COMPSCI 101

Principles of Programming

Lecture 16 – the split() method, updating the elements of lists, lists are mutable objects

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Learning outcomes

At the end of this lecture, students should be able to:

- use the index number to access individual elements of a list
- make changes to the elements of a list
- copy the values of a list
- use the split() method on a string to obtain a list of string objects
- lists are mutable objects

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Recap

From lecture 14

- we can iterate through the elements of a list using a for…in loop
- calculations can done using the values in the elements of a list

```
def start_with_vowel_count(a_list):
   vowels = "aeiouAEIOU"
   count = 0
   for word in a_list:
       if vowels.find(word[0]) > -1:
            count = count + 1
    return count

def main():
   my_list = ['Nobody', 'goes', 'to', 'that', 'restaurant',
                     'because', 'it', 'is', 'too', 'crowded']
   vowel_starters = start_with_vowel_count(my_list)
   print("Start with a vowel", vowel_starters)
main()
```

```
Start with a vowel: 2
```

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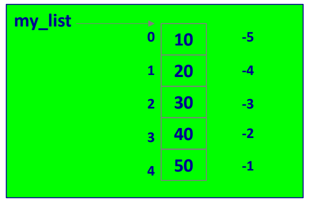
Accessing elements from the end of a list

A negative index value can be used to access the elements from the end of a list.

```
my_list = [10, 20, 30, 40, 50]
print(my_list[-4])
my_list[-3] = my_list[-1] + my_list[-2]
print(my_list[-3], my_list[1], my_list[-5])
```

```
20
90 20, 10
```



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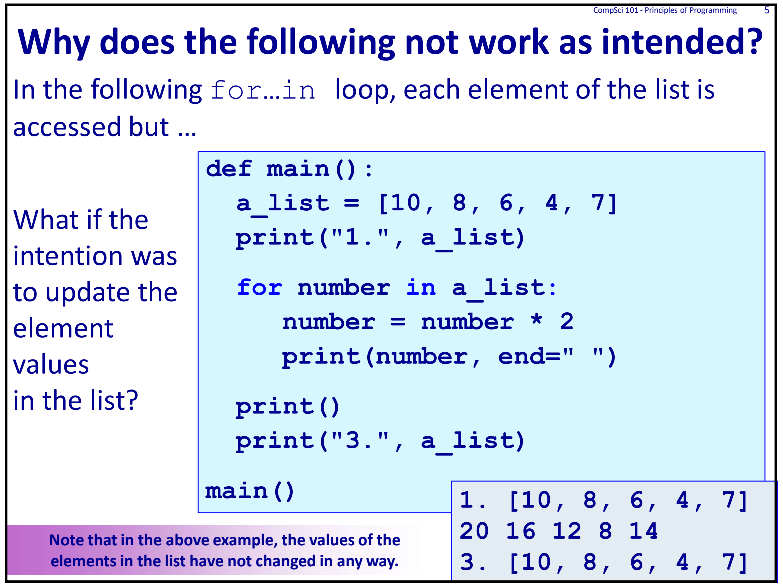

Why does the following not work as intended?

In the following `for…in` loop, each element of the list is accessed but …

What if the intention was to update the element values in the list?

```
def main():
  a_list = [10, 8, 6, 4, 7]
  print("1.", a_list)

  for number in a_list:
     number = number * 2
     print(number, end=" ")

  print()
  print("3.", a_list)

main()
```

```
1. [10, 8, 6, 4, 7]
20 16 12 8 14
3. [10, 8, 6, 4, 7]
```

Note that in the above example, the values of the elements in the list have not changed in any way.

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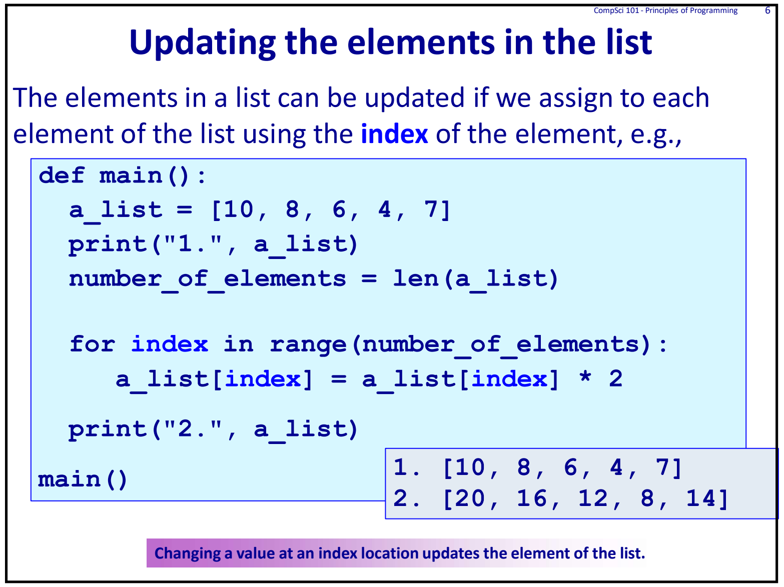

Updating the elements in the list

The elements in a list can be updated if we assign to each element of the list using the **index** of the element, e.g.,

```
def main():
  a_list = [10, 8, 6, 4, 7]
  print("1.", a_list)
  number_of_elements = len(a_list)

  for index in range(number_of_elements):
     a_list[index] = a_list[index] * 2

  print("2.", a_list)

main()
```

```
1. [10, 8, 6, 4, 7]
2. [20, 16, 12, 8, 14]
```

Changing a value at an index location updates the element of the list.

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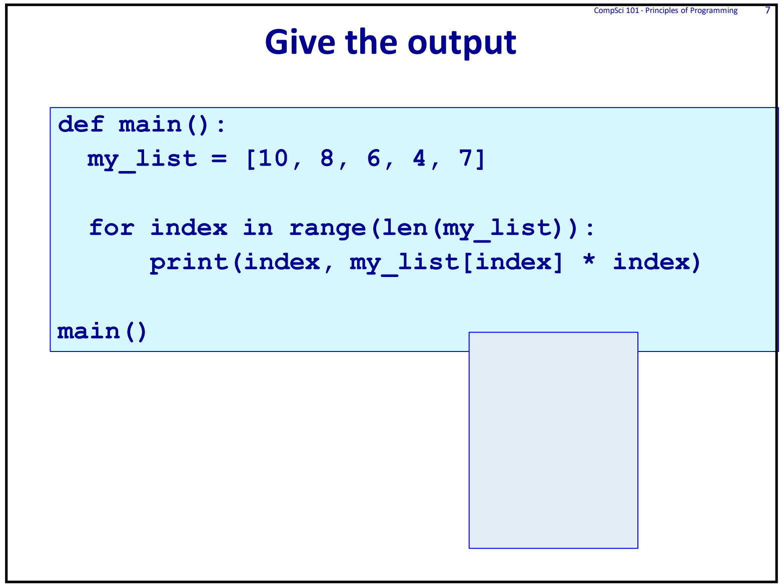

Give the output

```
def main():
  my_list = [10, 8, 6, 4, 7]

  for index in range(len(my_list)):
      print(index, my_list[index] * index)

main()
```

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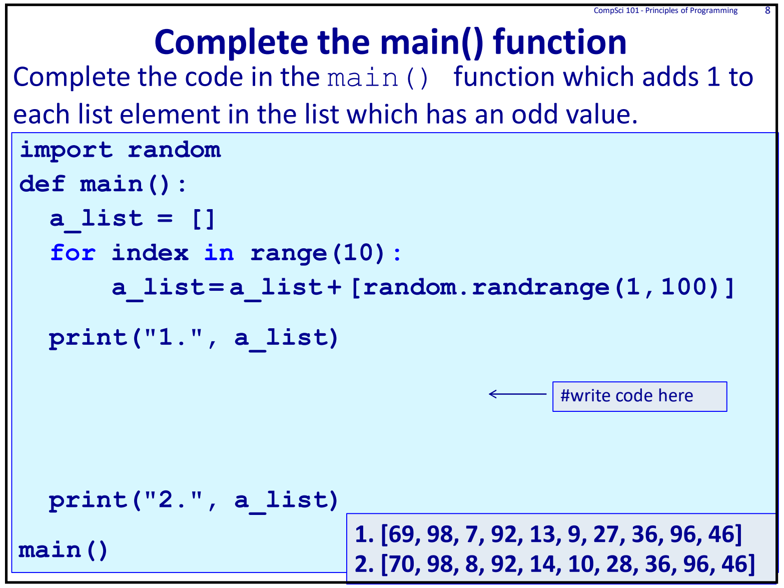

Complete the main() function

Complete the code in the `main()` function which adds 1 to each list element in the list which has an odd value.

```
import random
def main():
  a_list = []
  for index in range(10):
      a_list=a_list+[random.randrange(1,100)]

  print("1.", a_list)

                                  ← #write code here



  print("2.", a_list)

main()
```

```
1. [69, 98, 7, 92, 13, 9, 27, 36, 96, 46]
2. [70, 98, 8, 92, 14, 10, 28, 36, 96, 46]
```

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Complete the main() function

Complete the code in the `main()` function which changes the elements **starting from index 1** so that each element is the accumulative total of the previous elements (i.e., element 1 is the sum of the element 0 and element 1, element 2 is the sum of element 1 and element 2, etc.).

```
import random
def main():
  a_list = []
  for num in range(10):
     a_list = a_list + [random.randrange(1, 10)]
  print("1.", a_list)

                                    #write code here

  print("2.", a_list)

main()
```

```
1. [8, 1, 9, 5, 6, 3, 6, 4, 5, 6]
2. [8, 9, 18, 23, 29, 32, 38, 42, 47, 53]
```

Complete the main() function

Complete the code in the `main()` function which changes each string element of the list **into an integer.**

```
import random
def main():
  a_list = ["6", "7", "5", "3", "8", "1", "9", "2", "8"]
  print("1.", a_list)

                                    #write code here

  print("2.", a_list)
main()
```

```
1. ['6', '7', '5', '3', '8', '1', '9', '2', '8']
2. [6, 7, 5, 3, 8, 1, 9, 2, 8]
```

The string method, split()

The **string method**, `split()`, separates a **single string** into **a list of the parts of the string** (the tokens) using the separator defined (inside the parentheses). Each element of the resulting list is a string object. This method can be applied to any string object.

If no separator is defined (as in the code below), whitespace is the default separator, e.g.,

```
def main():
  phrase = 'The best   cure for insomnia   is to get  a
                                          lot of sleep'
  words_list = phrase.split()
  print(words_list[0], words_list[4], words_list[7])

main()
```

```
The insomnia get
```

The split() method - example

```
def main():
  prompt = "Enter a line of numbers: "
  line_of_nums = input(prompt)
  list_of_nums = line_of_nums.split()

  for index in range(len(list_of_nums)):
    list_of_nums[index] = int(list_of_nums[index])

  total = 0
  for number in list_of_nums:
    total = total + number
  print("Total:", total)

main()
```

```
Enter a line of numbers: 4 6 12 13 9
Total: 44
```

```
Enter a line of numbers: 5 -3 6     8    1
Total: 17
```

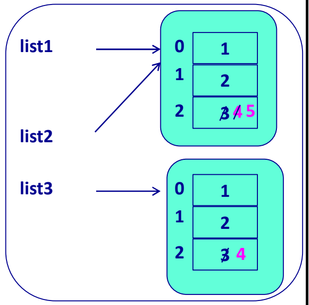
Note that split() function breaks a **string** up into a **list** of strings.

Assigning a list object to a variable

```
list1 = [1, 2, 3]
list2 = list1
list3 = [1, 2, 3]

print(list1)
print(list2)
print(list3)

list1[2] = list1[2] + 1
list2[2] = list2[2] + 1
list3[2] = list3[2] + 1

print()
print(list1)
print(list2)
print(list3)
```

```
[1, 2, 3]
[1, 2, 3]
[1, 2, 3]

[1, 2, 5]
[1, 2, 5]
[1, 2, 4]
```

Python lists are **objects**. When an object is assigned to a variable, **the reference (i.e., the address) is copied** and stored in the variable.



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Same output?

Do the following two sections of code give the same output? If not, what is the difference in output?

Code A

```
list1 = [1, 2, 3]
list2 = list1

for index in range(len(list1)):
    list2[index] = list1[index] * 2

print("1.", list1)
print("2.", list2)
```

Code B

```
list1 = [1, 2, 3]
list2 = [1, 2, 3]

for index in range(len(list1)):
    list2[index] = list1[index] * 2

print("1.", list1)
print("2.", list2)
```

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Summary

In a Python program:

- a `for … in` loop can be used to access each individual element of a list
- a `for … in range()` loop can be used to make changes to individual element of a list
- a list is an object. Assigning a list to a variable makes a copy of the reference (not a copy of the list).
- lists are mutable objects
- we use the split() method to break a string into a list of strings. The default separator for the split() method is whitespace.

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Examples of Python features used in this lecture

```
def change_list(a_list):
   number_of_elements = len(a_list)
   for i in range(number_of_elements):
         a_list[i] = a_list[i] * 2

def use_lists(list1, list2):
   list3 = []
   for index in range(len(list1)):
      list3 = list3 + [list1[index] + list2[index]]

   return list3

def split_message(message):
   words = message.split()
   print(words[2], words[0])
```

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