#CodeYork

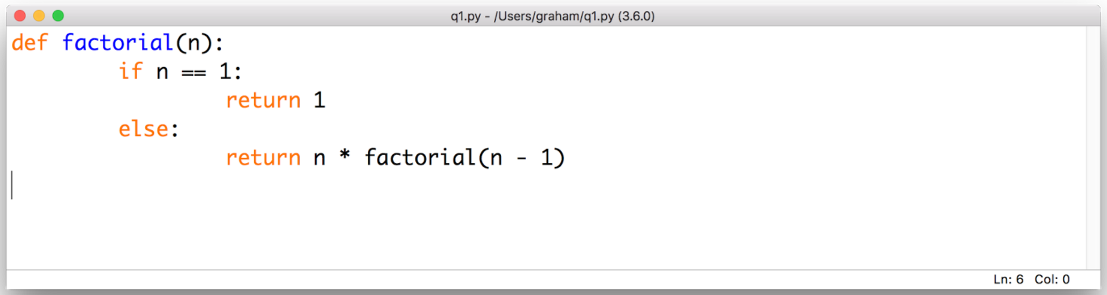
Solutions 3

Summer 2017

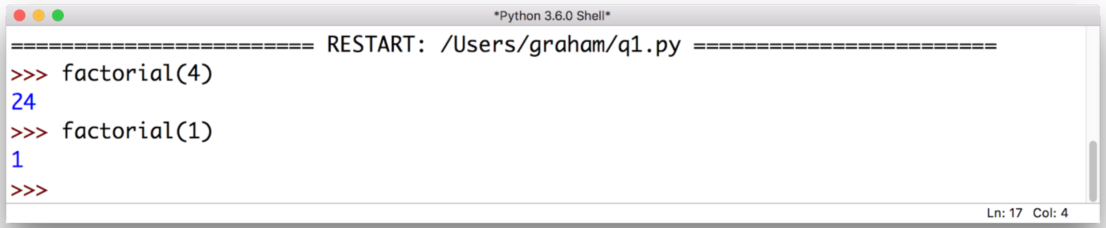
Task 1 - Recursive Factorials

We define a factorial(n) as n multiplied by factorial(n-1), with the base case factorial(1) = 1.

We will not be concerned with the fact that factorial(0) is 1, so that could be used as a better base case, since while the code does not grow, subtlety is unnecessary.



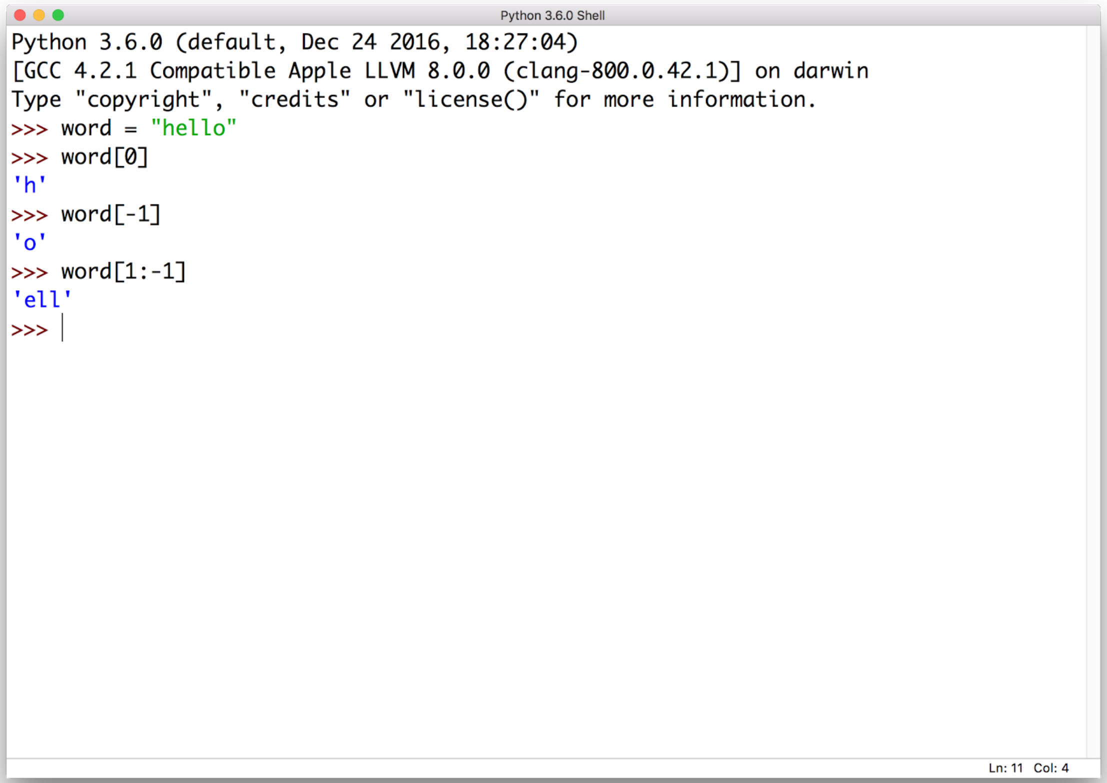
```
def factorial(n):
	if n == 1:
		return 1
	else:
		return n * factorial(n - 1)
```



```
======================== RESTART: /Users/graham/q1.py ========================
>>> factorial(4)
24
>>> factorial(1)
1
>>>
```

Task 2 - String Manipulation

This task is very similar to the task given in the first session regarding lists, and is specifically designed as a lead into task 3.

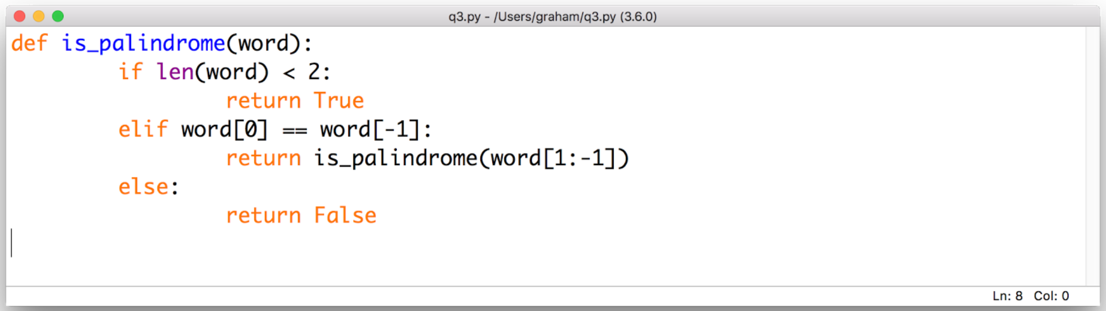


```
Python 3.6.0 (default, Dec 24 2016, 18:27:04)
[GCC 4.2.1 Compatible Apple LLVM 8.0.0 (clang-800.0.42.1)] on darwin
Type "copyright", "credits" or "license()" for more information.
>>> word = "hello"
>>> word[0]
'h'
>>> word[-1]
'o'
>>> word[1:-1]
'ell'
>>>
```

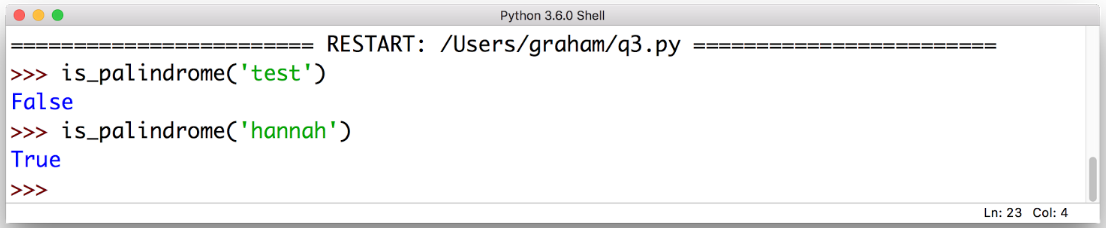
Task 3 - Recursive Palindromes

A palindrome is a word which reads the same backward or forward, such as madam or kayak.

We define our recursive function with the definition that if the first and last letters are the same, and the middle is a palindrome, then the word is a palindrome. Our base case is if the of length less than 2. We define those to be palindromes.



```
def is_palindrome(word):
	if len(word) < 2:
		return True
	elif word[0] == word[-1]:
		return is_palindrome(word[1:-1])
	else:
		return False
```

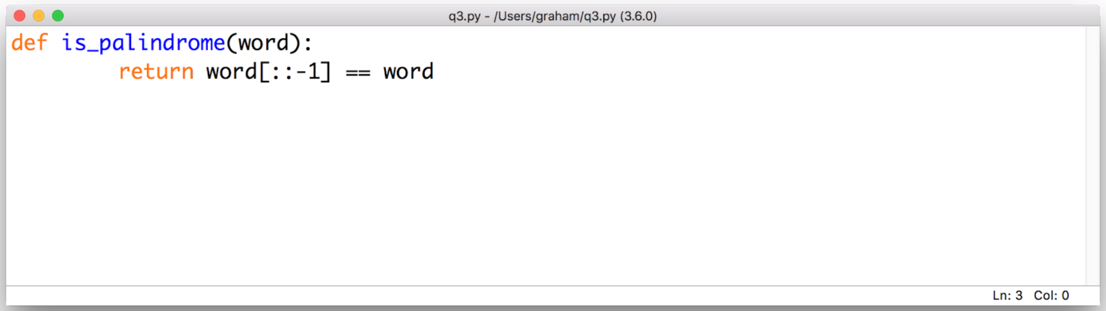


```
======================== RESTART: /Users/graham/q3.py ========================
>>> is_palindrome('test')
False
>>> is_palindrome('hannah')
True
>>>
```

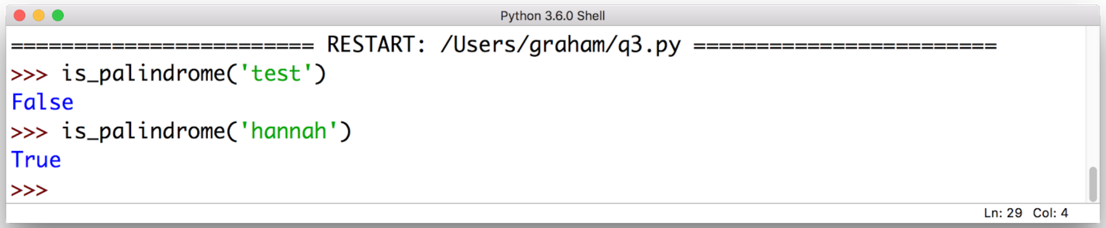
Task 4 - Palindromes Again

A simpler non-recursive definition reverses the string, and then checks if this is equal to the original.

The simpler version might be undesirable for a very large string though, since Python has to reverse the entire string, rather than potentially just checking the start and end characters, and seeing they're different.



```
def is_palindrome(word):
        return word[::-1] == word
```


Python 3.6.0 Shell

```
======================== RESTART: /Users/graham/q3.py ========================
>>> is_palindrome('test')
False
>>> is_palindrome('hannah')
True
>>>
```

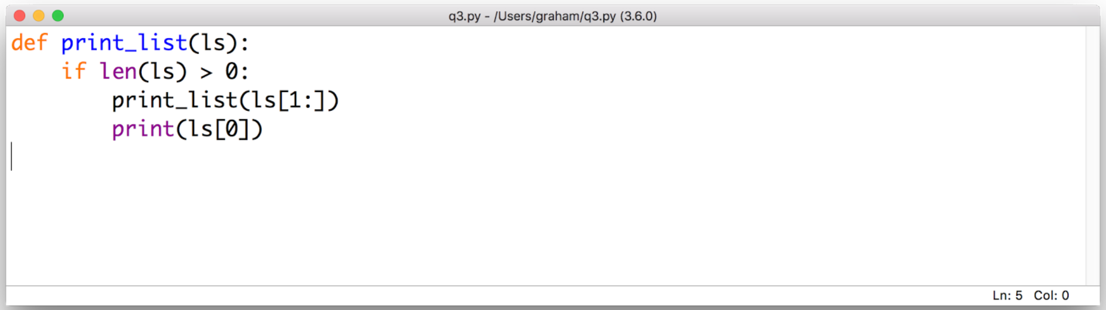
Ln: 29 Col: 4

Task 5 - Printing a List

Our original function works by printing the first element, and then printing the rest, recursively. The base case is implicit here, since it really is just “do nothing”. See how this function does not “return”, it only has the “side effect” of writing to the screen.

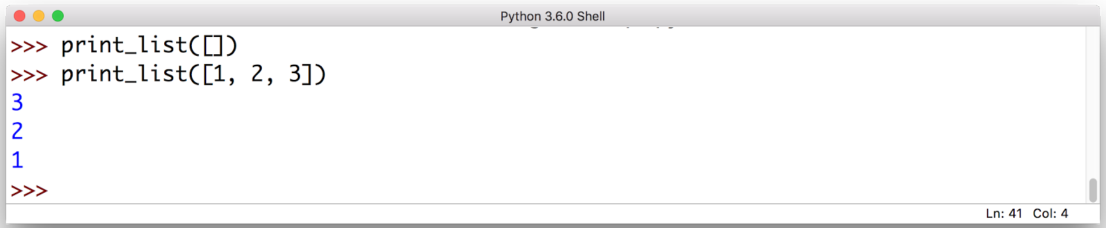
In order to modify this, we simply move the call to print under the recursive call, so instead of printing the element, and then printing the rest of the list, we now print the rest of the list, and then printing the rest of the list.

This demonstrates a way that recursion can make our life a lot easier, by using Python call stack implicitly to keep track of our progress.


q3.py - /Users/graham/q3.py (3.6.0)

```python
def print_list(ls):
    if len(ls) > 0:
        print_list(ls[1:])
        print(ls[0])
```

Ln: 5   Col: 0


Python 3.6.0 Shell

```
>>> print_list([])
>>> print_list([1, 2, 3])
3
2
1
>>>
```

Ln: 41   Col: 4