



COMPSCI 101

Principles of Programming

Lecture 27 - Using the Python interpreter, Python sequences



Learning outcomes

- ▶ **At the end of this lecture, students should be able to:**
 - ▶ recognise sequences and the common features of sequences
 - ▶ use the interactive Python interpreter to check python statements and functions
 - ▶ use the interactive Python interpreter to look up Python help



Sequences: strings, lists and tuples

▶ Sequence types

- ▶ There are five types of sequences in Python. In CompSci 101 we use three of these: **strings**, **lists** and **tuples**.

```
a_tuple = (3, 4, 8)
a_list = [3, 4, 8]
a_string = "348"
```

- ▶ Sequences allow you to store multiple values in an organized and efficient fashion.
- ▶ The indices of the elements of a sequence start at 0. The indices can be negative (to access elements from the end of the sequence).
- ▶ The order of the elements in a sequence is important.
- ▶ Each element of a sequence can be accessed using square brackets and the index number, e.g.,

```
a_tuple = (3, 4, 8)
print(a_tuple[2])
middle = a_list[1]
last = a_string[-1]
```



Sequences continued

▶ Sequences can be sliced:

```
a_tuple = (3, 4, 8, 7, 2)
a_list = [3, 4, 8, 0, 1]
a_string = "3and 4"
a_tuple2 = a_tuple[0:3:2]
a_list2 = a_list[1:3]
print(a_tuple2, a_list2, a_string[5:1:-2])
```

```
(3, 8) [4, 8] 4d
```

▶ The **len()**, **min()**, **max()** functions can be applied to sequences (**sum()** can be used with tuples and lists).

```
a_tuple_list = [(3, 'c'), (9, 'a'), (1, 'z')]
print(len(a_tuple))
print(len(a_string))
print(max(a_tuple))
print(max(a_string))
print(len(a_tuple_list))
print(max(a_tuple_list))
```

```
5
6
8
n
3
(9, 'a')
```



Sequences continued

- ▶ The **+**, *****, and **'in'** operators can all be used with sequences

```
a_tuple = (3, 4) * 3 + (2, 1)
a_list = [3, 0, 1] + [6, 2] * 2
a_string = "3 & 4" * 2 + "end"
print(a_tuple)
print(a_list)
print(a_string)
```

```
(3, 4, 3, 4, 3, 4, 2, 1)
[3, 0, 1, 6, 2, 6, 2]
3 & 43 & 4end
False False False
```

```
print(4 not in a_tuple, 24 in a_list, "23" in a_string)
```



Iterating through the elements of sequences

- ▶ A **for ... in ... loop** can be used to visit each element of a sequence, e.g.,

```
a_tuple = (3, 4, 8, 7, 2)
a_list = [3, 4, 8, 24, 1]
```

```
total = 0
for number in a_tuple:
    total += number
print("1.", total)
```

```
total = 0
for number in a_list:
    total += number
print("2.", total )
```

1.24
2.40



Iterating through the elements of strings

- ▶ A `for ... in ...` loop is used to visit each character in a string sequence. The elements of a string sequence are the characters making up the string.

```
word = "wonderful"
number = 0

for letter in word:
    if letter in "aeiou":
        number += 1

print(number)
```

3



Iterating through the characters of a sequence – Exercise 1

- ▶ Complete the `get_num_uniques()` function which returns the number of unique elements in the sequence (including non alphabetic characters).

```
def get_num_uniques(a_sequence):  
    uniques = []  
    for  
        if  
            uniques.  
    return len(uniques)
```

```
Number of unique elements: 8  
Number of unique elements: 7  
Number of unique elements: 2  
Number of unique elements: 5  
Number of unique elements: 5
```

```
def use_get_num_uniques():  
    words = "Number of unique elements:"  
    print(words, get_num_uniques("green apple"))  
    print(words, get_num_uniques("abcdefg") )  
    print(words, get_num_uniques("abbbbbbb") )  
    print(words, get_num_uniques((3, 4, 3, 3, 4, 6, 3, 7, 8, 4)) )  
    print(words, get_num_uniques([3, 4, 3, 3, 4, 6, 3, 7, 8, 4]) )  
main()
```




Iterating through the characters of a string – Exercise 2

- ▶ Complete the `count_longer_words()` function to find the count of words that are longer than the parameter word from a given list of words.

```
def count_longer_words(a_list, word):  
    count = 0  
    for  
        if  
  
    return count  
  
def main():  
    print(count_longer_words(['Double', 'letters', 'in', 'green', 'apple'], 'go'))  
    print(count_longer_words(['Number', 'of', 'unique', 'elements'], 'go'))  
main()
```

4
3



Iterating through the characters of a string – Exercise 3

- ▶ Complete the `count_doubles()` function which returns the number of double letters (a letter followed by the same letter) excluding double spaces, in the string passed as a parameter.

```
def count_doubles(text):  
    count = 0  
    ...  
  
def main():  
    print("Double letters in green apple", count_doubles("green apple"))  
    print("Double letters in abcdefg", count_doubles("abcdefg"))  
    print("Double letters in abbbbbb", count_doubles("abbbbbb"))
```

```
main()
```

```
Double letters in green apple 2  
Double letters in abcdefg 0  
Double letters in abbbbbb 3
```



Compilers and interpreters

▶ Compilers

- ▶ Compilers convert source code into machine code and store the machine code in a file. The machine code can then be run directly by the operating system as an executable program (... .exe file).

▶ Interpreters

- ▶ Interpreters bypass the compilation process and convert and execute the code directly statement by statement.
- ▶ Python is an interpreted language, i.e., the Python interpreter reads and executes each statement of the Python source program statement by statement:
 - this is why even if you can have an error in the program further down, the program executes until it hits that error.



Python IDLE

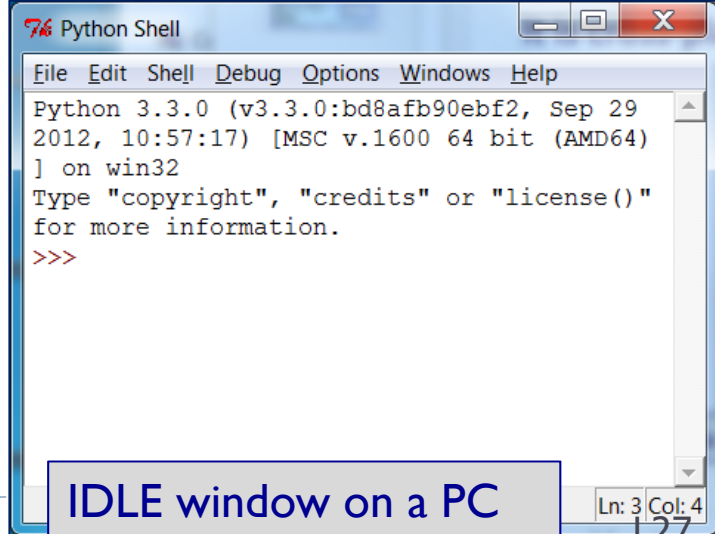
- ▶ IDLE (Integrated DeveLopment Environment) is an integrated development environment for Python. This is the development environment provided when you download Python.
 - ▶ WIKIPEDIA states "IDLE is intended to be a simple IDE and suitable for beginners, especially in an educational environment. To that end, it is cross-platform, and avoids feature clutter."

IDLE provides an interactive environment for checking Python code and for running Python programs.



```
Python 3.3.3 (v3.3.3:c3896275c0f6, Nov 16 2013, 23:39:35)
[GCC 4.2.1 (Apple Inc. build 5666) (dot 3)] on darwin
Type "copyright", "credits" or "license()" for more in
formation.
>>> WARNING: The version of Tcl/Tk (8.5.9) in use may
be unstable.
Visit http://www.python.org/download/mac/tcltk/ for cu
rrent information.
>>>
```

IDLE window on a MAC



```
Python 3.3.0 (v3.3.0:bd8afb90ebf2, Sep 29
2012, 10:57:17) [MSC v.1600 64 bit (AMD64)
] on win32
Type "copyright", "credits" or "license()"
for more information.
>>>
```

IDLE window on a PC



The Python interactive interpreter (Python shell)

- ▶ The interactive Python interpreter
 - ▶ The Python interactive interpreter makes it easy to **check** Python commands.
 - ▶ Open the interactive interpreter
 - ▶ We will use IDLE which opens a window with the interpreter prompt:
>>>
 - ▶ Once the Python interpreter has started any Python command can be executed (at the prompt >>>)

Notice that the interpreter displays the result of each statement even though there is no print() in the statement.

```
>>> word = "amazing"
>>> len(word)
7
>>> word = word * 3
>>> word
'amazingamazingamazing'
>>> another_word = word[2::3]
>>> another_word
'anmiazg'
>>> word[:0:-4]
'ganmi'
```



The Python interactive interpreter cont.

- ▶ The interactive Python interpreter can also be used to test functions
 - ▶ The Python interactive interpreter makes it easy to check Python code.

```
>>> def get_result(command, what_to_do, where):  
    return command + " " + what_to_do + " in the " + where  
  
>>> get_result("a", "b", "c")  
'a b in the c'  
  
>>> get_result("come", "sing", "hall")  
'come sing in the hall'  
  
>>> get_result("go", "jump", "pond")  
'go jump in the pond'
```

Notice that it is necessary to insert a blank line to end the function definition.

See the results of calling the function three times with different arguments.



The Python interactive interpreter help

- ▶ The interactive Python interpreter can also be used to get help:

```
>>> help(str.rfind)
rfind(...)
    S.rfind(sub[, start[, end]]) -> int
    Return the highest index in S 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.

>>> help(sum)
sum(...)
    sum(iterable[, start]) -> value

    Return the sum of an iterable of numbers (NOT strings) plus
    the value of parameter 'start' (which defaults to 0).  When
    the iterable is empty, return start.
```



None

- ▶ print statements (in the interpreter window) just print to the interpreter window.
- ▶ A function which does not explicitly return a value, always returns None.

```
>>> def do_little(n1, n2):  
    print("Sum:", n1 + n2)
```

Notice that it is necessary to insert a blank line to end the function definition.

```
>>> do_little(3, 5)
```

```
Sum: 8
```

The code in the function executes.

```
>>> print(do_little(3, 5))
```

```
Sum: 8
```

The result of calling the function is printed.

```
None
```




Summary

- ▶ **strings, lists and tuples are sequences**
 - ▶ The operators: +, * and in can be used with sequences
 - ▶ We use a for ... in ... to iterate through each element of a sequence
 - ▶ len(), min(), max() can be used with sequences
 - ▶ sum() can be used with tuples and lists
 - ▶ Each element of a sequence can be accessed using the index operator. The index can be negative (starting from the end of the sequence)
 - ▶ Sequences can be sliced using [slice_start: slice_end: step]
- ▶ **The Python interactive interpreter (IDLE)**
 - ▶ use the interactive Python interpreter to check python statements and functions
 - ▶ use the interactive Python interpreter to look up Python help