CSI31 Introduction to Computer Programming I

Dr. Sharon Persinger
Fall 2018

Topics

- Computing with numbers
- Math library
- Binary representation of integers
- Computing with large integers

Computing with numbers

- Basic numerical data comes in two types:
  - integer – int – whole numbers, positive, negative, zero, no fractional part: -2, 0, 1, 5
  - numbers with fractional part – float – decimals with fractions: -4.5, 0.0, 2.0, 181.87, 0.0000000453
- Python has type function

Computing with numbers

- Why two different types?
  - Some things are counted by integers with no fractions.
  - Some things are measured so fractional parts are neded.
- Different data types are represented differently in hardware.Operations are implemented differently.

Python’s built-in operations

- Addition +, subtraction -
- Multiplication *, float division /
- Exponentiation **, absolute value abs()
- Integer division //, remainder %
  - a = (a//b)*(b) + (a%b)
- Mixed arithmetic

Math library

- import math - to make the math library available
- constants – math.pi, math.e - and functions - square root math.sqrt, trig functions, exponential functions, logarithms
- Create module quadratic.py to solve a quadratic equation using the quadratic formula
- Documentation for math library at https://docs.python.org/3/library/math.html?highlight=math%20library

Computing factorials

- What is the factorial of 10?
- Write a program to compute factorial of n.
- Use Accumulator pattern: build up the solution to the problem in an accumulator variable
  - Initialize accumulator variable correctly
  - Loop until final result reached , update the accumulator variable each time

More on range

- range(start, stop, step) creates the sequence of integers beginning with

  start, up to but not including stop, adding step each time
- start, stop, step must be integers, can be negative
- [2, 3, 4, ..., n]
- [n, n-1, ..., 2]

Computer representation of integers

- Binary numbers
- 2 digits: 0, 1
- Base 2 place value system
- Place values
- Convert 25 (decimal) to binary
- Convert 100101101 to decimal

What is the biggest number

- That can be represented in 4 bits? 8 bits? 16 bits? 32 bits?

- Most programming languages have a fixed size to represent integers - 32bits, say. In Python if the computations require it, the memory used to represent an integer will be expanded automatically.

Arithmetic operations in binary

- Add, subtract
- Multiply
- Divide?