DATA 8

Summer 2018

Lecture 4

Data Types

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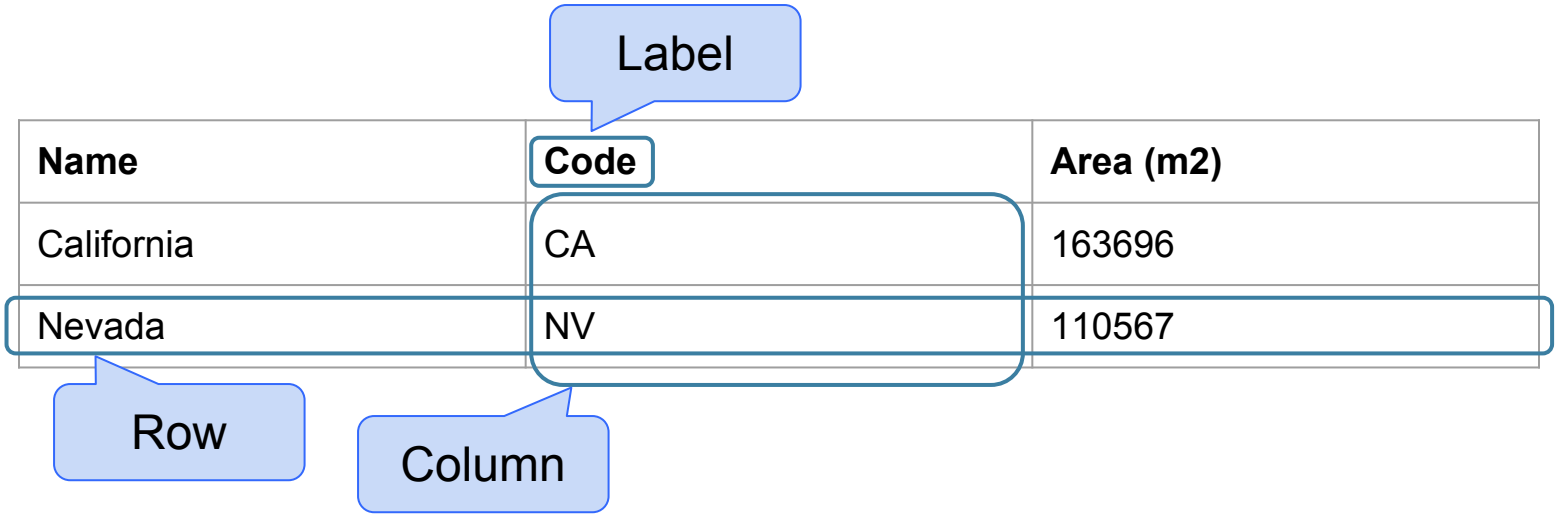
Announcements

Context: Last Lecture

Python Programming Language

- Table structure within the `datascience` package
- CA minimum wage, ice-cream cones, NBA player statistics



Review

What are the column labels of each table?

cones

Flavor	Color	Price
strawberry	pink	3.55
chocolate	light brown	4.75
chocolate	dark brown	5.25
strawberry	pink	5.25
chocolate	dark brown	5.25
bubblegum	pink	4.75

```
x = cones.select('Flavor', 'Color')
x
```

```
y = x.drop('Color')
y
```

```
x = cones.select('Color', 'Price)
x
```

```
y
```

Arithmetic

Arithmetic Operators

Operation	Operator	Example	Value
Addition	+	2 + 3	5
Subtraction	-	2 - 3	-1
Multiplication	*	2 * 3	6
Division	/	7 / 3	2.66667
Remainder	%	7 % 3	1
Exponentiation	**	2 ** 0.5	1.41421

(Demo)

Ints and Floats

Python has two real number 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

Arithmetic Question

Rank the results of the following expressions in order from least to greatest

```
A. 3 * 10 ** 10
B. 10 * 3 ** 10
C. (10 * 3) ** 10
D. 10 / 3 / 10
E. 10 / (3 / 10)
```

```
A. 300000000000
B. 590490
C. 5904900000000000
D. 0.3333333333333337
E. 33.333333333333336
```

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 consisting of numbers can be converted to numbers

- `int('12')`
- `float('1.2')`

Any value can be converted to a string

- `str(5)`

(Demo)

Discussion Question

Assume you have run the following statements

```
x = 3
y = '4'
z = '5.6'
```

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

A. `x + y`
B. `x + int(y + z)`
C. `str(x) + int(y)`
D. `str(x, y) + z`

Types

Every value has a type

We've seen 5 types so far:

- `int: 2`
- `float: 2.2`
- `str: 'Red fish, blue fish'`
- `builtin_function_or_method: abs`
- `Table`

The `type` function can tell you the type of a value

- `type(2)`
- `type(2 + 2)`

An expression's "type" is based on its value, not how it looks

- `x = 2`
- `type(x)`

(Demo)

Conversions

Strings that contain numbers can be converted to numbers

- `int('12')`
- `float('1.2')`
- ~~`float('one point two')`~~ `# Not a good idea!`

Any value can be converted to a string

- `str(5)`

Numbers can be converted to other numeric types

- `float(1)`
- `int(1.2) # DANGER: loses information!`

Arrays

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)