7. String Methods

Topics:

- Methods and Data
- More on Strings
- Functions and Methods
- The String Class

Data + Functions Together

"The square root of nine is three."

The tone of this comment is that the square root function can be applied to numbers like nine.

"Three is nine's square root."

The tone of this comment is that the number nine (like all numbers) comes equipped with a sqrt function.

A new point of view

Methods

A special kind of function that is very important to object-oriented programming is called a method.

In this style of programming, there is a tight coupling between structured data and the methods that work with that data.

Methods

Hard to appreciate the reasons for this coupling between data and methods so early in the course.

For now, we settle on getting used to the special notation that is associated with the use of methods.

We will get into this topic using strings.

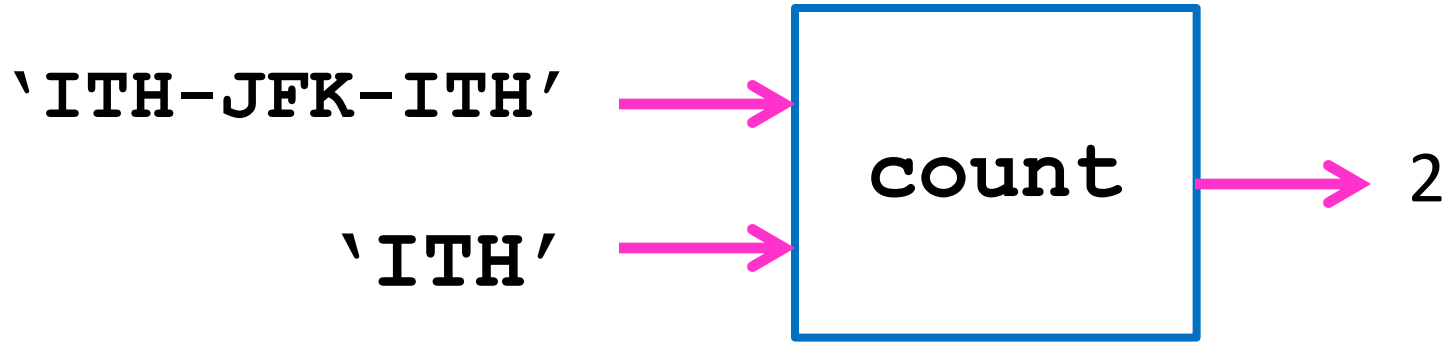
Three String Methods

`count`	How many times does string `t` occur in a string `s`?
`find`	Where is the first occurrence of string `t` in a string `s`?
`replace`	In a string `s` replace all occurrences of a string `s1` with a string `s2`.

There will be others later in the course.

Designing `count` as a Function

`count`	How many times does string `y` occur in a string `x`?



It would then be used like this: `n = count(y,x)`

Designing `count` as a Method

Suppose

```
x = 'ITH-JFK-ITH'
y = 'ITH'
```

Instead of the usual function-call syntax

```
n = count(y,x)
```

we will write

```
n = x.count(y)
```

Methods: The Notation

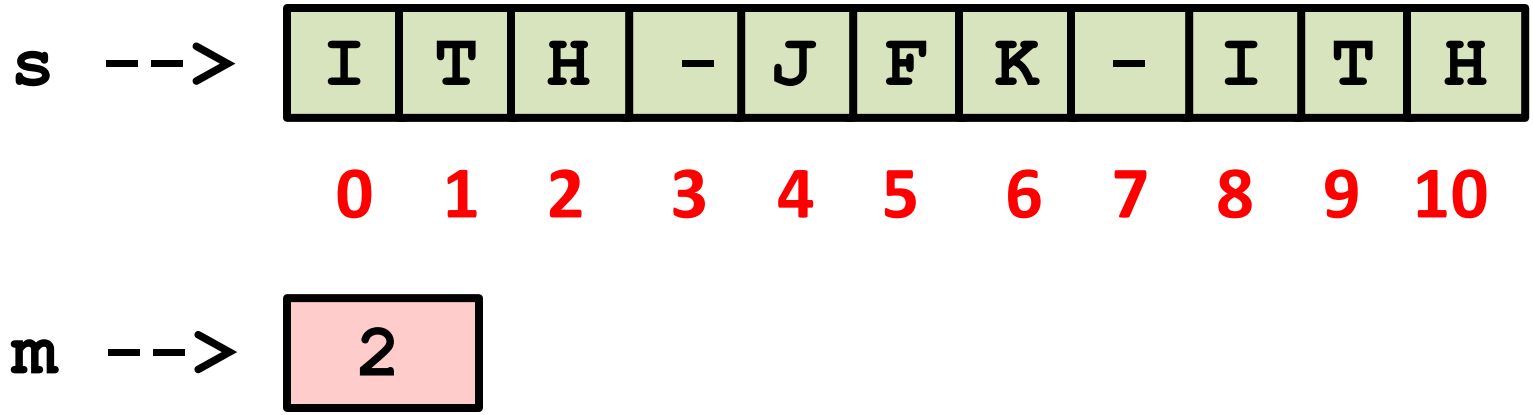
Here is the syntax associated with using a string method:

name of string . name of method (arg1,arg2,…)

Once again, the 'dot" notation

String Methods: count

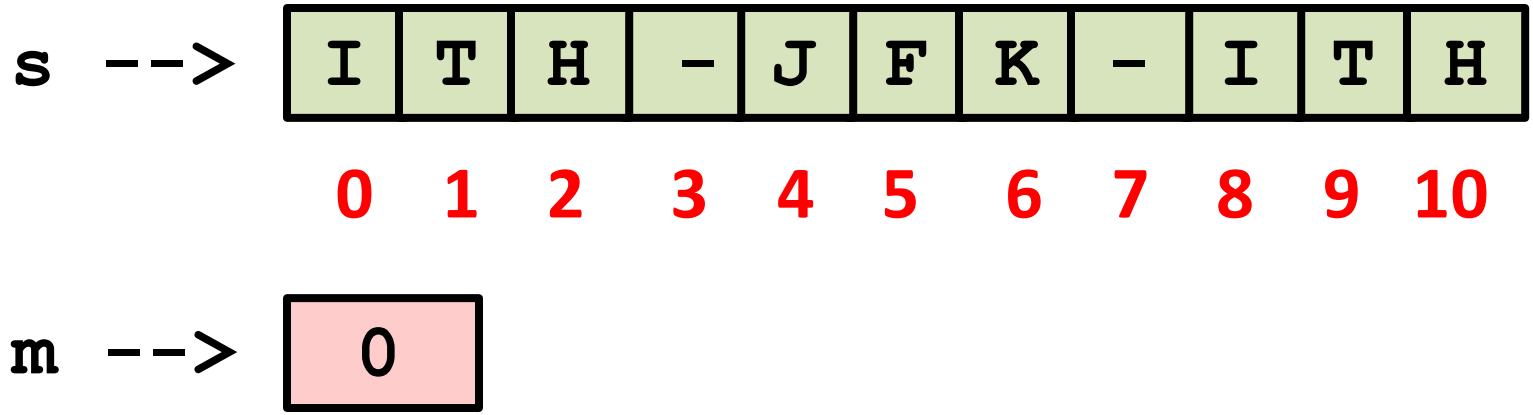
```
>>> s ='ITH-JFK-ITH'
>>> m = s.count('ITH')
```



`s1.count(s2)` the number of occurrences of string `s2` in string `s1`

String Methods: count

```
>>> s ='ITH-JFK-ITH'
>>> m = s.count('LGA')
```



`s1.count(s2)` the number of occurrences of string `s2` in string `s1`

count
The Formal Definition

If `s1` and `s2` are strings, then

`s1.count(s2)`

returns an int value that is the number of occurrences of string `s2` in string `s1`.

Note, in general `s1.count(s2)` is not the same as `s2.count(s1)`

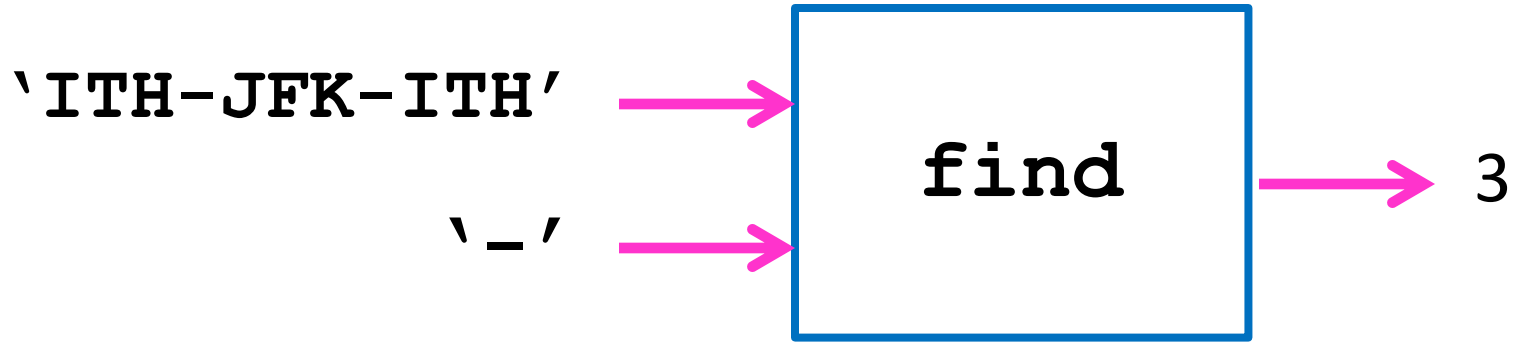
Using count: An Example

```
# Count the number of vowels…
A = 'auric goldfinger'
n = 0
n = n + A.count('a')
n = n + A.count('e')
n = n + A.count('i')
n = n + A.count('o')
n = n + A.count('u')
print n
```

Illegal: n = A.count('a' or 'e' or 'I' or 'o' or 'u')

Designing `find` as a Function

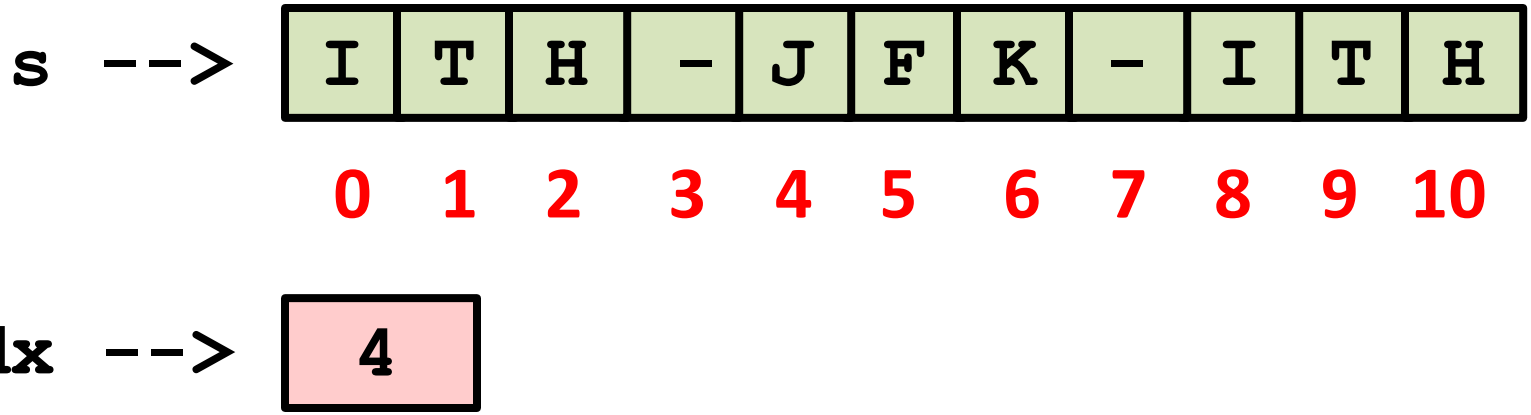
`find`	Where is the first occurrence of string `y` in a string `x`?



It would then be used like this: `n = find(y,x)`

Designing `find` as a Method

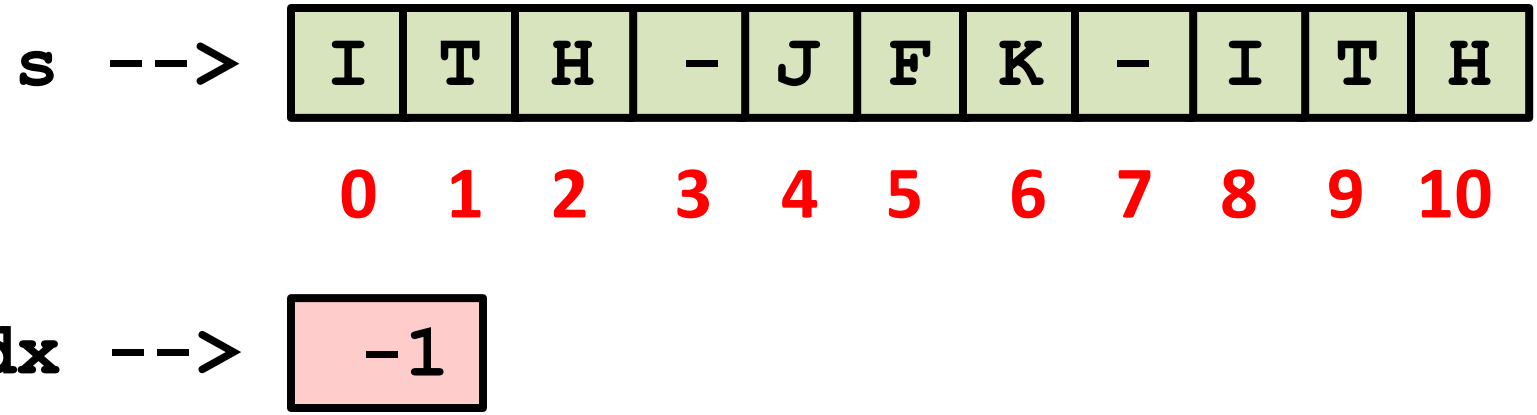
```
>>> s ='ITH-JFK-ITH'
>>> idx = s.find('JFK')
```



`s1.index(s2)` the index of the first occurrence of string `s2` in string `s1`

String Methods: find

```
>>> s ='ITH-JFK-ITH'
>>> idx = s.find('RFK')
```



`s1.index(s2)` evaluates to -1 if there is no occurrence of `s2` in `s1`

`find`
The Formal Definition

If `s1` and `s2` are strings, then

```
s1.find(s2)
```

returns an int value that is the index of the first occurrence of string `s2` in string `s1`.

If there is no such occurrence, then the value -1 is returned.

Using `find` : Some Examples

```
s = 'nine one one'
n1 = s.find('one')
n2 = s.find('two')
n3 = s.find(' nine')
```

n1 -> 5 n2 -> -1 n3 -> -1

`in` : A Handy Boolean Device

If `s1` and `s2` are strings, then

```
s1 in s2
```

is a boolean-valued expression.

`True`	if there is an instance of `s1` in `s2`.
`False`	if there is NOT an instance of `s1` in `s2`.

in versus find

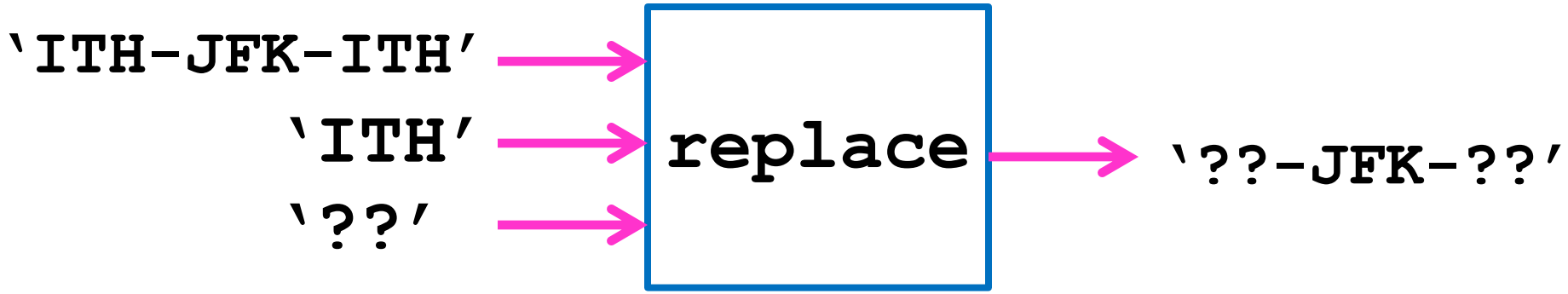
These are equivalent:

```
x = s1 in s2
```

```
x = s2.find(s1)>=0
```

Designing `replace` as a Function

`replace` In a string **`s`** replace all occurrences of a string `s1` with a string **`s2`**.



It would then be used like this: `sNew = replace(s,s1,s2)`

Designing replace as a Method

```
s = 'one hundred and one'
t = s.replace(' ','-')
```

```
s ->  'one hundred and one'
```

```
t ->  'one-hundred-and-one'
```

Replacing one character with another

The replace Method

```
s = 'one hundred and one'
t = s.replace(' ','')
```

```
s ->  'one hundred and one'
```

```
t ->  'onehundredandone'
```

The null string has length 0.

Replacing each blank with the "null string"

The replace Method

```
s = 'one hundred and one'
t = s.replace('x','-')
```

```
s ->  'one hundred and one'
```

```
t ->  'one hundred and one'
```

No change if the character to be replaced is missing

The replace Method

```
s = 'one hundred and one'
t = s.replace('one','seven')
```

```
s ->  'one hundred and one'
```

```
t ->  'seven hundred and seven'
```

Replacing one substring with another

The replace Method

```
s = 'one hundred and one'
t = s.replace('two','seven')
```

```
s ->  'one hundred and one'
```

```
t ->  'one hundred and one'
```

No change if the designated substring is missing

`replace`
The Formal Definition

If `s`, `s1` and `s2` are strings, then

`s.replace(s1,s2)`

returns a copy of the string `s` in which every non- overlapping occurrence of the string `s1` is replaced by the string `s2`.

If `s1` is not a substring of `s`, then the returned string is just a copy of `s`.

Using replace : Some Examples

```
s = 'xxx'
t1 = s.replace('x','o')
t2 = s.replace('xx','o')
t3 = s.replace('xx','oo')
```

t1 -> 'ooo'

t2 -> 'ox'

t3 -> 'oox'

`replace` does Not Replace

`s.replace(s1,s2)` does not change the value of `s`.

It produces a copy of `s` with the specified replacements.

You are allowed to overwrite the "original" `s` with the its "updated" copy:

```
s = s.replace(s1,s2)
```

Illegal!

```
s = 'abcdefgh'
s[5] = 'x'
```

Strings are immutable. They cannot be changed.

Have to ``live with'' the replace function, slicing, and concatenation

```
s = 'abcdefgh'
s = s[:5]+'x'+s[6:]
```

Quickly Review Some Other String Methods

The upper and lower Methods

```
s = 'A2sh?'
t1 = s.upper()
t2 = s.lower()
```

```
s ->  'A2sh?'
t1 ->  'A2SH?'
t2 ->  'a2sh?'
```

Some Boolean-Valued Methods

These methods return either **`True`** or **`False`**:

`islower()`

`isupper()`

`isalnum()`

`isalpha()`

`isdigit()`

Boolean-Valued Methods

	s='ab3?'	s='AbcD'	s='AB3'
s.islower()	True	False	False
s.isupper()	False	False	True

Boolean-Valued Methods

	'23'	'5a7'	'ab'	'-2.3'
s.isalnum()	True	True	True	False
s.isalpha()	False	False	True	False
s.isdigit()	True	False	False	False

Useful String Constants

```
alpha = string.letters
```

```
abcdefghijklmnopqrstuvwxyzABCDEFGHIJKLMNOPQRSTUVWXYZ
```

Useful String Constants

```
specialChar = string.punctuation
```

```
!"#$%&'()*+,./:;<=>?@[\]^_`{|}~
```

Useful String Constants

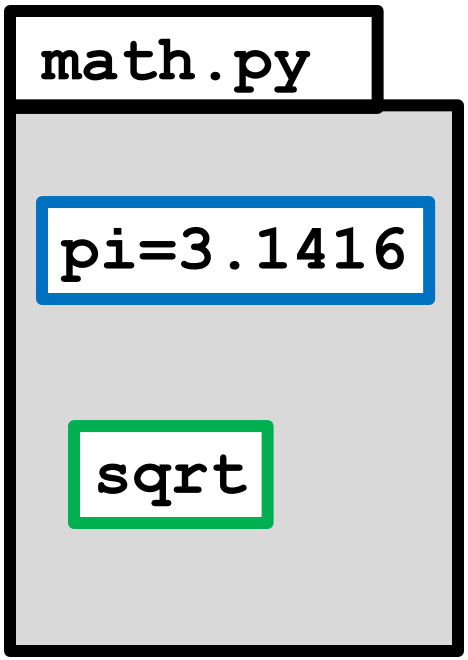
```
TheDigits  = string.digits
```

```
1234567890
```

The "Dot" Notation--Again

We have seen it with modules and import

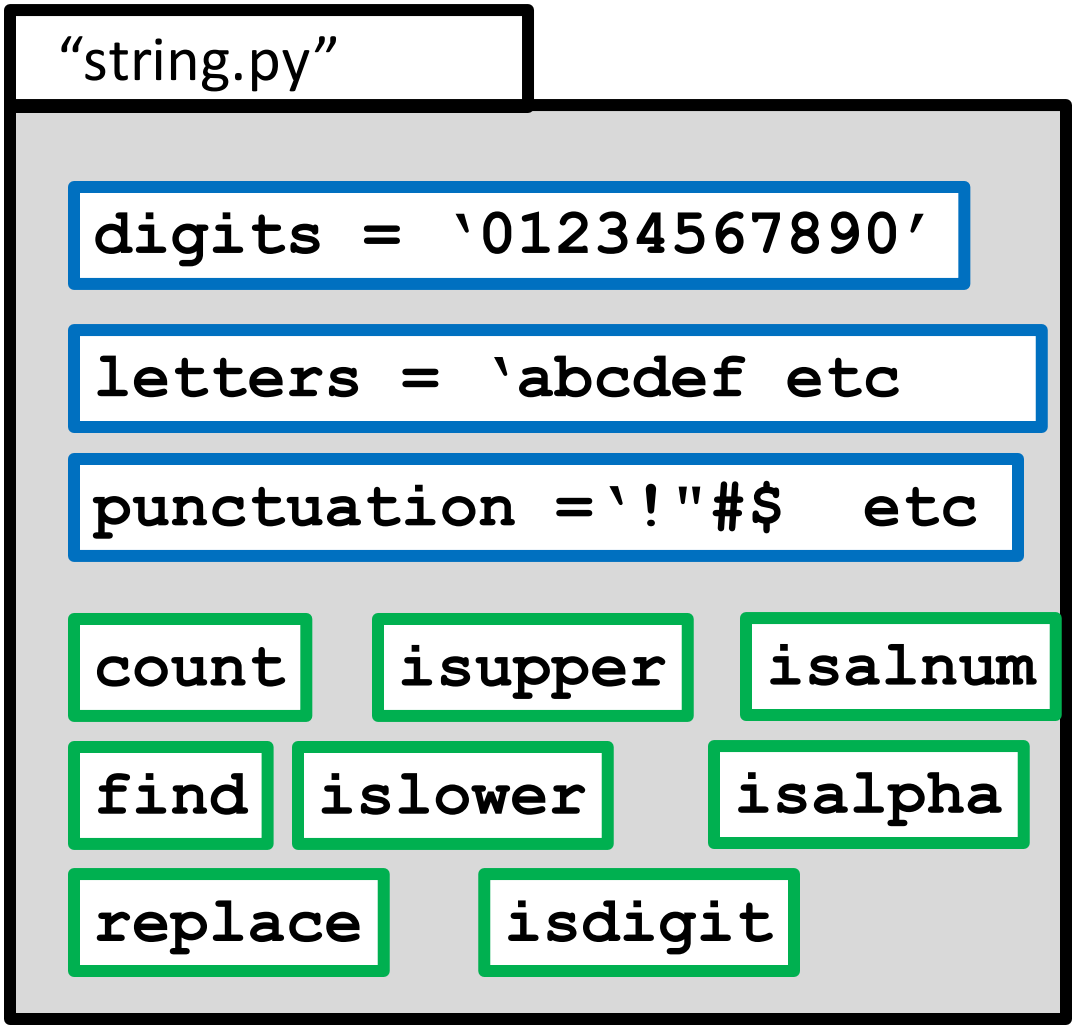
```
math.sqrt
math.pi
```



The "folder metaphor.

The "dot" means "go inside and get this"

string is a "Special" Module



The "folder" metaphor.

The "dot" means "go inside and get this"

`string` is actually a "class". More in a few lectures.