CSC 223 - Advanced Scientific Programming

Introduction to Python

Python

- Python was created by Guido van Rossum and first released in 1991
- Python is an interpreted high-level programming language
- Python is a multi-paradigm programming language
- Python is dynamically typed – types of variables do not need to be declared
- Python is strongly typed – types are not implicitly coerced

Elements of Programming

- Every powerful programming language has mechanisms for combining simple ideas to form more complex ideas:
    - primitive expressions and statements which represent the simplest building blocks that the language provides.
    - means of combination, by which compound elements are built from simpler ones, and
    - means of abstraction, by which compound elements can be named an manipulated as units.

Expressions

- In programming, we deal with two kinds of elements:
  - data: the stuff that we want to manipulate
  - functions: describe rules for manipulating data
- Python programs are composed of expressions, which are evaluated by the Python interpreter.
- There are two main kinds of expressions:
  - primitive expressions, for example the number 42
  - compound expressions, for example 3 * 4

Call Expressions

- The most important kind of compound expression is a call expression, which applies function to some arguments.
- A call expression has subexpressions:
  - the *operator* is an expression that precedes parentheses, and
  - a comma delimited list of *operand* expressions.
- Example:

  ```
  max(7.5, 9.5)
  ```

  - The operator specifies the function
  - When the call expression is evaluate, we say that the function `max` is *called* with *arguments* 7.5 and 9.5 and *returns* a *value* of 9.5.

Function Notation vs. Mathematical Notation

- Functions can take an arbitrary number of arguments instead of only two

  ```
  max(1, -2, 3, -4)
  ```

- Function notation extends to *nested* expressions.

  ```
  max(min(1,2), min(pow(3, 5), -4))
  ```

- Function notation only requires a name instead of the various forms of mathematical notation.

Running Python Code

- The Python interpreter is the most basic way to execute Python code.
- The interpreter can be started by typing `python` at the command prompt.

```
$ python
>>>
```

- The interpreter can be used to evaluate Python expressions.

```
>>> 1 + 1
2
>>> x = 5
>>> x * 3
15
```

Self-contained Python Scripts

- Python programs (scripts) are saved in files with a `.py` extension.
- Example: file named `test.py` with the contents

```
# file: test.py
print("Running test.py")
x = 5
print("Result is", 3 * x)
```

- A python file is run with the `python` *filename* command.

```
$ python test.py
Running test.py
Result is 15
```