2.1 - Data Types

Ha Khanh Nguyen (hkngyuen)

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Scalar Types

- **Scalar** refers to “single value” type of data.
  - Numerical data (integer or float), strings, boolean (`True` or `False`) values.
- The table below contains all standard Python scalar types.

Type	Description
`None`	The Python “null” value
`str`	String type, holds Unicode (UTF-8 encoded) strings
`bytes`	Raw ASCII bytes (or Unicode encoded as bytes)
`float`	Double-precision (64-bit) floating-point number
`bool`	A `True` or `False` value
`int`	Arbitrary precision signed integer

1. Numeric types

- The primary Python types for numbers are `int` and `float` .
  - `float` data type can also be expressed with scientific notation.

```
ival = 1242
fval = 7.2425
fval = 6.78e-5
```

- Integer division not resulting in a whole number will always yield a floating-point number.

```
x = 3 / 2
x
```

```
## 1.5
```

```
type(x)
```

```
## <class 'float'>
```

- Use the function `type()` to get the data type of the object/variable.

```
x = 4 / 2
x
```

```
## 2.0
```

```
type(x)
```

```
## <class 'float'>
```

- But `//` (floor-division operator) returns an integer:

```
x = 3 // 2
x
```

```
## 1
```

```
type(x)
```

```
## <class 'int'>
```

2. Strings

- Python is known for its powerful and flexible built-in string processing capabilities.
- You can write a string using either single quotes `'` or double quotes `"` .

```
a = 'one way of writting a string'
b = "another way"
```

- For multiline strings with line breaks, you can use triple quotes, either `'''` or `"""` :

```
c = """
This is a longer string that
spans multiple lines
"""
```

```
c
```

```
## '\nThis is a longer string that\nspans multiple lines\n'
```

- `\n` denotes the new line character for the computer.
- We use the backslash `\` as an escape character, meaning that it is used to specify special characters like newline `\n` or Unicode characters.

```
s = 'It\'s a string!'
```

- **Methods for string**: All the methods for string in Python can be found in the Python documentation (https://docs.python.org/3.8/library/stdtypes.html#string-methods).

2.1 Length of a string

- The length of a string = the number of characters the string contains.

```
s = 'foo'
len(s)
```

```
## 3
```

```
s = '''foo
foot'''
s
```

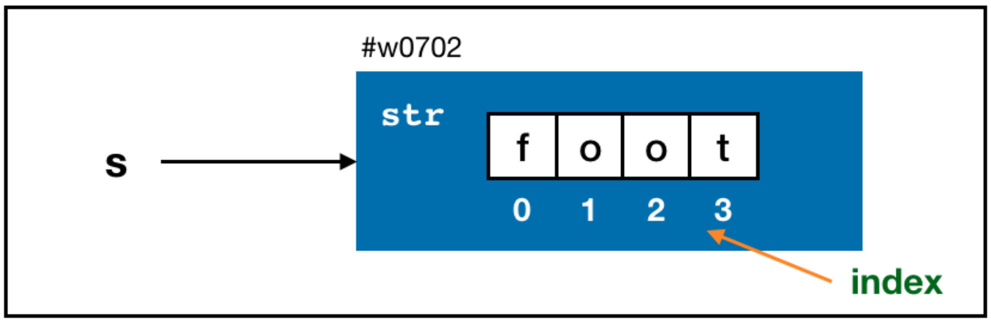
```
## 'foo\nfoot'
```

```
len(s)
```

```
## 8
```

2.2 String indexing & slicing

```
s = 'foot'
```



- Use square bracket `[]` to access characters inside a string.

```
s[0]
```

```
## 'f'
```

```
s[0:2]
```

```
## 'fo'
```

```
s[1:len(s)]
```

```
## 'oot'
```

2.3 `count()`

- The `count(sub)` method/function returns the number of non-overlapping occurrences of substring `sub` in the original string.

```
s = 'foofooooo'
s.count('f')
```

```
## 2
```

```
s.count('foo')
```

```
## 2
```

Exercise

What are the outcomes of the following commands?

```
s.count('foofoo')
s.count('o')
s.count('oo')
```

2.4 `replace()`

- The `replace(old, new [,count])` method/function returns a copy of the string with all occurrences of substring `old` replaced by `new`.
    - If the *optional* argument `count` is given, only the first `count` occurrences are replaced.

```
a = 'this is a string'
b = a.replace('string', 'longer string')
b
```

```
## 'this is a longer string'
```

```
a
```

```
## 'this is a string'
```

```
s = 'hello this is ha. ha is a student.'
s.replace('ha', 'alex')
```

```
## 'hello this is alex. alex is a student.'
```

```
s.replace('ha', 'alex', 1)
```

```
## 'hello this is alex. ha is a student.'
```

2.5 String Concatenation

- To concatenate 2 strings or add more character to a string, simply use `+` .

```
a = 'hello'
b = 'world'
a + b
```

```
## 'helloworld'
```

```
a + ' ' + b
```

```
## 'hello world'
```

- Note that `+` only works with string. A string `+` a number does not work!

```
'python' + 3
```

```
## Error in py_call_impl(callable, dots$args, dots$keywords): TypeError: must be str,
not int
##
## Detailed traceback:
##   File "<string>", line 1, in <module>
```

- To fix this, we need to transform `3` to a string `'3'` first before concatenate it to `python` .

3. Booleans

- The two boolean values in Python are written as `True` and `False` .

```
True and True
```

```
## True
```

```
False or True
```

```
## True
```

```
True & True
```

```
## True
```

```
False | True
```

```
## True
```

4. Type Casting

- The `str` , `bool` , `int` , and `float` types are also functions that can be used to cast values to those types.

```
s = '3.14159'
fval = float(s)
fval
```

```
## 3.14159
```

```
type(fval)
```

```
## <class 'float'>
```

```
ival = int(fval)
ival
```

```
## 3
```

```
type(ival)
```

```
## <class 'int'>
```

```
bval = bool(fval)
bval
```

```
## True
```

```
type(bval)
```

```
## <class 'bool'>
```

```
bool(0)
```

```
## False
```

```
s = str(ival)
s
```

```
## '3'
```

```
type(s)
```

```
## <class 'str'>
```

Exercise

The code segment below gives an error. Fix it using type casting.

```
x = 3
print("The value of x is " + x)
```

```
## Error in py_call_impl(callable, dots$args, dots$keywords): TypeError: must be str,
not int
##
## Detailed traceback:
##   File "<string>", line 1, in <module>
```

This lecture note is modified from Chapter 2 of Wes McKinney's Python for Data Analysis 2nd Ed (https://www.oreilly.com/library/view/python-for-data/9781491957653/).