COMP 141

Strings

Rhodes College

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Announcements

- Program 6 has been assigned
  - Due Tuesday, March 27th by 11:55pm via Moodle

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Lab from Last Time

Basic String Operations

- Many types of programs perform operations on strings
  - So far we've only really seen strings as input/output
- In Python, many tools for examining and manipulating strings
  - Strings are sequences, so many of the tools that work with sequences work with strings

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Strings are built from characters

The string "Computer" is represented internally like this:

"C"	"o"	"m"	"p"	"u"	"t"	"e"	"r"

- Each piece of a string is called a ***character***.
- A character is a special kind of string that is made up of exactly one letter, number, or symbol.

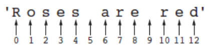
Accessing Characters

Each character in a string is numbered by its position:

0	1	2	3	4	5	6	7
"C"	"o"	"m"	"p"	"u"	"t"	"e"	"r"

The numbers shown here above the characters are called ***indices*** (singular: index) or ***positions***.

Figure 9-2 String indexes



```
myString = "Roses are red"
ch = myString[6]      #ch is now equal to 'a'
```

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Accessing Characters

0	1	2	3	4	5	6	7
"C"	"o"	"m"	"p"	"u"	"t"	"e"	"r"

- There is a separate variable for each character in the string, which is the string variable followed by [ ] with an integer in the middle.

```
my_string = "Computer"
print(my_string[0])   # prints C
print(my_string[7])   # prints r
```

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Accessing Characters

0	1	2	3	4	5	6	7
"C"	"o"	"m"	"p"	"u"	"t"	"e"	"r"

- These individual variables can be used just like regular variables, ***except*** **you cannot assign to them**.

```
my_string = "Computer"
my_string[0] = "B"  # illegal!
```

String are ***immutable*** (unchangeable)
- Once they are created, they cannot be changed

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Accessing Characters

0	1	2	3	4	5	6	7
“C”	“o”	“m”	“p”	“u”	“t”	“e”	“r”

- You can print them, assign them to variables, pass them to functions, etc.

```
my_string = "Computer"
first = my_string[0]
third = my_string[2]
print(first, third, my_string[4])
```

0	1	2	3	4	5	6	7
"C"	"o"	"m"	"p"	"u"	"t"	"e"	"r"

```
def which_first(letter1, letter2):
  if letter1 < letter2:
    return letter1
  else:
    return letter2

def main():
  s = "Computer"
  earlier = which_first(s[6], s[3])
  print(earlier, "comes earlier in the alphabet.")
```

Another Example

```
name = input(“What is your name?”)
initial = name[0]
print(“The first initial of your name
is”, initial)
```

```
Sample Output:
What is your name? Catie
The first initial of your name is C
```

Getting the Length of a String

- `IndexError` exception will occur if:
  - You try to use an index that is out of range for the string
    - Likely to happen when loop iterates beyond the end of the string
- `len(`***`string`***`)` function can be used to obtain the length of a string
  - Useful to prevent loops from iterating beyond the end of a string

```
myString = “Hello World”
n = len(myString)
print(myString[n+1])      #This will cause an IndexError
print(myString[n])        #This will also cause an IndexError
```

Getting the Length of a String

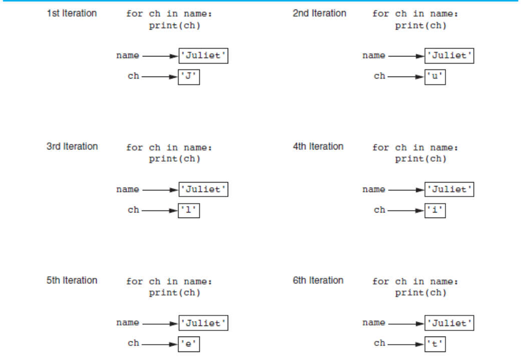
- Assume s is a string variable
- `len (s)` returns the length of s
- `len(“Computer”)` returns 8
- `len(“A B C”)` returns ??? 5
- `len(“”)` returns ??? 0
- `len` uses return, meaning if you want to capture the length, you should save the return value in a variable

Loops over Strings

- Wanting to be able to access characters one at a time naturally leads to using a loop to process strings

- Use a `for` loop
  - Format: `for` *`character`* `in` *`string`*`:`
  - Useful when need to iterate over the whole string, such as to count the occurrences of a specific character

Figure 9-1 Iterating over the string `'Juliet'`



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```
# This program counts the number of times
# the letter T (uppercase or lowercase)
# appears in a string.

def main():
    # Create a variable to use to hold the count.
    # The variable must start with 0.
    count = 0

    # Get a string from the user.
    my_string = input('Enter a sentence: ')

    # Count the Ts.
    for ch in my_string:
        if ch == 'T' or ch  == 't':
            count += 1

    # Print the result.
    print('The letter T appears', count, 'times.')

# Call the main function.
main()
```

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```
# This program counts the number of times
# the letter T (uppercase or lowercase)
# appears in a string.

def main():
    # Create a variable to use to hold the count.
    # The variable must start with 0.
    count = 0

    # Get a string from the user.
    my_string = input('Enter a sentence: ')

    # Count the Ts.
    for ind in range(0, len(my_string)):
        ch = my_string[ind]
        if ch == 'T' or ch  == 't':
            count += 1

    # Print the result.
    print('The letter T appears', count, 'times.')

# Call the main function.
main()
```

You can also access individual characters by index and loop over the range of all possible indices.

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Practice

- Write a loop to count the number of capital letter A's in a string.
- Write a loop to count capital or lowercase A's.
- Write a loop to print all the letters in a string in reverse order
- Write a loop to print every other character in a string, starting with the first.

String Testing Methods

Table 9-1 Some string testing methods

Method	Description
`isalnum()`	Returns true if the string contains only alphabetic letters or digits and is at least one character in length. Returns false otherwise.
`isalpha()`	Returns true if the string contains only alphabetic letters, and is at least one character in length. Returns false otherwise.
`isdigit()`	Returns true if the string contains only numeric digits and is at least one character in length. Returns false otherwise.
`islower()`	Returns true if all of the alphabetic letters in the string are lowercase, and the string contains at least one alphabetic letter. Returns false otherwise.
`isspace()`	Returns true if the string contains only whitespace characters, and is at least one character in length. Returns false otherwise. (Whitespace characters are spaces, newlines (`\n`), and tabs (`\t`).
`isupper()`	Returns true if all of the alphabetic letters in the string are uppercase, and the string contains at least one alphabetic letter. Returns false otherwise.

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Example using isupper()

```
# This program counts the number of times
# the an uppercase letter appears in a string.

def main():
    # Create a variable to use to hold the count.
    # The variable must start with 0.
    count = 0

    # Get a string from the user.
    my_string = input('Enter a sentence: ')

    # Count the uppercase letters
    for ch in my_string:
        if ch.isupper():
            count += 1

    # Print the result.
    print(count, 'of the letters were uppercase.')

# Call the main function.
main()
```

String Modification Methods

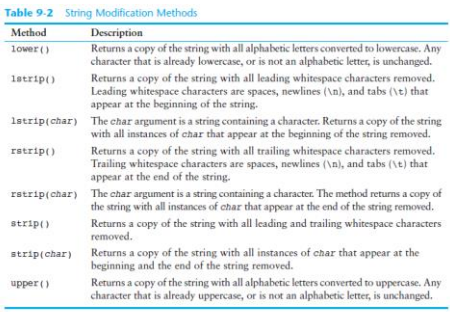

Table 9-2 String Modification Methods

Method	Description
`lower()`	Returns a copy of the string with all alphabetic letters converted to lowercase. Any character that is already lowercase, or is not an alphabetic letter, is unchanged.
`lstrip()`	Returns a copy of the string with all leading whitespace characters removed. Leading whitespace characters are spaces, newlines (`\n`), and tabs (`\t`) that appear at the beginning of the string.
`lstrip(char)`	The *char* argument is a string containing a character. Returns a copy of the string with all instances of *char* that appear at the beginning of the string removed.
`rstrip()`	Returns a copy of the string with all trailing whitespace characters removed. Trailing whitespace characters are spaces, newlines (`\n`), and tabs (`\t`) that appear at the end of the string.
`rstrip(char)`	The *char* argument is a string containing a character. The method returns a copy of the string with all instances of *char* that appear at the end of the string removed.
`strip()`	Returns a copy of the string with all leading and trailing whitespace characters removed.
`strip(char)`	Returns a copy of the string with all instances of *char* that appear at the beginning and the end of the string removed.
`upper()`	Returns a copy of the string with all alphabetic letters converted to uppercase. Any character that is already uppercase, or is not an alphabetic letter, is unchanged.

Example

```
shape = input(“Enter shape: Sphere or Cube ”)
shape = shape.lower()
if shape == ‘sphere’ or shape == ‘cube’:
      validShape = True
else:
      validShape = False
```