8. Iteration: Strings

Topics:

- Using Methods from the string class
- Iterating through a string with `for`

Iterating Through a String

Two problems we cannot easily solve:

1. Given a string `s`, assign to `t` the "reversed" string. `'abcd'` → `'dcba'`
2. Given a string `s`, how many digit characters does it contain? `'1or2or3'` → `3`

The Reverse String Problem

```
s = 'abcd'
t = ''
for c in s:
    t = c + t
```

s -> `'abcd'`

t -> `'dcba'`

How does the `for` loop work?

The Number-of-Digits Problem

```
s = '2x78y'
n = 0
for c in s:
   if c.isdigit():
      n=n+1
```

s -> `'2x78y'`

n -> `3`

How does the `for` loop work?

Using for to Traverse a String Character-by-Character

```
s = 'abcd'
for c in s:
   print c
```

Output:

```
a
b
c
d
```

In this example, the "for-loop" variable is `c`. One at a time, it takes on the value of each character in `s`.

The Reverse String Problem

```
s = 'abcd'
t = ''
for c in s:
   t = c + t
print t
```

s -> `'abcd'`

t -> `''`

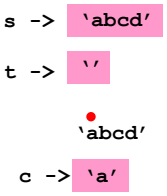
`'abcd'`

c -> `'a'`

At the start of the loop, `c` is assigned the zeroth character in `s`.

The Reverse String Problem

```
s = 'abcd'
t = ''
for c in s:
    t = c + t
print t
```



The loop body is executed using that value in c.

The Reverse String Problem

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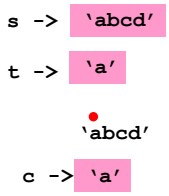
t = ''
for c in s:
    t = c + t
print t
```



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t = ''
for c in s:
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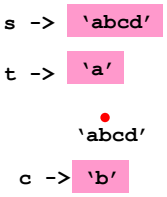
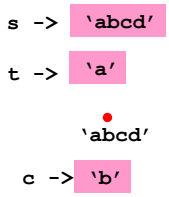
print t
```



The next time through the loop, c is assigned the first character in s.

The Reverse String Problem

```
s = 'abcd'
t = ''
for c in s:
    t = c + t
print t
```



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The Reverse String Problem

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t = ''
for c in s:
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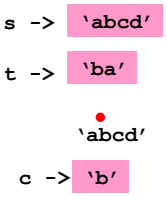
print t
```



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The Reverse String Problem

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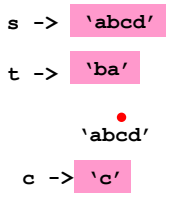
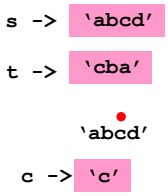
t = ''
for c in s:
    t = c + t
print t
```



The next time through the loop, c is assigned the second character in s.

The Reverse String Problem

```
s =  'abcd'
t = ''
for c in s:
   t = c + t
print t
```



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The Reverse String Problem

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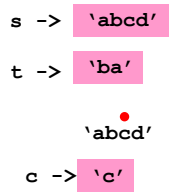
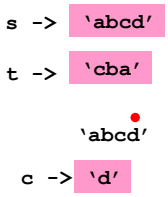
s =  'abcd'
t = ''
for c in s:
   t = c + t
print t
```



The loop body is executed using that value in c.

The Reverse String Problem

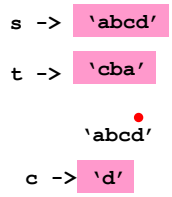
```
s =  'abcd'
t = ''
for c in s:
   t = c + t
print t
```



The last time through the loop, c is assigned the third character in s.

The Reverse String Problem

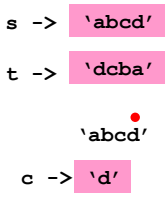
```
s =  'abcd'
t = ''
for c in s:
   t = c + t
print t
```



The loop body is executed using that value in c.

The Reverse String Problem

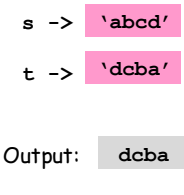
```
s =  'abcd'
t = ''
for c in s:
   t = c + t
print t
```



The loop body is executed using that value in c.

The Reverse String Problem

```
s =  'abcd'
t = ''
for c in s:
   t = c + t
print t
```



The string has been traversed. The iteration ends. The next statement after the loop is executed. Indentation important.

for-loop Mechanics

```
for <loop variable> in <string>:
```

Loop Body

If the string has length n, then the loop body is executed n times.

for-loop Mechanics

```
for x in y:
```

Loop Body

Let x = y[0] and then execute the loop body.
Let x = y[1] and then execute the loop body.
Let x = y[2] and then execute the loop body.
etc
Let x = y[n-1] and then execute the loop body.

Function for Reversing Strings

```
def Reverse(s):
    """ Returns a string that is obtained
    from s by reversing the order of its
    characters.

    Precondition: s is a string."""

    t = ''        # The empty string
    for c in s:
        t = c+t   # Repeated concatenation
    return t
```

The Number-of-Digits Problem

Given a string s, how many of its characters are digit characters?

'a10b20c30d40' → 8

The Number-of-Digits Problem

```
s =  '2z78y'
n = 0
for x in s:
    if x.isdigit():
        n=n+1
print n
```

s -> '2z78y'

n -> 0

x -> '2'

'2z78y'

At the start of the loop, x is assigned the zeroth character in s.

The Number-of-Digits Problem

```
s =  '2z78y'
n = 0
for x in s:
    if x.isdigit():
        n=n+1
print n
```

s -> '2z78y'

n -> 0

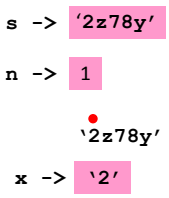
x -> '2'

'2z78y'

The loop body is executed using that value in x.

The Number-of-Digits Problem

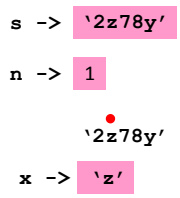
```
s = '2z78y'
n = 0
for x in s:
    if x.isdigit():
        n=n+1
print n
```



The loop body is executed using that value in **x**.

The Number-of-Digits Problem

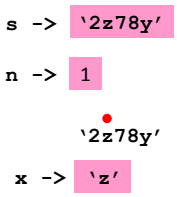
```
s = '2z78y'
n = 0
for x in s:
    if x.isdigit():
        n=n+1
print n
```



The next time through the loop, **x** is assigned the first character in **s**.

The Number-of-Digits Problem

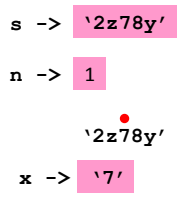
```
s = '2z78y'
n = 0
for x in s:
    if x.isdigit():
        n=n+1
print n
```



The loop body is executed using that value in **x**.

The Number-of-Digits Problem

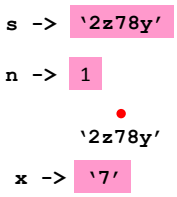
```
s = '2z78y'
n = 0
for x in s:
    if x.isdigit():
        n=n+1
print n
```



The next time through the loop, **x** is assigned the second character in **s**.

The Number-of-Digits Problem

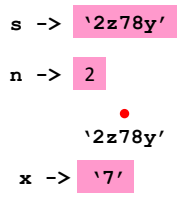
```
s = '2z78y'
n = 0
for x in s:
    if x.isdigit():
        n=n+1
print n
```



The loop body is executed using that value in **x**.

The Number-of-Digits Problem

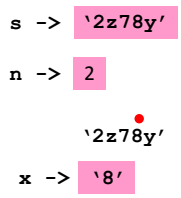
```
s = '2z78y'
n = 0
for x in s:
    if x.isdigit():
        n=n+1
print n
```



The loop body is executed using that value in **x**.

The Number-of-Digits Problem

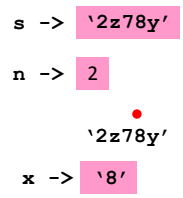
```
s = '2z78y'
n = 0
for x in s:
    if x.isdigit():
        n=n+1
print n
```



The next time through the loop, **x** is assigned the third character in **s**.

The Number-of-Digits Problem

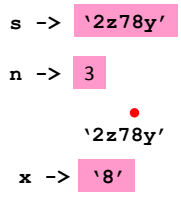
```
s = '2z78y'
n = 0
for x in s:
    if x.isdigit():
        n=n+1
print n
```



The loop body is executed using that value in **x**.

The Number-of-Digits Problem

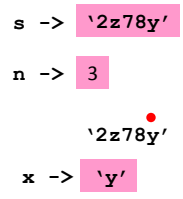
```
s = '2z78y'
n = 0
for x in s:
    if x.isdigit():
        n=n+1
print n
```



The loop body is executed using that value in **x**.

The Number-of-Digits Problem

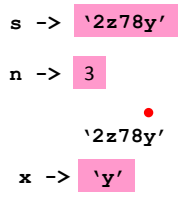
```
s = '2z78y'
n = 0
for x in s:
    if x.isdigit():
        n=n+1
print n
```



The next time through the loop, **x** is assigned the fourth character in **s**.

The Number-of-Digits Problem

```
s = '2z78y'
n = 0
for x in s:
    if x.isdigit():
        n=n+1
print n
```

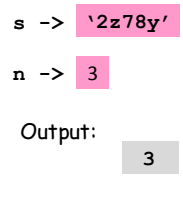


The loop body is executed using that value in **x**.

The Number-of-Digits Problem

```
s = '2z78y'
n = 0
for x in s:
    if x.isdigit():
        n=n+1

print n
```



The string has been traversed. The iteration ends. The next statement after the loop is executed. Indentation important.

Function for Counting Digits

```
def nDigits(s):
  """ Returns an int whose value is the
  number of digit characters that are in
  s.

  Precondition: s is a string."""
  n = 0;
  for c in s:
      # Increment n if c is a digit
      if c.isdigit():
          n=n+1
  return n
```