CIS 122

Types, Types and More Types
Integers

- Whole numbers (positive or negative)
  - 1
  - -7
  - 42
  - -525600

- What about these?
  - +1
  - --7
  - +--+-+42
Integers

- What can you do with them?
  - add $(2 + 3)$
  - subtract $(5 - 12)$
  - multiply $(4 * 5)$
  - divide $(5 / 3)$
  - exponentiate $(2 ** 4)$

- Spacing is optional
  - 2+3
  - 2 + 3

- Avoid leading spaces, though...
Integers

- Integer operations always yield integer results
  - Easy for addition, subtraction, multiplication
  - What about division?
Integers

- Integer operations always yield integer results
  - Easy for addition, subtraction, multiplication
  - What about division?

- Just chop off the non-integer part!
Integers

• Standard order of operations
  ○ Parentheses
  ○ Exponents
  ○ Multiplication / Division
  ○ Addition / Subtraction

• PEMDAS (Please Excuse My Dear Aunt Sally)
  ○ A little misleading...
  ○ Multiplication and Division have the same priority
  ○ Addition and Subtraction have the same priority

• In ties, evaluate from left to right
Integers - Pop Quiz

- $5 / 2 = 2$
- $99 / 100 = 0$
- $1 + 2 * 3 = 7$
- $(1 + 2) * 3 = 9$
- $6 - 3 + 3 = 6$
- $8 * 3 / 4 = 6$
- $8 * (3 / 4) = 0$
Floats

- Short for "Floating Point Numbers"
  - Name comes from representation
- Allow us to represent fractional numbers
- Any number with a '.'
  - 1.2
  - 0.0
  - .12345
  - 42.
Floats

- Floats can do just about anything an integer can do
  - $1.1 + 2.3$
  - $0.5 \times 10.0$

- What about this one?
  - $0.1 + 0.2$

- Floats are imprecise
  - Don't worry about the details
  - But don't be alarmed if your calculations are a little off
Floats

- What happens when you mix floats and integers?
  - $1 + 2.3$
  - $3.0 \times 4$
Floats

- What happens when you mix floats and integers?
  - 1 + 2.3
  - 3.0 * 4

- Python converts the result to a float
  - No information lost
Floats

- What happens when you mix floats and integers?
  - $1 + 2.3$
  - $3.0 \times 4$

- Python converts the result to a float
  - No information lost

- Great for precisely dividing integers

$5.0 / 2 \rightarrow 2.5$
- What if we want to read and write messages?
- We could just encode everything numerically...
  - Actually, that's what happens under the surface
  - But it would be a pain for us to read
- Use strings
Strings

- Text surrounded by quotes
- Single quotes
  - 'This is a string'
- Double quotes
  - "So is this"
- Triple quotes (three sets of single/double quotes)
  - "'''This string can span multiple lines'''"
Strings

• Strings can even contain quotes (sometimes...)
  ○ "This 'string' is a valid string"
  ○ 'This "string" is also valid'
  ○ "Oops, this "string" cuts off early"

• Everything inside quotes is part of the string
  ○ " 1 a" (this string contains five characters)
  ○ " " (this string contains one character)
  ○ "" (this string contains no characters)
Strings

- What can we do with strings?
- You can add them
  - Adding strings is different then adding ints
    - "Hello" + "World" → "HelloWorld"
- There's a big difference between these expressions
  - 1 + 1
  - '1' + '1'
Strings

- What can we do with strings?
- You can multiply them
  - But not by each other...

- What happens when you multiply a string by an integer?
  - 'Hip Hip Hooray!' * 3
  - 'What about me?' * 0
  - 'Huh?' * -5

- What if you multiply a string by a float?
Types

● We've seen a few
  ○ Integers
  ○ Floats
  ○ Strings

● But there are more
  ○ Booleans
  ○ Lists

● And you can even make your own
  ○ Classes
  ○ We'll get to that much later...