CSCI 141

Lecture 19
String Methods
String Comparisons and Ordering

Announcements

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- A4 due next Wednesday.

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- I have office hours 2-3:30 today.

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- I have office hours 2-3:30 today.
- QOTD explanations continue to be linked from the last question.
- No class monday! No labs next week!

A4

- The green corner should have 255 green.
- The green corner does not need to have 0 red and 0 blue.
- My color calculations are based on distance from the corner, irrespective of direction.
- Other approaches are ok too!

Goals

- Know how to use a few of the basic methods of string objects:
    - `upper`, `lower`, `find`, `replace`
- Understand the behavior of the following operators on strings:
    - `<`, `>`, `==`, `!=`, `in`, and `not in`
    - Understand how Python orders strings using lexicographic ordering

QOTD

```
s = "blockade"
```

0	1	2	3	4	5	6	7
b	**l**	**o**	**c**	**k**	**a**	**d**	**e**
-8	-7	-6	-5	-4	-3	-2	-1

```
print(s[ 4 ])
print(s[ 4:6 ])
print(s[ -5:5 ])
print(s[ :4 ])
print(s[ -4: ])
```

QOTD

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```
print(s[ 4 ])          k
print(s[ 4:6 ])
print(s[ -5:5 ])
print(s[ :4 ])
print(s[ -4: ])
```

QOTD

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print(s[ 4 ])          k
print(s[ 4:6 ])        ka
print(s[ -5:5 ])
print(s[ :4 ])
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```
print(s[ 4 ])          k
print(s[ 4:6 ])        ka
print(s[ -5:5 ])       ck
print(s[ :4 ])
print(s[ -4: ])
```

QOTD

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0	1	2	3	4	5	6	7
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print(s[ 4 ])          k
print(s[ 4:6 ])        ka
print(s[ -5:5 ])       ck
print(s[ :4 ])         bloc
print(s[ -4: ])
```

QOTD

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s = "blockade"
```

0	1	2	3	4	5	6	7
b	l	o	c	k	a	d	e
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```
print(s[ 4 ])          k
print(s[ 4:6 ])        ka
print(s[ -5:5 ])       ck
print(s[ :4 ])         bloc
print(s[ -4: ])        kade
```

QOTD

```
def uun_letters(first_name, last_name):
    """ Return the letters in a student's WWU Universal
    Username given the student's first_name and last_name.
    The username begins with the first 6 characters of
    the last name, followed by the first letter of the
    first name. Return the username in all lower case.
    Example: uun_letters("Scott", "Wehrwein") => "wehrwes"
    """

  return (last_name[1:6] + first_name[0]).lower()

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    Example: uun_letters("Scott", "Wehrwein") => "wehrwes"
    """
```

not the first 6 characters

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    Example: uun_letters("Scott", "Wehrwein") => "wehrwes"
    """
```

not the first 6 characters (arrow pointing to `[1:6]`)

```python
return (last_name[1:6] + first_name[0]).lower()
```

✓

```python
return (last_name[:6] + first_name[0]).lower()
```

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return last_name[:6].lower() + first_name[:0].lower()
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QOTD

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```

not the first 6 characters

empty string

QOTD

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    """ Return the letters in a student's WWU Universal
    Username given the student's first_name and last_name.
    The username begins with the first 6 characters of
    the last name, followed by the first letter of the
    first name. Return the username in all lower case.
    Example: uun_letters("Scott", "Wehrwein") => "wehrwes"
    """
```

not the first 6 characters (↓ pointing at `1:6`)

```python
return (last_name[1:6] + first_name[0]).lower()
```

✓

```python
return (last_name[:6] + first_name[0]).lower()
```

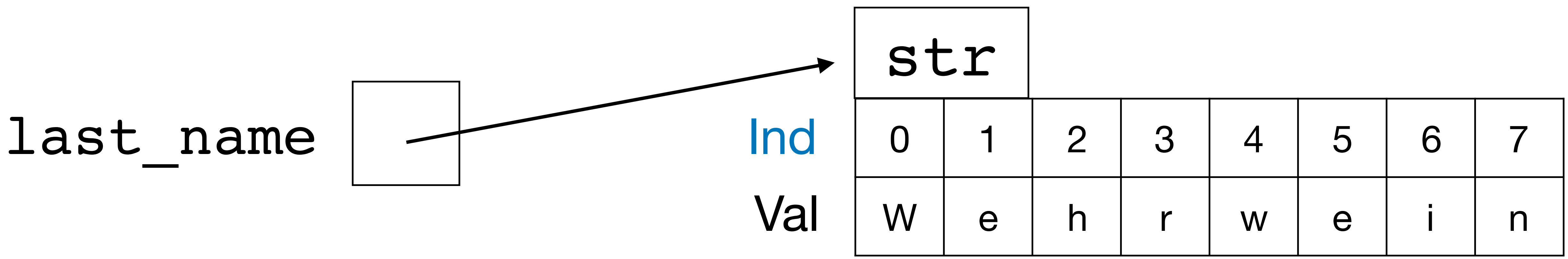
empty string (↙ pointing at `[:0]`)

```python
return last_name[:6].lower() + first_name[:0].lower()
```

✓

```python
return last_name[0:6].lower() + first_name[0].lower()
```

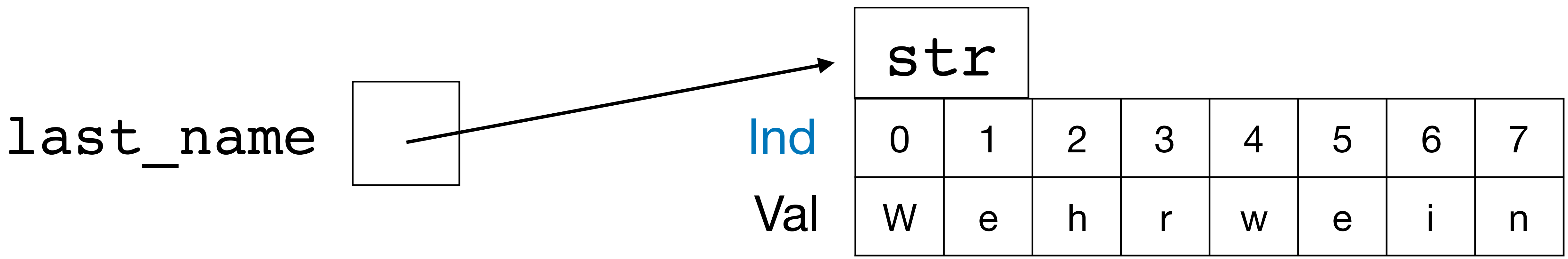
Strings have methods!



Strings are objects - they also have methods.

```
last_name = "Wehrwein"
```

Strings have methods!



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variable that refers to
a string object

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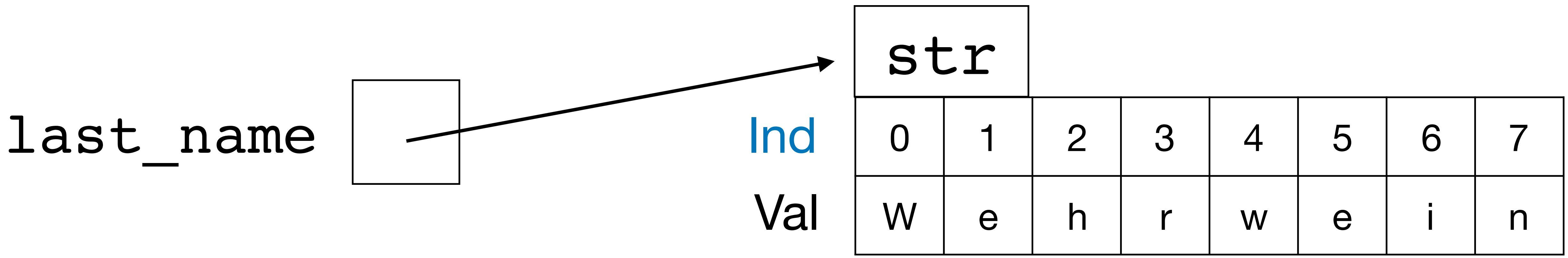


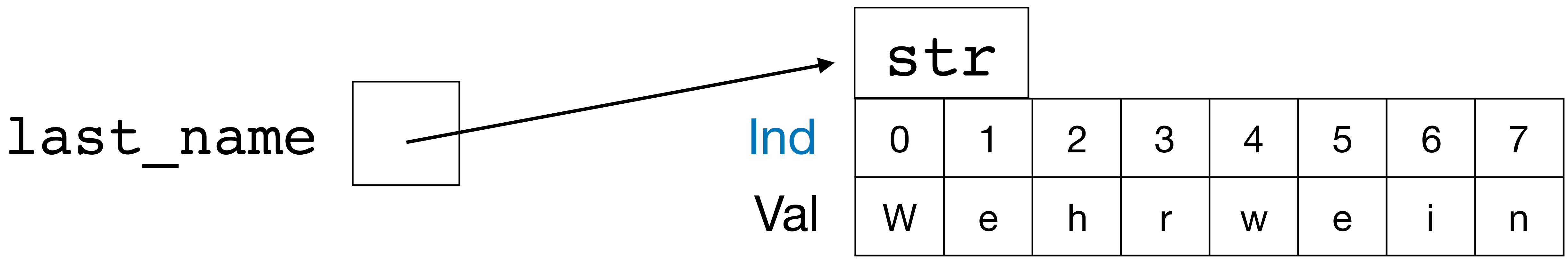
Strings are objects - they also have methods.

variable that refers to a string object

a string literal

```
last_name = "Wehrwein"
```

Strings have methods!



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```
last_name = "Wehrwein"

last_name.upper()
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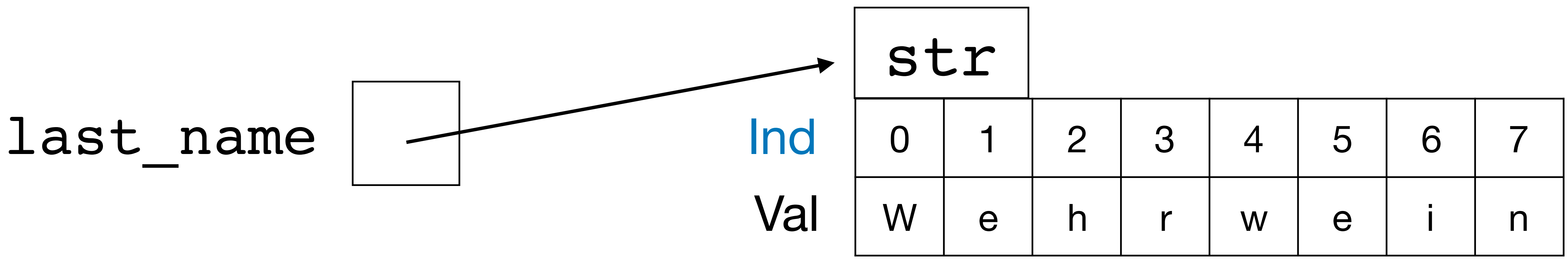

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method of a string object

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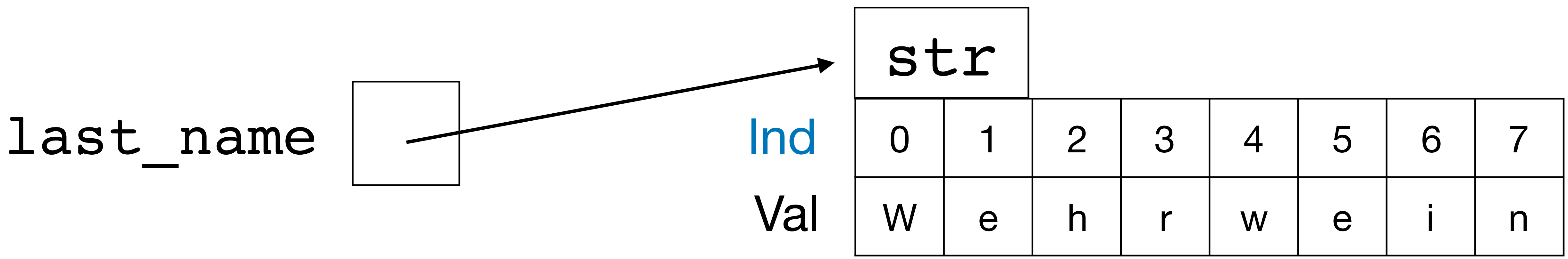

Strings are objects - they also have methods.

variable that refers to a string object

a string literal

```
last_name = "Wehrwein"

last_name.upper()
```

method of a string object

Methods can be called directly on the literal string, too:

```
"Wehrwein".upper()
```

Strings have many methods

here are a few of them:

Method	Parameters	Description
upper	none	Returns a string in all uppercase
lower	none	Returns a string in all lowercase
strip	none	Returns a string with the leading and trailing whitespace removed
count	item	Returns the number of occurrences of item
replace	old, new	Replaces all occurrences of old substring with new
find	item	Returns the leftmost index where the substring item is found, or -1 if not found

String methods: demo

`upper, lower, count, replace, find, strip`

String methods: demo

`upper, lower, count, replace, find, strip`

```
word = "Banana"
word.upper()
word.lower()
word.count("a")
word.replace("a", "A")

line = " snails are out "
line.find("s")
line.find("snails")
line.find("banana")
line.strip()
line.strip().upper()

word = "Bellingham"
word = word[:9] + word[9].upper()
```

String Methods: More

The textbook (Section 9.5) has a more complete listing of string methods:
http://interactivepython.org/runestone/static/thinkcspy/Strings/StringMethods.html

The Python documentation has full details of the `str` type and all its methods:

https://docs.python.org/3/library/stdtypes.html#str

You should know how to use `upper`, `lower`, `replace`, and `find`.

String Methods: Evaluation

Problem: write an expression to determine if a string `user_input` contains the word `"yes"`, with any capitalization and with any amount of spaces.

```
user_input
```

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```
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```

```
=> " Y  eS "
```

String Methods

Problem: write an expression to determine if a string `user_input` contains the word `"yes"`, with any capitalization and with any amount of spaces.

```
user_input.replace(" ", "")
```

```
=> "YeS"
```

String Methods

Problem: write an expression to determine if a string `user_input` contains the word `"yes"`, with any capitalization and with any amount of spaces.

```
user_input.replace(" ", "").lower()
```

```
=> "yes"
```

String Methods

Problem: write an expression to determine if a string `user_input` contains the word `"yes"`, with any capitalization and with any amount of spaces.

```
user_input.replace(" ", "").lower()
```

```
=> "yes"
```

dot (method call) operators are evaluated left-to-right!

String Methods

Problem: write an *expression* to determine if a string `user_input` contains the word `"yes"`, with any capitalization and with any amount of spaces.

```
user_input.replace(" ", "").lower() == "yes"
```

```
=> " Y  eS ".replace(" ", "").lower() == "yes"

=> "YeS".lower() == "yes"

=> "yes" == "yes"
```

dot (method call) operators are evaluated left-to-right!

String Methods

Problem: write an *expression* to determine if a string `user_input` contains the word `"yes"`, with any capitalization and with any amount of spaces.

```
user_input.replace(" ", "").lower() == "yes"
```

```
=> " Y  eS ".replace(" ", "").lower() == "yes"

=> "YeS".lower() == "yes"

=> "yes" == "yes"

=> True
```

dot (method call) operators are evaluated left-to-right!

Effects vs Return Values, again.

Most turtle methods **change the state** of the turtle object they're called on:

```
t.forward(100) # actually moves t forward
```

Most string methods return a **new** string with the given modifications:

Effects vs Return Values, again.

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Most string methods return a **new** string with the given modifications:

```
s = "BOO"
```

Effects vs Return Values, again.

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Most string methods return a **new** string with the given modifications:

```
s = "BOO"
s.lower() # => "boo"
```

Effects vs Return Values, again.

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Most string methods return a **new** string with the given modifications:

```
s = "BOO"
s.lower() # => "boo"
print(s)  # prints BOO
```

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t.forward(100) # actually moves t forward
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Most string methods return a **new** string with the given modifications:

```
s = "BOO"
s.lower() # => "boo"
print(s)  # prints BOO
t = s.lower() # if you want "boo", save it
```

Effects vs Return Values, again.

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s = "BOO"
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Why is this? Because strings can't be modified. Try this:

Effects vs Return Values, again.

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t.forward(100) # actually moves t forward
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s = "BOO"
s.lower() # => "boo"
print(s)  # prints BOO
t = s.lower() # if you want "boo", save it
```

Why is this? Because strings can't be modified. Try this:

```
s = "Scott"
s[3] = "o" # error
```

String Methods

- What does this expression evaluate to?

```
"Wow".replace("W", "t").upper()
```

A. tot

B. WOW

C. TOW

D. TOT

Operators on Strings

Familiar:

`+`	concatenation
`*`	repetition
`[ ]`	indexing, slicing
`==`	equals
`!=`	not equals

Operators on Strings

Familiar:

+	concatenation	`"a" + "b" => "ab"`
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Operators on Strings

Familiar:

+	concatenation	`"a" + "b" => "ab"`
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Familiar:

`+`	concatenation	`"a" + "b" => "ab"`
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`[ ]`	indexing, slicing	`"batman"[:3] => "bat"`
`==`	equals	
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Operators on Strings

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`+`	concatenation	`"a" + "b" => "ab"`
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`[ ]`	indexing, slicing	`"batman"[:3] => "bat"`
`==`	equals	`"antman" == "natman" => False`
`!=`	not equals	

Operators on Strings

Familiar:

+	concatenation	`"a" + "b" => "ab"`
*	repetition	`"ha" * 3 => "hahaha"`
[ ]	indexing, slicing	`"batman"[:3] => "bat"`
==	equals	`"antman" == "natman" => False`
!=	not equals	`"antman" != natman" => True`

String operators

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Unfamiliar, but intuitive:

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`in`

String operators

Unfamiliar, but intuitive:

```
in      "a" in "abc".          # => True
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"a" in "abc".              # => True
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```

String operators

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in    "a" in "abc".              # => True
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```

String operators

Unfamiliar, but intuitive:

`in`

```
"a" in "abc".               # => True
"dab" in "abacadabra" # => True
"A" in "abate"              # => False
"eye" in "team"             # => False
```

String operators

Unfamiliar, but intuitive:

`in`

```
"a" in "abc".               # => True
"dab" in "abacadabra"  # => True
"A" in "abate"             # => False
"eye" in "team"            # => False
```

`not in`: exactly what you think (opposite of `in`)

String operators

Familiar, but (a little) unintuitive:

`<, >`

much like in a dictionary

Inequality comparisons follow lexicographic ordering:

- Order based on the first character
- If tied, use the next character,
- and so on

These are all `True`:

```
"a" < "b"
"ab" < "ac"
"a" < "aa"
"" < "a"
```

String operators

Familiar, but (a little) unintuitive:

`<, >`

Caveat: lexicographic ordering is case-sensitive, and ALL upper-case characters come before ALL lower-case letters:

These are all `True`:

```
"A" < "a"
"Z" < "a"
"Jello" < "hello"
```

Lexicographic Ordering

Example: `"Bellingham" > "Bellevue"`

```
"Bellingham"
"Bellevue
```

Lexicographic Ordering

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Tie - next character

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Lexicographic Ordering

Example: `"Bellingham" > "Bellevue"`

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"Bellingham"
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`i > e`, so `"Bellingham" > "Bellevue"`

Lexicographic Ordering

Example: `"Bellingham" > "Bellevue"`

`"Bellingham"`

`"Bellevue`

`i > e`, so `"Bellingham" > "Bellevue"`

Aside:
`"Bell" < "Bellingham" => True`

When all letters are tied, the shorter word comes first.

Lexicographic Ordering: Aside

```
"?" < "!" # => ???
```

Lexicographic Ordering: Aside

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The ord function takes a character and returns its numerical (ASCII) code, which determines its ordering.

Lexicographic Ordering: Aside

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The ord function takes a character and returns its numerical (ASCII) code, which determines its ordering.

The chr function takes a numerical (ASCII) code and returns the corresponding character.

Lexicographic Ordering: Aside

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The ord function takes a character and returns its numerical (ASCII) code, which determines its ordering.

The chr function takes a numerical (ASCII) code and returns the corresponding character.

```
ord("?") # => 63
ord("!") # => 33
```

Lexicographic Ordering: Aside

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"?" < "!" # => ???
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The ord function takes a character and returns its numerical (ASCII) code, which determines its ordering.

The chr function takes a numerical (ASCII) code and returns the corresponding character.

```
ord("?") # => 63
ord("!") # => 33
```

```
"?" < "!" # => False
```

Lexicographic Ordering

ABCD: Which of the these evaluates to `True`?

A. `"bat" > "rat"`

B. `"tap" < "bear"`

C. `"Jam" < "bet"`

D. `"STEAM" > "STEP!"`