Strings

Chapter 6

Python for Informatics: Exploring Information
www.pythonlearn.com

String Data Type

- A string is a sequence of characters
- A string literal uses quotes 'Hello' or "Hello"
- For strings, + means "concatenate"
- When a string contains numbers, it is still a string
- We can convert numbers in a string into a number using int()

```
>>> str1 = "Hello"
>>> str2 = 'there'
>>> bob = str1 + str2
>>> print bob
Hellothere
>>> str3 = '123'
>>> str3 = str3 + 1
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
TypeError: cannot concatenate 'str'
and 'int' objects
>>> x = int(str3) + 1
>>> print x
124
>>>
```

Reading and Converting

- We prefer to read data in using strings and then parse and convert the data as we need
- This gives us more control over error situations and/ or bad user input
- Raw input numbers must be converted from strings

```
>>> name = raw_input('Enter:')
Enter:Chuck
>>> print name
Chuck
>>> apple = raw_input('Enter:')
Enter:100
>>> x = apple - 10
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
TypeError: unsupported operand
type(s) for -: 'str' and 'int'
>>> x = int(apple) - 10
>>> print x
90
```

Looking Inside Strings

- We can get at any single character in a string using an index specified in square brackets
- The index value must be an integer and starts at zero
- The index value can be an expression that is computed

b	a	n	a	n	a
0	1	2	3	4	5

```
>>> fruit = 'banana'
>>> letter = fruit[1]
>>> print letter
a
>>> n = 3
>>> w = fruit[n - 1]
>>> print w
n
```

A Character Too Far

- You will get a python error if you attempt to index beyond the end of a string.
- So be careful when constructing index values and slices

```
>>> zot = 'abc'
>>> print zot[5]
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
IndexError: string index out of range
>>>
```

Strings Have Length

- There is a built-in function len that gives us the length of a string

b	a	n	a	n	a
0	1	2	3	4	5

```
>>> fruit = 'banana'
>>> print len(fruit)
6
```

Len Function

```
>>> fruit = 'banana'
>>> x = len(fruit)
>>> print x
6
```

A function is some stored code that we use. A function takes some input and produces an output.

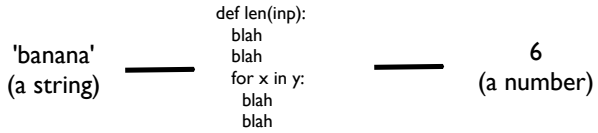
'banana' (a string) → len() function → 6 (a number)

Guido wrote this code

Len Function

```
>>> fruit = 'banana'
>>> x = len(fruit)
>>> print x
6
```

A function is some stored code that we use. A function takes some input and produces an output.



Looping Through Strings

- Using a while statement and an iteration variable, and the len function, we can construct a loop to look at each of the letters in a string individually

```
fruit = 'banana'                    0 b
index = 0                           1 a
while index < len(fruit) :          2 n
    letter = fruit[index]           3 a
    print index, letter             4 n
    index = index + 1               5 a
```

Looping Through Strings

- A definite loop using a for statement is much more elegant
- The iteration variable is completely taken care of by the for loop

```
fruit = 'banana'
for letter in fruit :
    print letter
```

```
b
a
n
a
n
a
```

Looping Through Strings

- A definite loop using a for statement is much more elegant
- The iteration variable is completely taken care of by the for loop

```
fruit = 'banana'
for letter in fruit :
    print letter

index = 0
while index < len(fruit) :
    letter = fruit[index]
    print letter
    index = index + 1
```

```
b
a
n
a
n
a
```

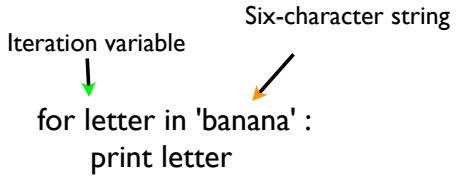
Looping and Counting

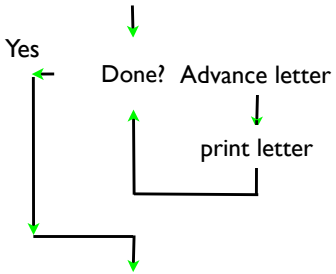
- This is a simple loop that loops through each letter in a string and counts the number of times the loop encounters the 'a' character.

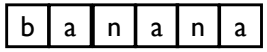
```
word = 'banana'
count = 0
for letter in word :
    if letter == 'a' :
        count = count + 1
print count
```

Looking deeper into in

- The iteration variable "iterates" though the sequence (ordered set)
- The block (body) of code is executed once for each value in the sequence
- The iteration variable moves through all of the values in the sequence



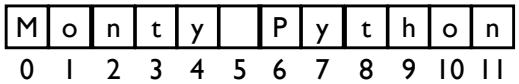




letter

```
for letter in 'banana' :
    print letter
```

The iteration variable "iterates" though the string and the block (body) of code is executed once for each value in the sequence

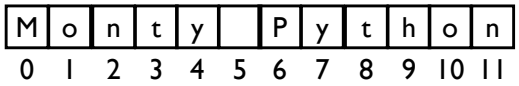


- We can also look at any continuous section of a string using a colon operator
- The second number is one beyond the end of the slice - "up to but not including"
- If the second number is beyond the end of the string, it stops at the end

```
>>> s = 'Monty Python'
>>> print s[0:4]
Mont
>>> print s[6:7]
P
>>> print s[6:20]
Python
```

Slicing Strings

Slicing Strings



- If we leave off the first number or the last number of the slice, it is assumed to be the beginning or end of the string respectively

```
>>> s = 'Monty Python'
>>> print s[:2]
Mo
>>> print s[8:]
thon
>>> print s[:]
Monty Python
```

String Concatenation

- When the + operator is applied to strings, it means "concatenation"

```
>>> a = 'Hello'
>>> b = a + 'There'
>>> print b
HelloThere
>>> c = a + ' ' + 'There'
>>> print c
Hello There
>>>
```

Using in as an Operator

- The in keyword can also be used to check to see if one string is "in" another string
- The in expression is a logical expression and returns True or False and can be used in an if statement

```
>>> fruit = 'banana'
>>> 'n' in fruit
True
>>> 'm' in fruit
False
>>> 'nan' in fruit
True
>>> if 'a' in fruit :
...     print 'Found it!'
...
Found it!
>>>
```

String Comparison

```
if word == 'banana':
    print  'All right, bananas.'

if word < 'banana':
    print 'Your word,' + word + ', comes before banana.'
elif word > 'banana':
    print 'Your word,' + word + ', comes after banana.'
else:
    print 'All right, bananas.'
```

String Library

- Python has a number of string functions which are in the string library
- These functions are already *built into* every string - we invoke them by appending the function to the string variable
- These functions do not modify the original string, instead they return a new string that has been altered

```
>>> greet = 'Hello Bob'
>>> zap = greet.lower()
>>> print zap
hello bob
>>> print greet
Hello Bob
>>> print 'Hi There'.lower()
hi there
>>>
```

```
>>> stuff = 'Hello world'
>>> type(stuff)
<type 'str'>
>>> dir(stuff)
['capitalize', 'center', 'count', 'decode', 'encode',
'endswith', 'expandtabs', 'find', 'format', 'index',
'isalnum', 'isalpha', 'isdigit', 'islower', 'isspace',
'istitle', 'isupper', 'join', 'ljust', 'lower', 'lstrip',
'partition', 'replace', 'rfind', 'rindex', 'rjust',
'rpartition', 'rsplit', 'rstrip', 'split', 'splitlines',
'startswith', 'strip', 'swapcase', 'title', 'translate',
'upper', 'zfill']
```

http://docs.python.org/lib/string-methods.html

`str.`**`replace`**(*old*, *new*[, *count*])
Return a copy of the string with all occurrences of substring *old* replaced by *new*. If the optional argument *count* is given, only the first *count* occurrences are replaced.

`str.`**`rfind`**(*sub*[, *start*[, *end*]])
Return the highest index in the string where substring *sub* is found, such that *sub* is contained within s[start,end]. Optional arguments *start* and *end* are interpreted as in slice notation. Return `-1` on failure.

`str.`**`rindex`**(*sub*[, *start*[, *end*]])
Like `rfind()` but raises `ValueError` when the substring *sub* is not found.

`str.`**`rjust`**(*width*[, *fillchar*])
Return the string right justified in a string of length *width*. Padding is done using the specified *fillchar* (default is a space). The original string is returned if *width* is less than `len(s)`.

http://docs.python.org/lib/string-methods.html

String Library

str.capitalize()

str.center(width[, fillchar])

str.endswith(suffix[, start[, end]])

str.find(sub[, start[, end]])

str.lstrip([chars])

str.replace(old, new[, count])

str.lower()

str.rstrip([chars])

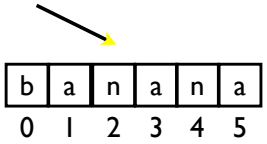
str.strip([chars])

str.upper()

http://docs.python.org/lib/string-methods.html

Searching a String

- We use the find() function to search for a substring within another string
- find() finds the first occurance of the substring
- If the substring is not found, find() returns -1
- Remember that string position starts at zero




```
>>> fruit = 'banana'
>>> pos = fruit.find('na')
>>> print pos
2
>>> aa = fruit.find('z')
>>> print aa
-1
```

Making everything UPPER CASE

- You can make a copy of a string in lower case or upper case
- Often when we are searching for a string using find() - we first convert the string to lower case so we can search a string regardless of case

```
>>> greet = 'Hello Bob'
>>> nnn = greet.upper()
>>> print nnn
HELLO BOB
>>> www = greet.lower()
>>> print www
hello bob
>>>
```

Search and Replace

- The replace() function is like a "search and replace" operation in a word processor
- It replaces all occurrences of the search string with the replacement string

```
>>> greet = 'Hello Bob'
>>> nstr = greet.replace('Bob','Jane')
>>> print nstr
Hello Jane
>>> greet = 'Hello Bob'
>>> nstr = greet.replace('o','X')
>>> print nstr
HellX BXb
>>>
```

Stripping Whitespace

- Sometimes we want to take a string and remove whitespace at the beginning and/or end
- lstrip() and rstrip() to the left and right only
- strip() Removes both begin and ending whitespace

```
>>> greet = '   Hello Bob  '
>>> greet.lstrip()
'Hello Bob  '
>>> greet.rstrip()
'   Hello Bob'
>>> greet.strip()
'Hello Bob'
>>>
```

Prefixes

```
>>> line = 'Please have a nice day'
>>> line.startswith('Please')
True
>>> line.startswith('p')
False
```


```
>>> data = 'From stephen.marquard@uct.ac.za Sat Jan  5 09:14:16 2008'
>>> atpos = data.find('@')
>>> print atpos
21
>>> sppos = data.find(' ',atpos)
>>> print sppos
31
>>> host = data[atpos+1 : sppos]
>>> print host
uct.ac.za
```

Summary

- String type
- Read/Convert
- Indexing strings []
- Slicing strings [2:4]
- Looping through strings with for and while
- Concatenating strings with +
- in as an operator
- String comparison
- String library
- Searching in strings
- Replacing text
- Stripping white space