Announcements

- Easy URL for website: datascienceforall.org
- What if you just added?
- HW 01 due Thursday (bonus point for early submission)
Tables

(leftover from Lecture 03)
Arithmetic
## Arithmetic Operators

<table>
<thead>
<tr>
<th>Operation</th>
<th>Operator</th>
<th>Example</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Addition</td>
<td>+</td>
<td>2 + 3</td>
<td>5</td>
</tr>
<tr>
<td>Subtraction</td>
<td>-</td>
<td>2 - 3</td>
<td>-1</td>
</tr>
<tr>
<td>Multiplication</td>
<td>*</td>
<td>2 * 3</td>
<td>6</td>
</tr>
<tr>
<td>Division</td>
<td>/</td>
<td>7 / 3</td>
<td>2.66667</td>
</tr>
<tr>
<td>Remainder</td>
<td>%</td>
<td>7 % 3</td>
<td>1</td>
</tr>
<tr>
<td>Exponentiation</td>
<td>**</td>
<td>2 ** 0.5</td>
<td>1.41421</td>
</tr>
</tbody>
</table>

(Demo)
Python has two numeric types

- **int**: an integer of any size
- **float**: a number with an optional fractional part

An int never has a decimal point; a float always does.

A float might be printed using scientific notation.

Three limitations of float values:

- They have limited size (but the limit is huge)
- They have limited precision of 15-16 decimal places
- After arithmetic, the final few decimal places can be wrong
Strings
Text and Strings

A string value is a snippet of text of any length
- 'a'
- 'word'
- "there can be 2 sentences. Here's the second!"

Strings that contain numbers can be converted to numbers
- int('12')
- float('1.2')

Any value can be converted to a string
- str(5)
Discussion Question

Assume you have run the following statements

\[
\begin{align*}
x &= 3 \\
y &= '4' \\
z &= '5.6'
\end{align*}
\]

What's the source of the error in each example?

A. \( x + y \)
B. \( x + \text{int}(y + z) \)
C. \( \text{str}(x) + \text{int}(y) \)
D. \( \text{str}(x, y) + z \)
Arrays and Ranges
Arrays

An array contains a sequence of values

- All elements of an array should have the same type
- Arithmetic is applied to each element individually
- When two arrays are added, they must have the same size; corresponding elements are added in the result
- A column of a table is an array

(Demo)
Ranges

A range is an array of consecutive numbers

- `np.arange(end)`: An array of increasing integers from 0 up to `end`
- `np.arange(start, end)`: An array of increasing integers from `start` up to `end`
- `np.arange(start, end, step)`: A range with `step` between consecutive values

The range always includes `start` but excludes `end`