[220 / 319] Strings

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Readings:
Chapter 8 (+ 9) of Think Python
Chapter 7 of Python for Everybody

Learning Objectives

Compare strings:

- using <, >, ==, or !=

Explain string methods:

- syntax and purpose (with examples)

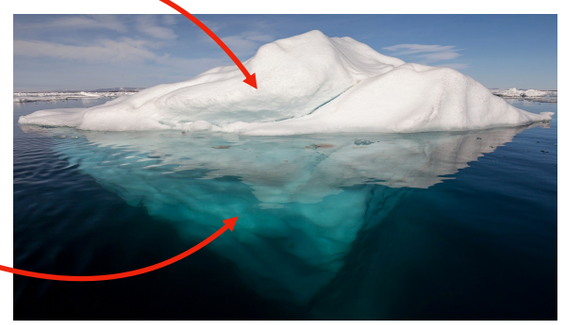
Sequence operations (a string is an example of a sequence)

- len
- indexing: extracting single item
- slicing: extracting sub-sequence
- for loop: iterating over a sequence

Chapter 8 + 9 of Think Python

what we've learned about strings so far

what we'll learn today



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Today's Outline

Comparison

String Methods

Sequences

Slicing

for loop over sequence

for loop over range

Comparison

1 < 2 → True

(because 1 is before 2)

200 < 100 → False

(because 200 is NOT before 100)

Comparison

1 < 2 → True

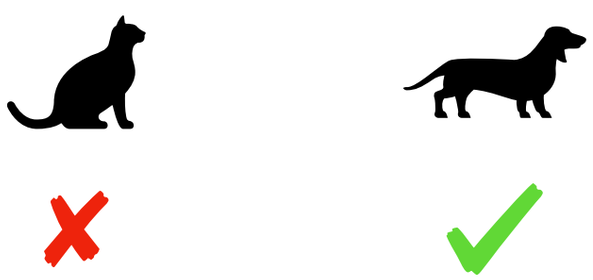
(because 1 is before 2)

200 < 100 → False

(because 200 is NOT before 100)

“cat” < “dog” → True

(because “cat” is before “dog” in the dictionary)



Python can also compare strings

Comparison

“dog” < “doo doo” → True

What about strings that start with the same letter?

Look for the first letter that’s different, and compare those.

Comparison

“dog” < “doo doo” → True

There are three gotchas:

1. case (upper vs. lower)
2. digits
3. prefixes

1. Case rules

“A” < “B” < … < “Y” < “Z” **makes sense**

“a” < “b” < … < “y” < “z” **makes sense**

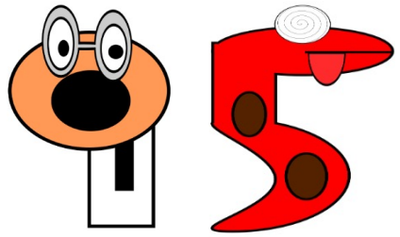
Any two characters are compared using their position in the ASCII table.

“C” < “b”
“Z” < “a”

In the ASCII table, upper case is before lower case.

To learn more, visit
https://simple.wikipedia.org/wiki/ASCII

2. Pesky digits



"0" < "1" **makes sense**

"8" < "9" **makes sense**

"11" < "2"

"100" < "15"

remember to find the FIRST difference,
and base everything on that

3. Prefixes

```
String 1: bat
String 2: batman
```

“” < “m”, so String 1 is first:

“bat” < “batman”

Do problem 1

Today's Outline

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What is a method?

A special function associated variable/value

```
>>> msg = "hello"
>>> len(msg)
5
>>>
```

len is a normal function,
it returns number
of characters in string.

It returns the number of
characters in a string

What is a method?

A special function associated variable/value

```
>>> msg = "hello"
>>> len(msg)
5
>>> msg.isdigit()
False
>>>
```

type of msg

method in str
(similar to mod)

```
str.isdigit(msg)
```

equivalent

isdigit is a special function,
called a method, that operates
on the string in msg.

It returns a bool, whether the
string is all digits

What is a method?

A special function associated variable/value

```
>>> msg = "hello"
>>> len(msg)
5
>>> msg.isdigit()
False
>>>
```

Both the regular function (len) and method (isdigit) are answering a question about the string in msg, but we call them slightly differently

What is a method?

A special function associated variable/value

```
>>> msg = "hello"
>>> len(msg)
5
>>> msg.isdigit()
False
>>> msg.upper()
'HELLO'
```

is upper a regular function or a method?

What is a method?

A special function associated variable/value

```
>>> msg = "hello"
>>> len(“220”)
3
>>> “220”.isdigit()
True
>>> “Hello World”.upper()
‘HELLO WORLD’
```

methods can be called with literal values as well as with values in variables

String Method	Purpose
s.upper()	change string to all upper case
s.lower()	opposite of upper()
s.strip()	remove whitespace (space, tab, etc) before and after
s.lstrip()	remove whitespace from left side
s.rstrip()	remove whitespace from right side
s.format(args…)	replace instances of “{}” in string with args
s.find(needle)	find index of needle in s
s.startswith(prefix)	does s begin with the given prefix?
s.endswith(suffix)	does s end with the given suffix?
s.replace(a, b)	replace all instances of a in s with b

Quick demos…

Do problem 2

Today's Outline

Comparison

String Methods

Sequences

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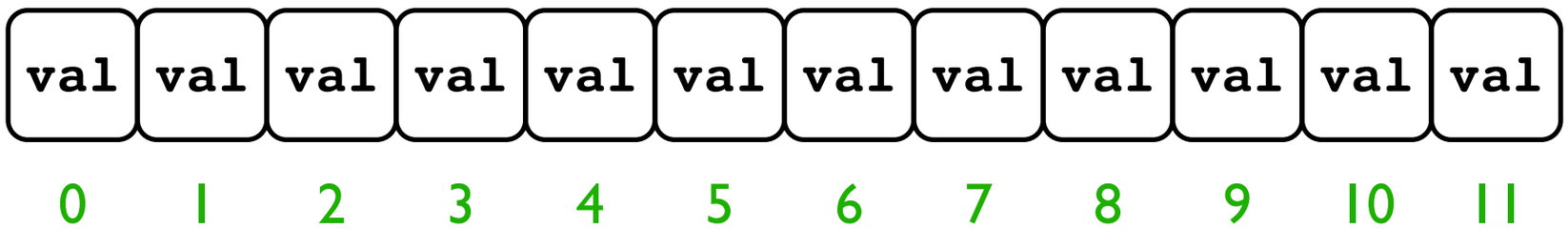
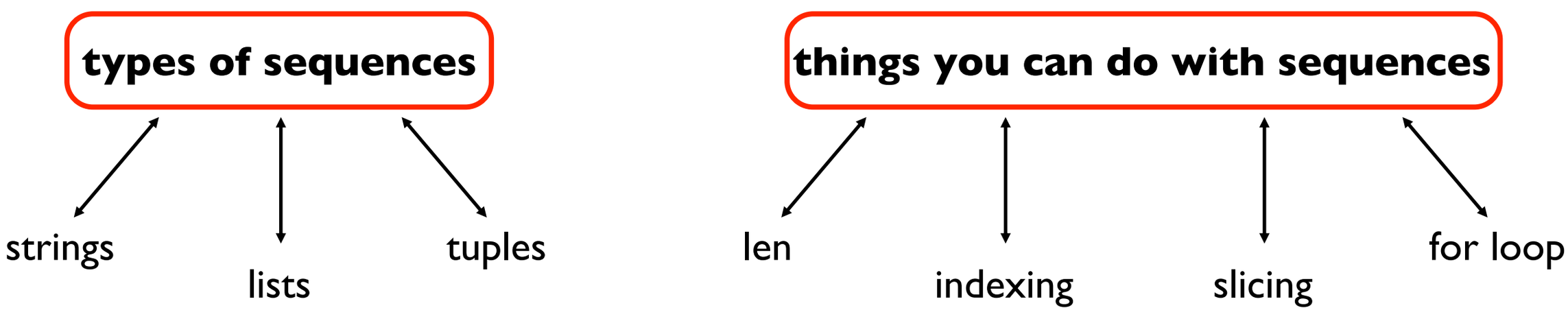
for loop over range

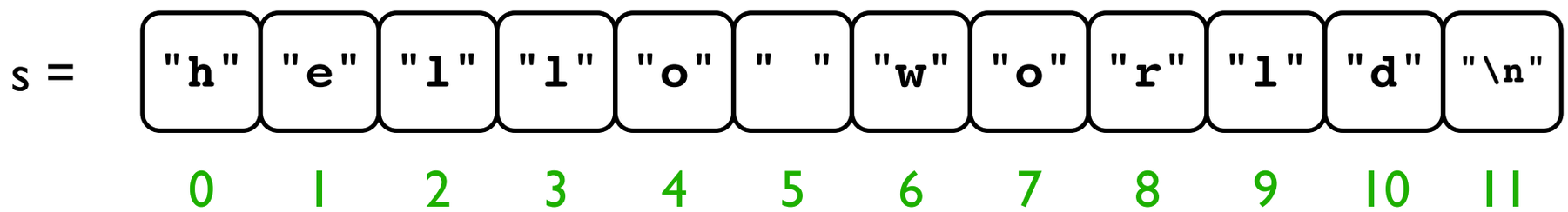
Python Sequences



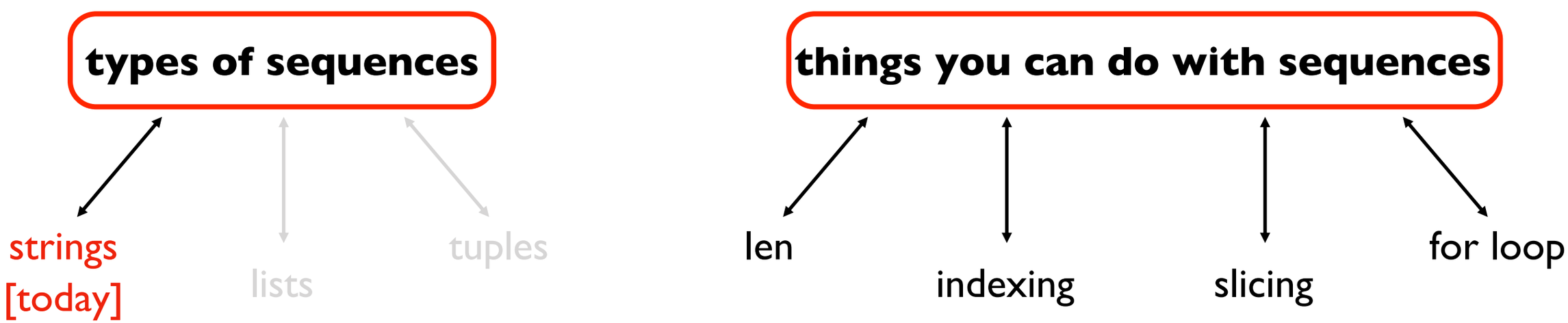
Definition: a *sequence* is a collection of numbered/ordered values



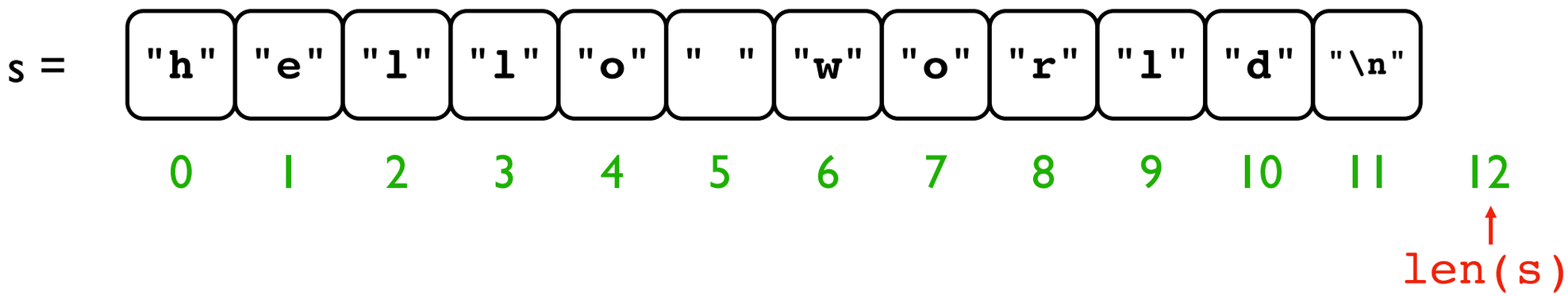
Python Sequences



Definition: a *string* is a sequence of one-character strings



Python Sequences



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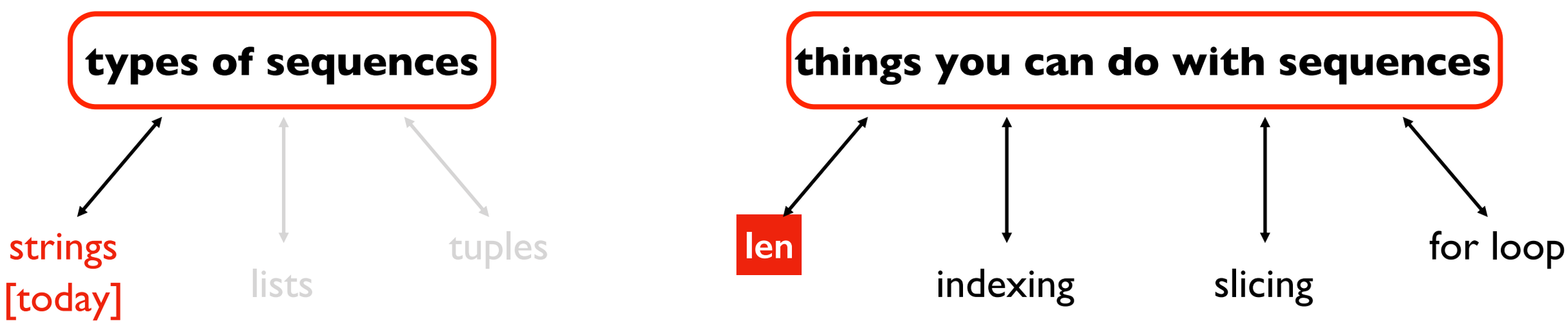
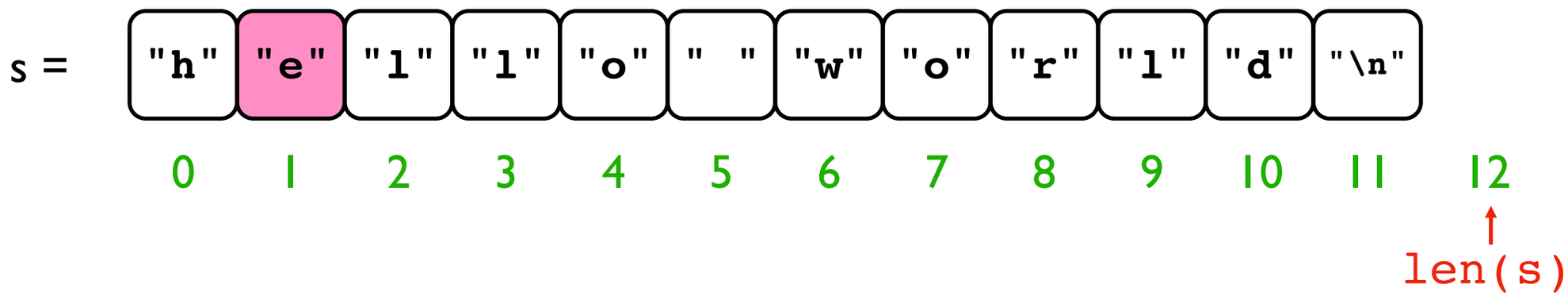


Python Sequences

indexing: access one value



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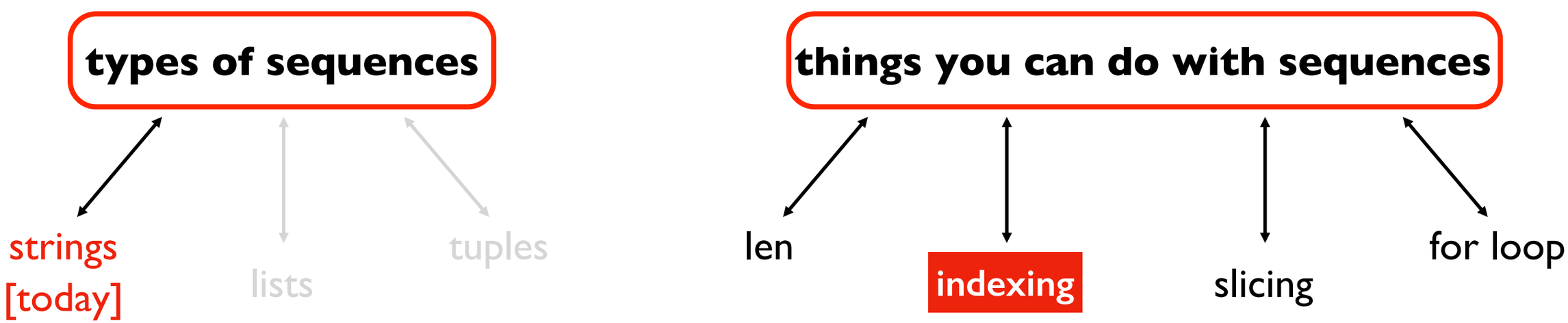
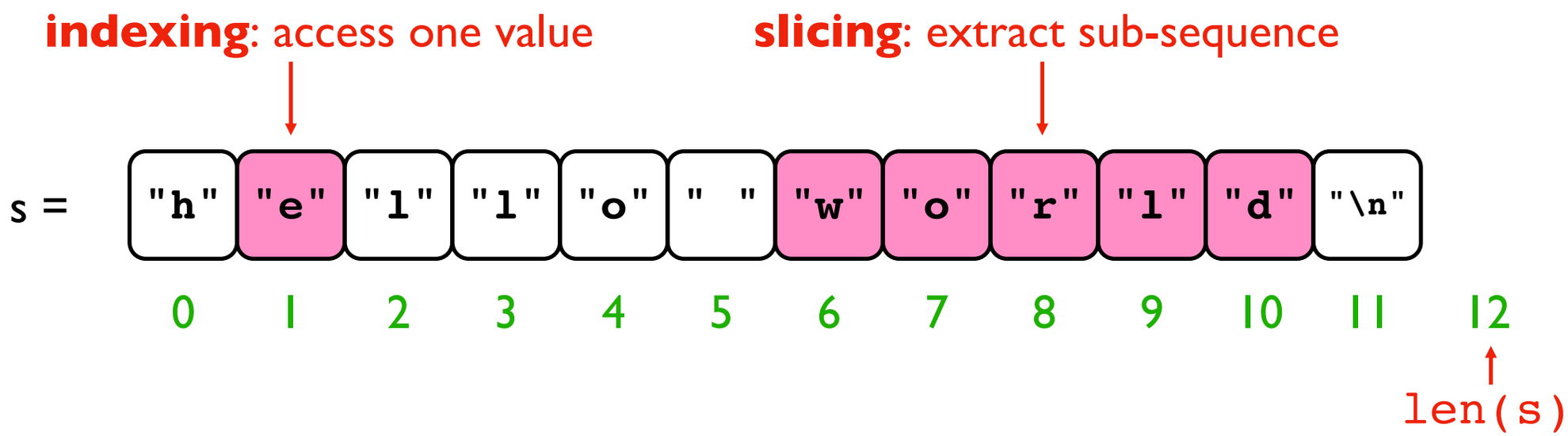


Python Sequences



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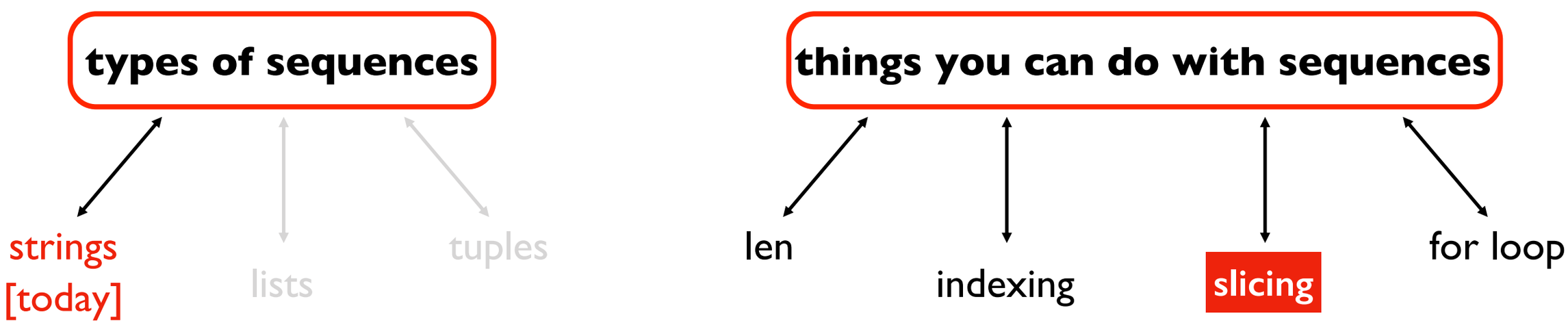
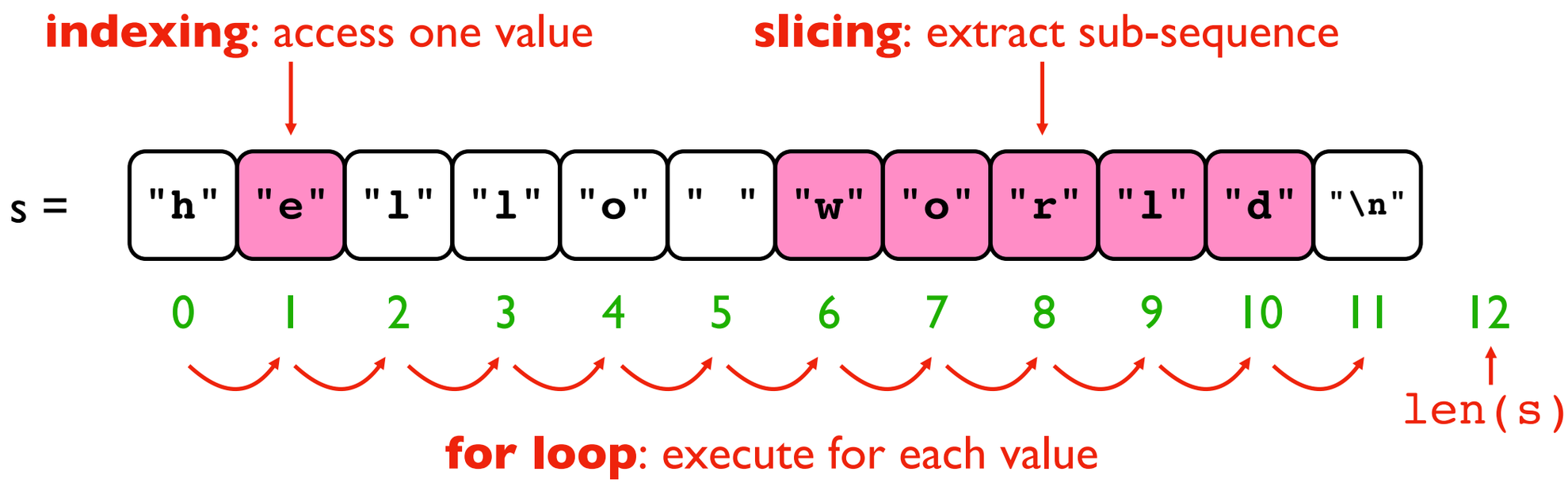


Python Sequences



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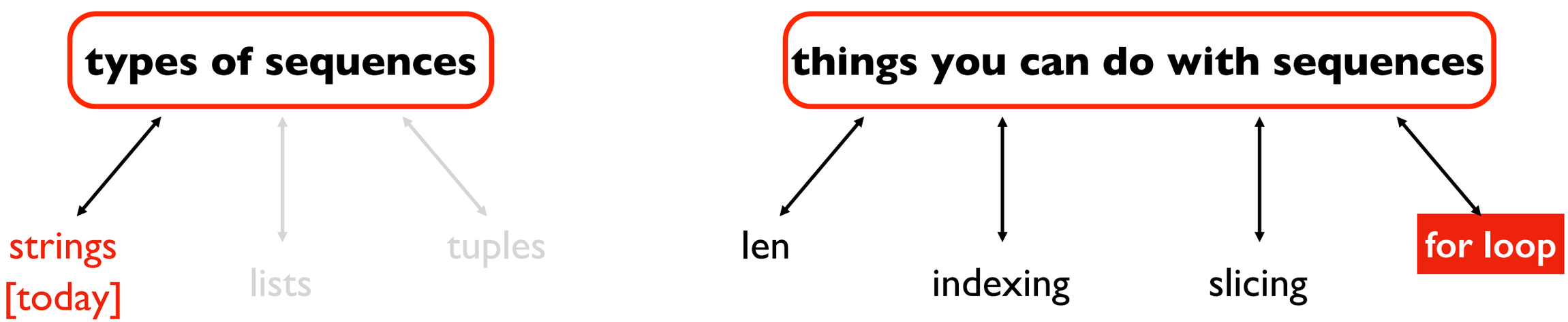
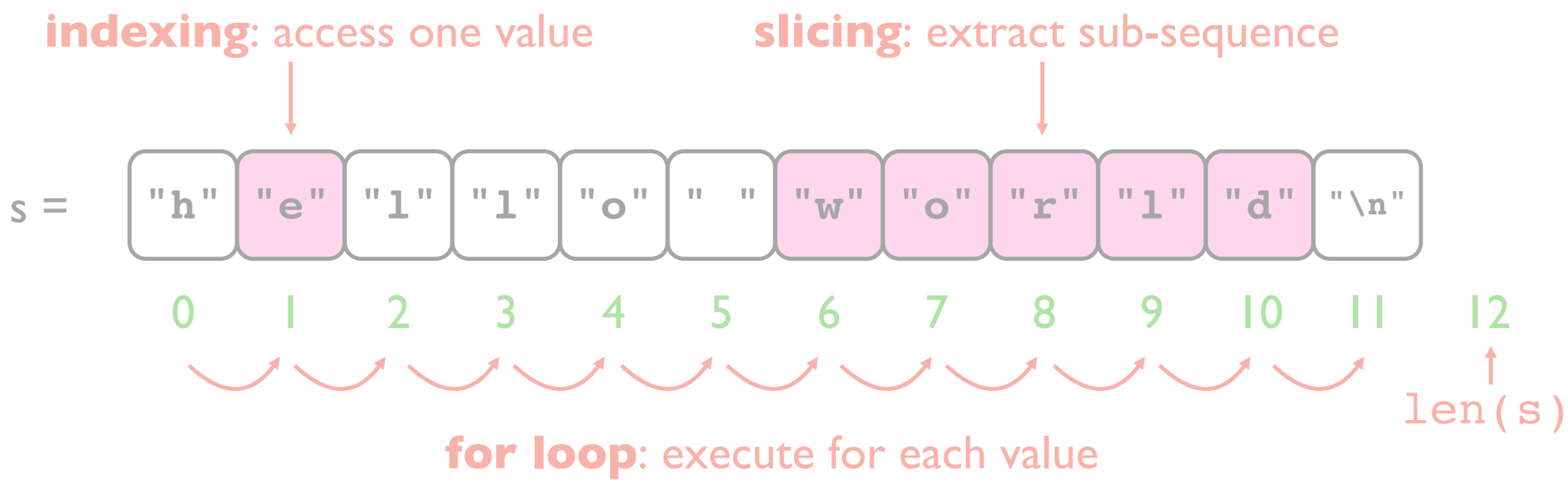


Python Sequences



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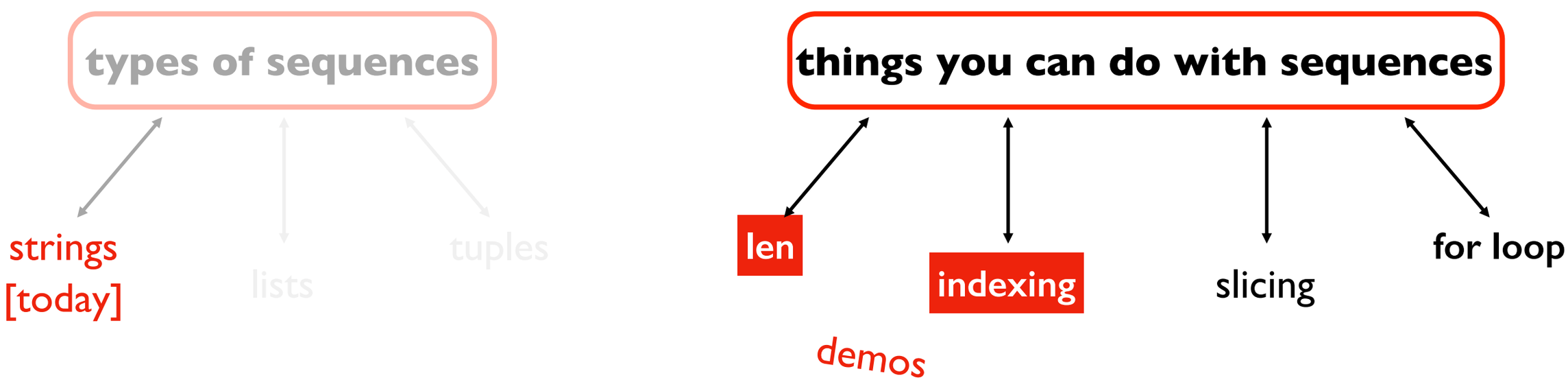
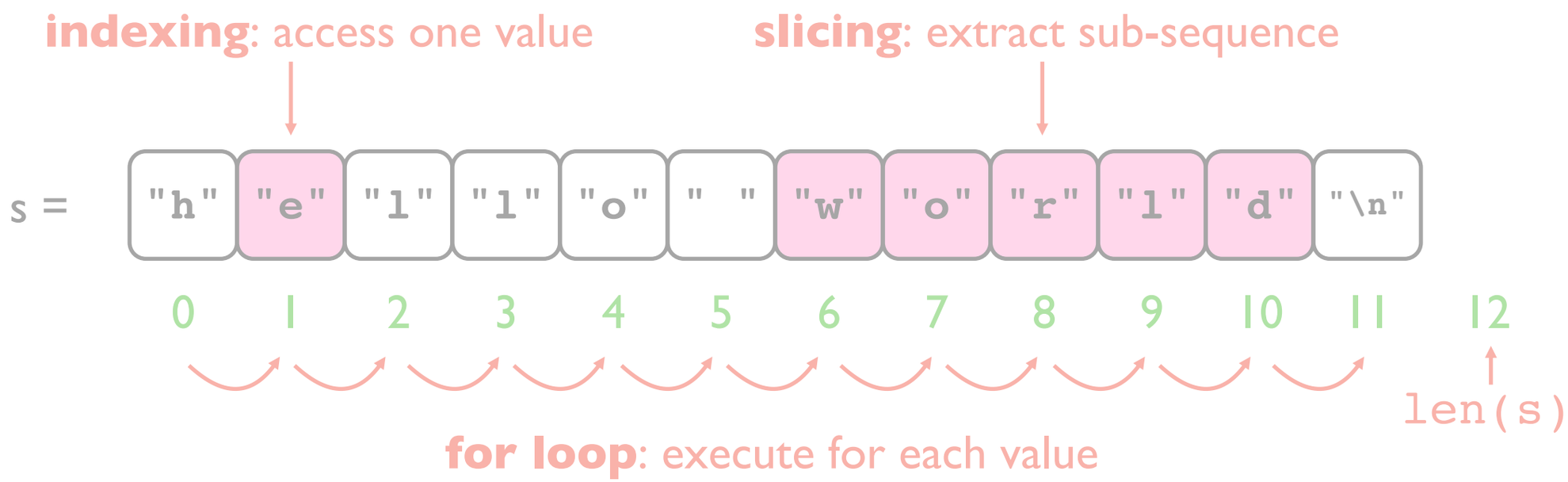


Do problem 3

Python Sequences



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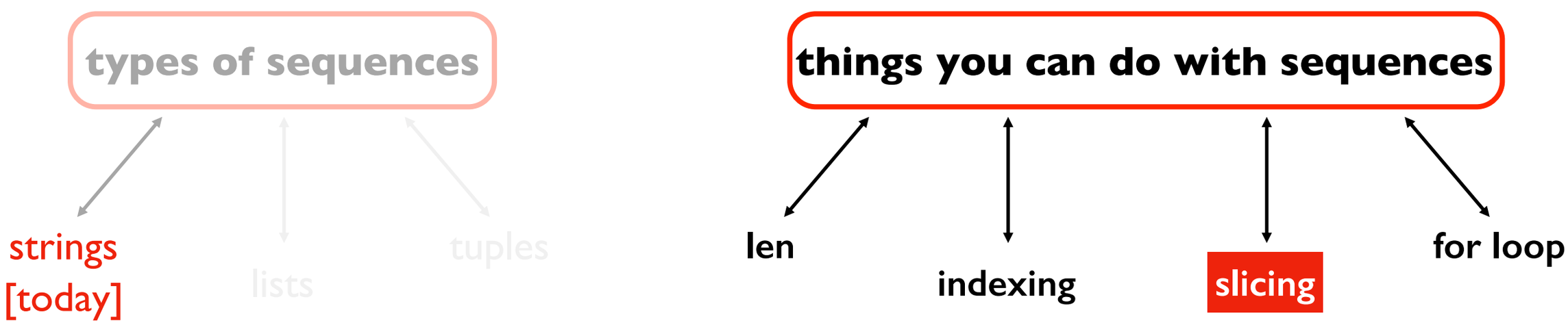


Today's Outline

Comparison

String Methods

Sequences

Slicing

for loop over sequence

for loop over range

Indexing

	0	1	2	3	4
S:	**P**	**I**	**Z**	**Z**	**A**
	-5	-4	-3	-2	-1

Code:

```
S = “PIZZA”
```

Indexing

	0	1	2	3	4
S:	**P**	**I**	**Z**	**Z**	**A**
	-5	-4	-3	-2	-1

S[0] → "P"

Indexing

	0	1	2	3	4
S:	**P**	**I**	**Z**	**Z**	**A**
	-5	-4	-3	-2	-1

S[1] → "I"

Indexing

	0	1	2	3	4
S:	**P**	**I**	**Z**	**Z**	**A**
	-5	-4	-3	-2	-1

S[-1] → "A"

Slicing

	0	1	2	3	4
S:	**P**	**I**	**Z**	**Z**	**A**
	-5	-4	-3	-2	-1

`S[???]` → `"IZZ"`

what to put if we want multiple letters, like "IZZ"?

Slicing

start is “inclusive”
end is “exclusive”

	0	1	2	3	4
S:	**P**	**I**	**Z**	**Z**	**A**
	-5	-4	-3	-2	-1

`S[1:4]` → “IZZ”

Slicing

	0	1	2	3	4
S:	**P**	**I**	**Z**	**Z**	**A**
	-5	-4	-3	-2	-1

`S[1:4]` → `"IZZ"`

Many different slices give the same result:
S[1:4] == S[1:-1] == S[-4:4] == S[-4:-1]

Slicing

S:

0	1	2	3	4
P	I	Z	Z	A
-5	-4	-3	-2	-1

```
S[1:100]
```

→ "IZZA"

Slices don't complain about out-of-range numbers.
You just don't get data for that part

Slicing

	0	1	2	3	4
S:	**P**	**I**	**Z**	**Z**	**A**
	-5	-4	-3	-2	-1

`S[50:100]` → “”

Slices don’t complain about out-of-range numbers.
You just don’t get data for that part

Slicing

S:

0	1	2	3	4
P	**I**	**Z**	**Z**	**A**
-5	-4	-3	-2	-1

`S[ : 2]` → `"PI"`

Feel free to leave out one of the numbers in the slice

Slicing

	0	1	2	3	4
S:	**P**	**I**	**Z**	**Z**	**A**
	-5	-4	-3	-2	-1

`S[2 : ]` → "ZZA"

Feel free to leave out one of the numbers in the slice

Slicing

	0	1	2	3	4
S:	**P**	**I**	**Z**	**Z**	**A**
	-5	-4	-3	-2	-1

`S[2 : ]` → "ZZA"

Inclusive start and exclusive end makes it easier to split and inject things

Slicing

let's inject "…" here

S:

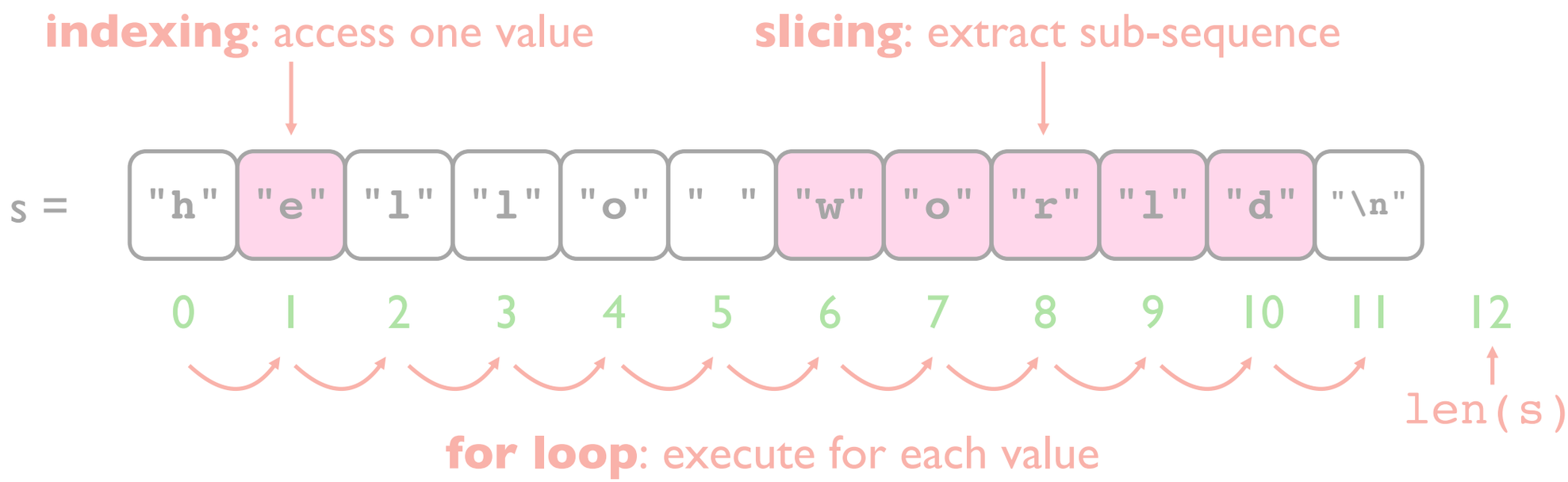
0	1	2	3	4
P	I	Z	Z	A
-5	-4	-3	-2	-1

`S[:3] + "…" + S[3:]` → `"PIZ...ZA"`

Inclusive start and exclusive end makes it easier to split and inject things

Do problem 4

Python Sequences



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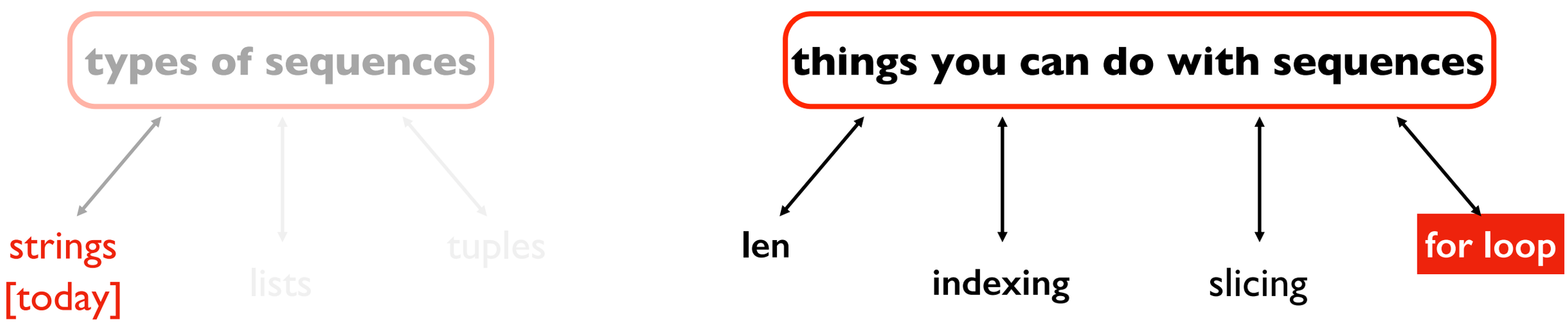

Today's Outline

Comparison

String Methods

Sequences

Slicing

for loop over sequence

for loop over range

Motivation

```
msg = "hello"

# let’s say we want to print
# each letter on its own line
```

Motivation

```
msg = "hello"

i = 0
while i < len(msg):
    ???
    i += 1
```

indexing starts at 0, so msg[0] is ‘h’,
so we want to start i at 0

last letter (o) has index 4,
or len(msg)-1

we don’t want to skip any letters

Motivation

```
msg = "hello"

i = 0
while i < len(msg):
    letter = msg[i]
    ???
    i += 1
```

get the letter for the current index

Motivation

```
msg = "hello"

i = 0
while i < len(msg):
    letter = msg[i]
    print(letter)
    i += 1
```

this is the only interesting part
(we just want to print each letter!)

Code like this for sequences is so common
that Python provides an easier way, with the **for loop**

while vs. for

while loop

```
msg = "hello"

i = 0
while i < len(msg):
    letter = msg[i]
    print(letter)
    i += 1
```

this happens automatically now

for loop

```
for letter in msg:
    print(letter)
```

they do the same thing!

for syntax

automatically initialized to a different item on each iteration ("h" on 1st, "e" on 2nd, etc)

the sequence (e.g., "hello")

for loop

```
for letter in msg:
    print(letter)
```

basic syntax always used

specify a variable name to use inside the loop, and the sequence you want to loop over

for syntax

do PythonTutor example

automatically initialized to a different item on each iteration ("h" on 1st, "e" on 2nd, etc)

the sequence (e.g., "hello")

for loop

```
for letter in msg:
    print(letter)
```

specify a variable name to use inside the loop, and the sequence you want to loop over

Do problem 5

Today's Outline

Comparison

String Methods

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for loop over sequence

for loop over range

for with range

```
msg = “01234”

for item in msg:
    print(item * 3)
```

Output:

```
000
111
222
333
444
```

what if we want to iterate over the integers 0 to 4 (instead of string digits “0” to “4”)?

for with range

```
for item in range(5):
    print(item * 3)
```

Output:

0
3
6
9
12

what if we want to iterate over the integers 0 to 4 (instead of string digits “0” to “4”)?

for with range

```
for item in range(5):
    print(item * 3)
```

Output:

0
3
6
9
12

using `range(N)` with a `for` loop will iterate with these values for item:
0, 1, 2, …, N-2, N-1

Do problem 6