execute tools/code using CMD/Terminal/Console
• Many Interactive Development Environments
BENEFITS

- Programs are clean, easy to understand and maintainable
- Programs are portable across Windows, Mac, Linux, etc.
  - ArcGIS Desktop only on Windows, but as we will see, lots of GIS tasks can be achieved directly using Python modules
- Many open-source libraries and modules available
  - Including with spatial programming support
- Plays nicely with programs written in other languages
  - ArcGIS is written in C++, but many Toolbox functions are
  - written in Python
CONS/DRAWBACKS

• Python is not the fastest kid on the block
  • Especially for heavy-duty number crunching
  • May want to write such modules in C/C++ and invoke them from Python
    • Another option to write such modules in Python, compile it and then link the compiled extensions into your code

• Still, Python is sufficient for many programming tasks
  • And hardware is getting more and more capable
- **Variable** is a way of storing values into the memory of the computer by using specific names that you define.

- **Data types**
  - Integer (int) = Whole number
  - Float (float) = Decimal number
  - String (str) = Text
  - Boolean (bool) = True / False
  - List (list) = A “container” that can store any kind of values. You can create a list with square brackets e.g. `[1, 2, 3, 'a', 'b', 'c']`.
  - Tuple (tuple) = A similar “container” as list with a difference that you cannot update the values in a tuple. You can create a tuple with parentheses `(1, 2, 3, 'a', 'b', 'c')`.

- **Index** number is the location of specific value stored in Python lists or tuples. The first index value of list is always 0.

- **Script** is a dedicated document for writing Python code that you can execute. Python script files should always have the `.py` file extension.
• QGIS – pygis

• ArcGIS – arcpy
Python functions are defined using a `def` statement.

Values are returned from the function using a `return` statement.

The `Reclass` function that was defined above, is called here.
Example of more advanced Python code in the Python window.

```python
>>> import arcpy, glob
>>> mod = arcpy.mapping.MapDocument('current')
>>> df = arcpy.mapping.ListDataFrames(mod)[0]
>>> for lyrfile in glob.glob('c:\data\*.lyr'):
...     print("Adding", lyrfile, "to map")
...     arcpy.mapping.AddLayer(df, lyrfile, "AUTO_ARRANGE")
... 
```
EXAMPLE OF SCRIPT LIBRARY

“MODULES”

- NumPy, Shapely, GDAL Python bindings, PySAL, pyshp and GeoDjango
- SciPy is a Python-based ecosystem of open-source software for mathematics, science, and engineering.
BUILD A TOOL WITH SCRIPT IN ARCGIS

- Creating a script tool allows you to turn your own Python scripts and functionality into your own geoprocessing tools—tools that look and act like system geoprocessing tools.
PYTHON CONSOLE IN QGIS