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?

\[ \frac{5}{2} \rightarrow 2.5 \rightarrow 2 \]

- Just chop off the non-integer part!
  - (rounding down)
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

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

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

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- Great for precisely dividing integers

5.0 / 2 ➔ 2.5
Strings

- 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 today
  - Integers
  - Floats
  - Strings

- But there are more
  - Booleans
  - Lists

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