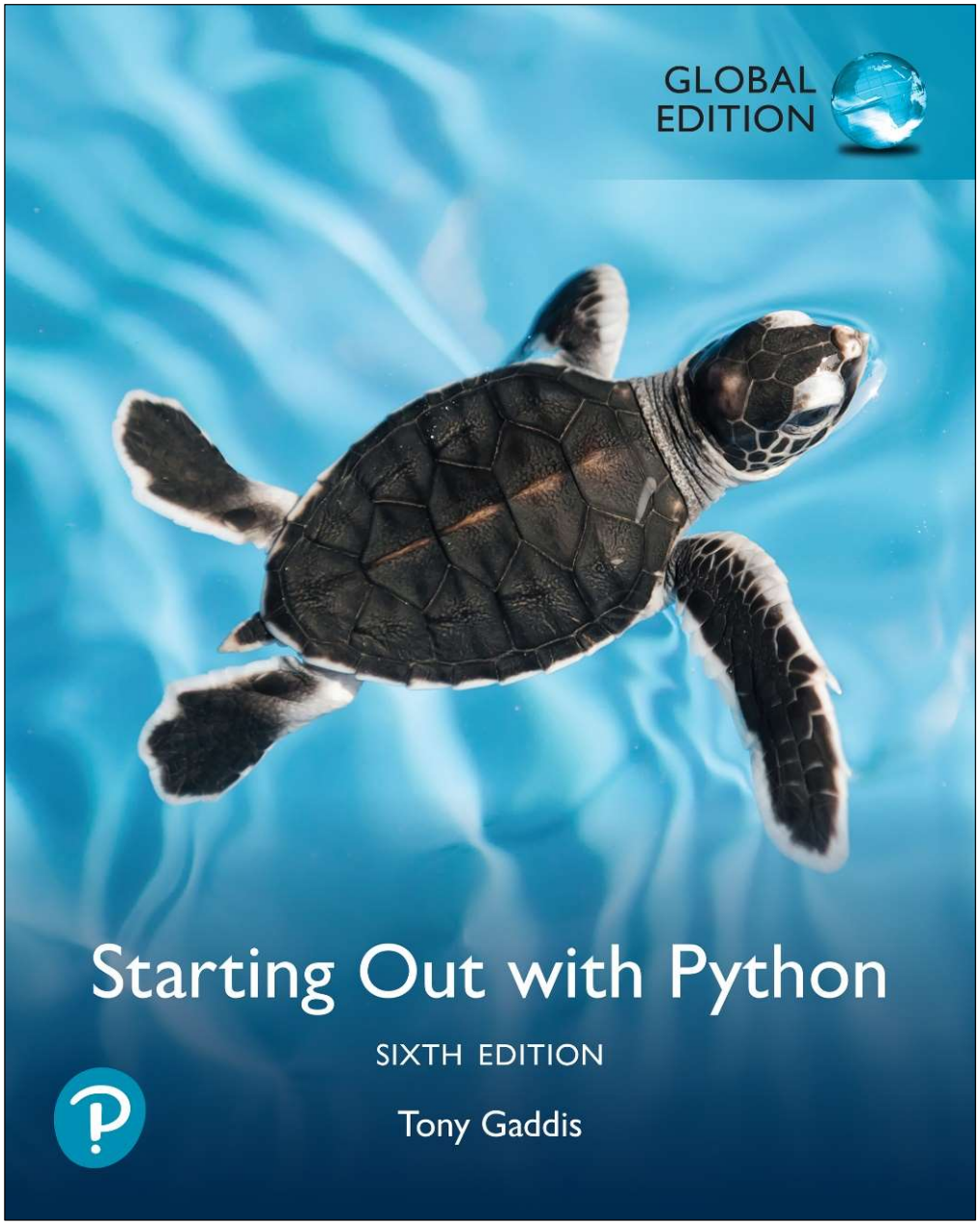
CHAPTER 8

More About Strings



Topics

- **Basic String Operations**
- **String Slicing**
- **Testing, Searching, and Manipulating Strings**

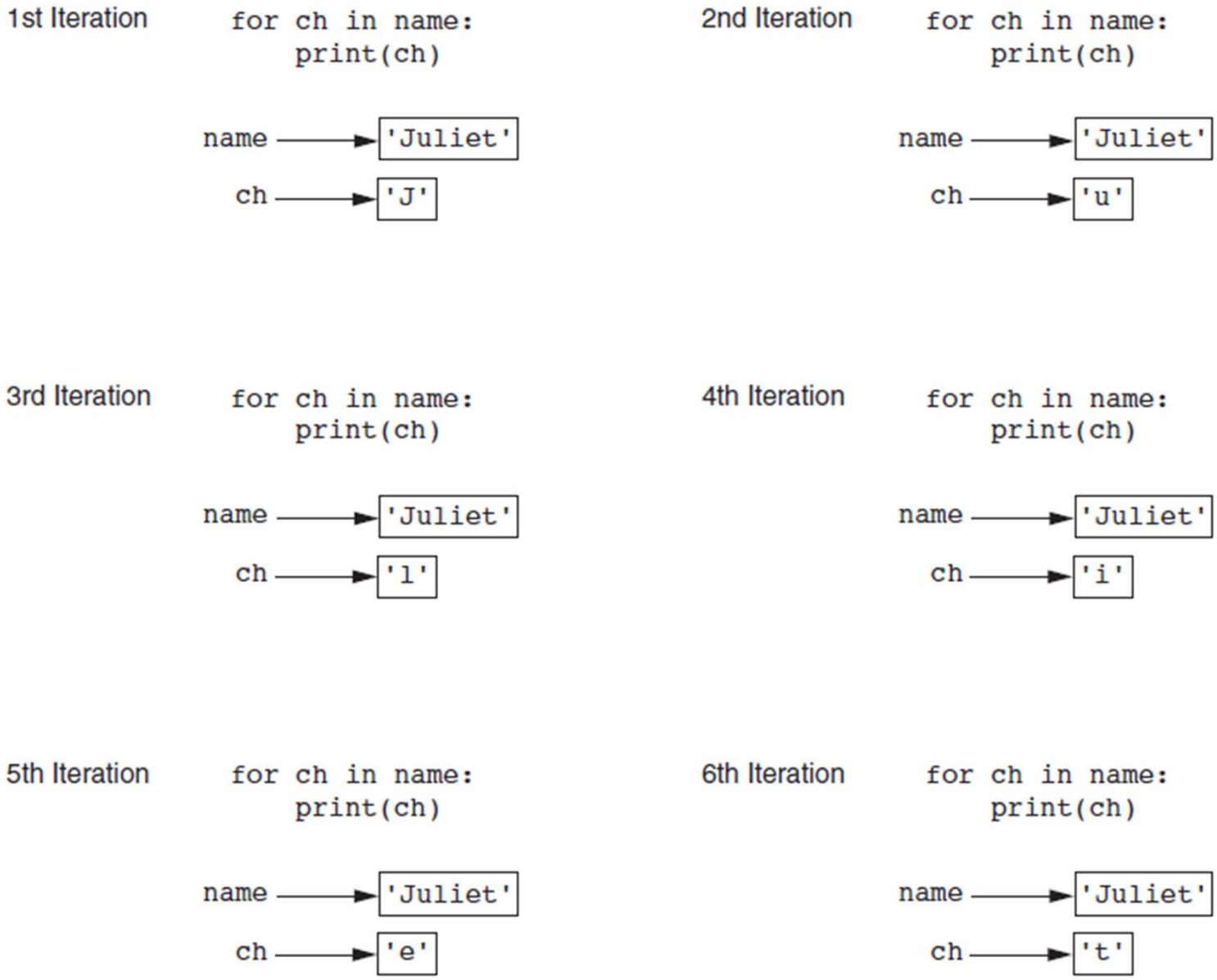
Basic String Operations

- **Many types of programs perform operations on strings**
- **In Python, many tools for examining and manipulating strings**
  - Strings are sequences, so many of the tools that work with sequences work with strings

Accessing the Individual Characters in a String

- **To access an individual character in a string:**
  - 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
  - Use indexing
    - Each character has an index specifying its position in the string, starting at 0
    - Format: *`character = my_string[i]`*

Figure 8-1 Iterating over the string `'Juliet'`



Accessing the Individual Characters in a String (cont'd.)

Figure 8-2 String indexes

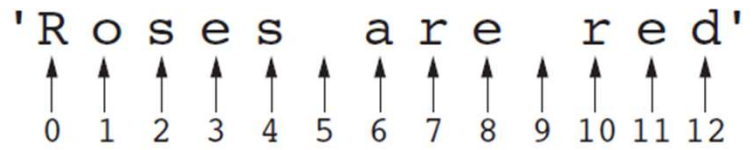
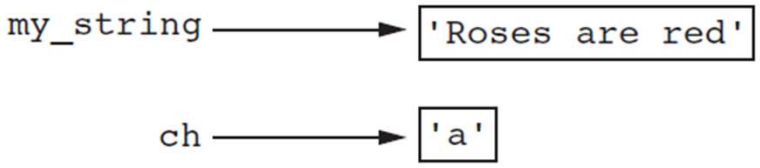


Figure 8-3 Getting a copy of a character from a string



Accessing the Individual Characters in a String (cont'd.)

- **`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

String Concatenation

- **Concatenation: appending one string to the end of another string**
  - Use the + operator to produce a string that is a combination of its operands
  - The augmented assignment operator += can also be used to concatenate strings
    - The operand on the left side of the += operator must be an existing variable; otherwise, an exception is raised

Strings Are Immutable

- **Strings are immutable**
  - Once they are created, they cannot be changed
    - Concatenation doesn't actually change the existing string, but rather creates a new string and assigns the new string to the previously used variable
  - Cannot use an expression of the form
  - `string[index] = new_character`
    - Statement of this type will raise an exception

Strings Are Immutable (cont'd.)

Figure 8-4 The string 'Carmen' assigned to name

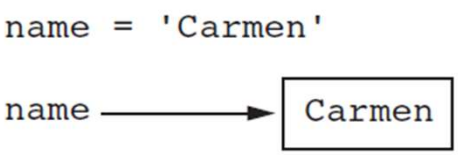
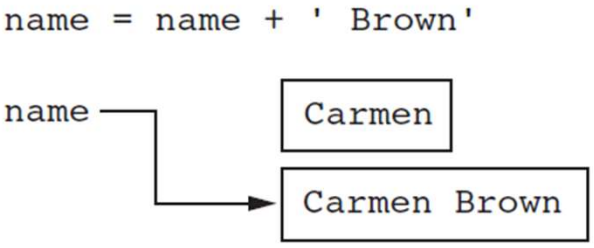


Figure 8-5 The string 'Carmen Brown' assigned to name



String Slicing

- **Slice: span of items taken from a sequence, known as *substring***
  - Slicing format: `string[start : end]`
    - Expression will return a string containing a copy of the characters from `start` up to, but not including, `end`
    - If `start` not specified, `0` is used for start index
    - If `end` not specified, `len(string)` is used for end index
  - Slicing expressions can include a step value and negative indexes relative to end of string

Testing, Searching, and Manipulating Strings

- **You can use the `in` operator to determine whether one string is contained in another string**
  - General format: *`string1`* `in` *`string2`*
    - *`string1`* and *`string2`* can be string literals or variables referencing strings
- **Similarly you can use the `not in` operator to determine whether one string is not contained in another string**

String Methods

- **Strings in Python have many types of methods, divided into different types of operations**
  - General format:

    mystring`.`*method*`(`*arguments*`)`
- **Some methods test a string for specific characteristics**
  - Generally Boolean methods, that return `True` if a condition exists, and `False` otherwise

String Methods (cont'd.)

Table 8-1 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.

String Methods (cont'd.)

- **Some methods return a copy of the string, to which modifications have been made**
  - Simulate strings as mutable objects
- **String comparisons are case-sensitive**
  - Uppercase characters are distinguished from lowercase characters
  - `lower` and `upper` methods can be used for making case-insensitive string comparisons

String Methods (cont'd.)

Table 8-2 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.

String Methods (cont'd.)

- **Programs commonly need to search for substrings**
- **Several methods to accomplish this:**
  - `endswith(`*`substring`*`)`: checks if the string ends with *`substring`*
    - Returns `True` or `False`
  - `startswith(`*`substring`*`)`: checks if the string starts with *`substring`*
    - Returns `True` or `False`

String Methods (cont'd.)

- **Several methods to accomplish this (cont'd):**
  - `find(substring)`: searches for *substring* within the string
    - Returns lowest index of the substring, or if the substring is not contained in the string, returns -1
  - `replace(substring, new string)`:
    - Returns a copy of the string where every occurrence of *substring* is replaced with *new_string*

String Methods (cont'd.)

Table 8-3 Search and replace methods

Method	Description
`endswith(substring)`	The *substring* argument is a string. The method returns true if the string ends with *substring*.
`find(substring)`	The *substring* argument is a string. The method returns the lowest index in the string where *substring* is found. If *substring* is not found, the method returns –1.
`replace(old, new)`	The *old* and *new* arguments are both strings. The method returns a copy of the string with all instances of *old* replaced by *new*.
`startswith(substring)`	The *substring* argument is a string. The method returns true if the string starts with *substring*.

The Repetition Operator

- **Repetition operator: makes multiple copies of a string and joins them together**
  - The * symbol is a repetition operator when applied to a string and an integer
    - String is left operand; number is right
  - General format: *string_to_copy * n*
  - Variable references a new string which contains multiple copies of the original string

Splitting a String

- **`split` method: returns a list containing the words in the string**
  - By default, uses space as separator
  - Can specify a different separator by passing it as an argument to the `split` method

Splitting a String

- **Examples:**

```
>>> my_string = 'One two three four'
>>> word_list = my_string.split()
>>> word_list
['One', 'two', 'three', 'four']
>>>
```

```
>>> my_string = '1/2/3/4/5'
>>> number_list = my_string.split('/')
>>> number_list
['1', '2', '3', '4', '5']
>>>
```

String Tokens

- **Sometimes a string contains substrings that are separated by a special character**
  - Example:

```
'peach raspberry strawberry vanilla'
```

  - This string contains the substrings *peach*, *raspberry*, *strawberry*, and *vanilla*
  - The substrings are separated by the space character
  - The substrings are known as *tokens* and the separating character is known as the *delimiter*

String Tokens

- **Example:**

```
'17;92;81;12;46;5'
```

  - This string contains the tokens 17, 92, 81, 12, 46, and 5
  - The delimiter is the ; character

String Tokens

- *Tokenizing* is the process of breaking a string into tokens
- When you tokenize a string, you extract the tokens and store them as individual items
- In Python you can use the `split` method to tokenize a string

String Tokens

- **Examples:**

```
>>> str = 'peach raspberry strawberry vanilla'
>>> tokens = str.split()
>>> tokens
['peach', 'raspberry', 'strawberry', 'vanilla']
>>>
```

```
>>> my_address = 'www.example.com'
>>> tokens = my_address.split('.')
>>> tokens
['www', 'example', 'com']
>>>
```

Summary

- **This chapter covered:**
  - String operations, including:
    - Methods for iterating over strings
    - Repetition and concatenation operators
    - Strings as immutable objects
    - Slicing strings and testing strings
    - String methods
    - Splitting a string