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.  
   `$abcd$ $\rightarrow$ `dcba`

2. Given a string $s$, how many digit characters does it contain?  
   `1or2or3` $\rightarrow$ 3

The Reverse String Problem

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

Output:
```
abcd
```

How does the for loop work?

The Number-of-Digits Problem

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

Output:
```
3
```

How does the for loop work?

Using for to Traverse a String Character-by-Character

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

Output:
```
a
b
 ```

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

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

Output:
```
abcd
```

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

```
abc
d
```
The Reverse String Problem

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

c -> 'a'  

The loop body is executed using that value in c.

s -> 'abcd'
t = 'a'
for c in s:
  t = c + t
print t

c -> 'b'

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

s -> 'abcd'
t = 'ba'
for c in s:
  t = c + t
print t

c -> 'b'

The loop body is executed using that value in c.

s -> 'abcd'
t = 'ba'
for c in s:
  t = c + t
print t

c -> 'c'

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
    c -> 'c'
```

The loop body is executed using that value in c.

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

The loop body is executed using that value in c.

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

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

The loop body is executed using that value in c.
**for-loop Mechanics**

for <loop variable> in <string>:

    Loop Body

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

**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
    x = x[1]
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

x = '2'
The loop body is executed using that value in x.

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

x = 'z'
The loop body is executed using that value in x.

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

x = '7'
The loop body is executed using that value in x.

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

x = 'y'
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 loop body is executed using that value in x.

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

```python
def nDigits(s):
    """ Returns an int whose value is the number of digit characters that are in s. """
    n = 0;
    for c in s:
        # Increment n if c is a digit
        if c.isdigit():
            n+=1
    return n
```

Precondition: s is a string."""