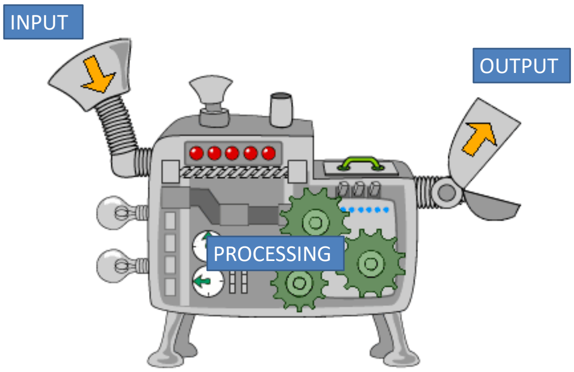
COMP 141

Functions that return values

Rhodes College

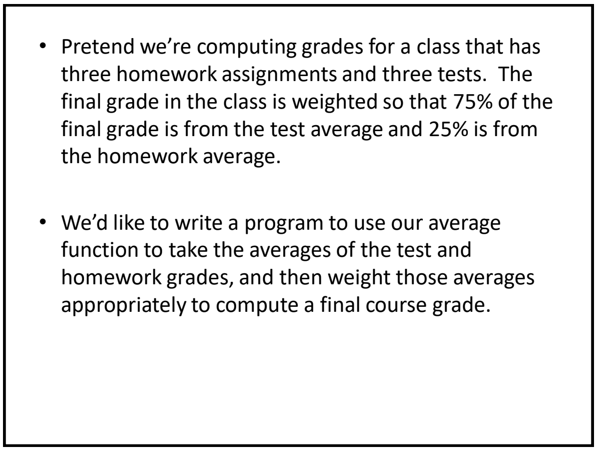
Announcements

- Reminders:
  - Program 3 due Thursday night by 11:55pm

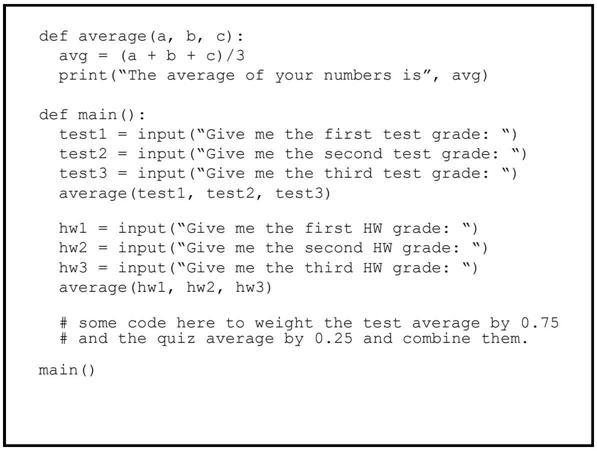


```
def average(a, b, c):
  avg = (a + b + c)/3
  print(“The average of your \
     numbers is”, avg)

def main():
  x = int(input(“Give me a number: “))
  y = int(input(“Give me a number: “))
  z = int(input(“Give me a number: “))
  average(x, y, z)

main()
```

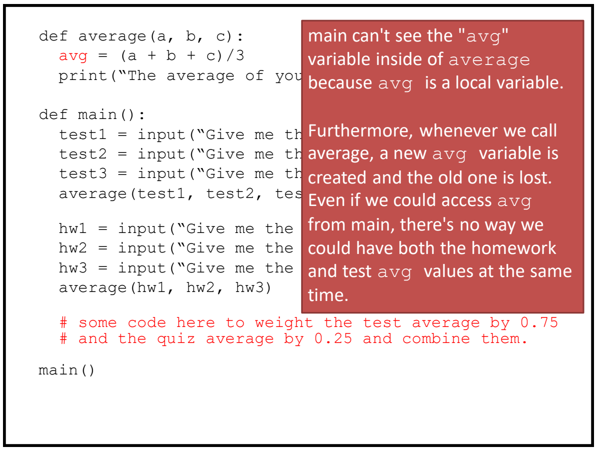
When main calls average, Python copies the values of x, y, and z (local variables in main) into a, b, and c (local variables in average).



- Pretend we’re computing grades for a class that has three homework assignments and three tests. The final grade in the class is weighted so that 75% of the final grade is from the test average and 25% is from the homework average.
- We’d like to write a program to use our average function to take the averages of the test and homework grades, and then weight those averages appropriately to compute a final course grade.



```
def average(a, b, c):
  avg = (a + b + c)/3
  print(“The average of your numbers is”, avg)

def main():
  test1 = input(“Give me the first test grade: “)
  test2 = input(“Give me the second test grade: “)
  test3 = input(“Give me the third test grade: “)
  average(test1, test2, test3)

  hw1 = input(“Give me the first HW grade: “)
  hw2 = input(“Give me the second HW grade: “)
  hw3 = input(“Give me the third HW grade: “)
  average(hw1, hw2, hw3)

  # some code here to weight the test average by 0.75
  # and the quiz average by 0.25 and combine them.

main()
```



```
def average(a, b, c):
  avg = (a + b + c)/3
  print(“The average of you

def main():
  test1 = input(“Give me th
  test2 = input(“Give me th
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  average(test1, test2, tes

  hw1 = input(“Give me the
  hw2 = input(“Give me the
  hw3 = input(“Give me the
  average(hw1, hw2, hw3)

  # some code here to weight the test average by 0.75
  # and the quiz average by 0.25 and combine them.

main()
```
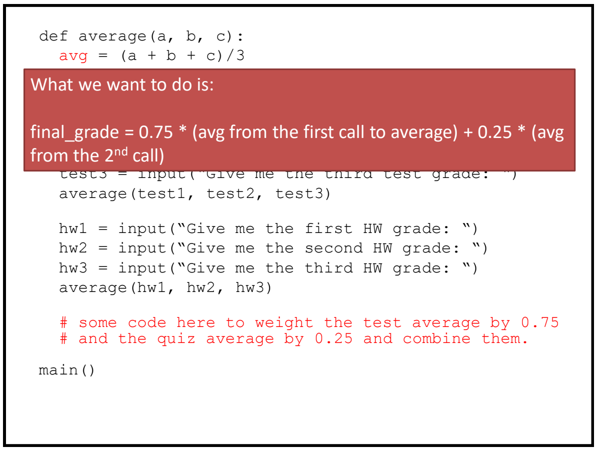

main can't see the "avg" variable inside of average because avg is a local variable.

Furthermore, whenever we call average, a new avg variable is created and the old one is lost. Even if we could access avg from main, there's no way we could have both the homework and test avg values at the same time.



```
def average(a, b, c):
  avg = (a + b + c)/3
```

What we want to do is:

final_grade = 0.75 * (avg from the first call to average) + 0.25 * (avg from the 2nd call)

```
  test3 = input(“Give me the third test grade: “)
  average(test1, test2, test3)

  hw1 = input(“Give me the first HW grade: “)
  hw2 = input(“Give me the second HW grade: “)
  hw3 = input(“Give me the third HW grade: “)
  average(hw1, hw2, hw3)

  # some code here to weight the test average by 0.75
  # and the quiz average by 0.25 and combine them.

main()
```

Return values to the rescue!

def function(arg1, arg2, …):

  statement

  statement

  [more statements if desired]

  return value

value can be a literal, like a number or a string, or it can be a local variable from the function.

Return values to the rescue!

def function(arg1, arg2, …):

  statement

  statement

  [more statements if desired]

  return value

When Python sees a line in a function beginning with "return," the function immediately ends, and the value is sent back to the caller.

value can be a literal, like a number or a string, or it can be a local variable from the function.

Capturing the return value

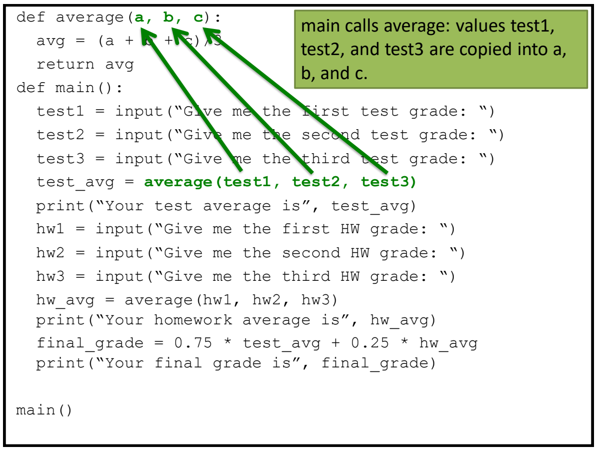
- Use an assignment statement to "capture" the return value.
  - Otherwise it disappears!

```
variable = function(…)
```

When Python sees a line like this, the function is called normally. However, when the function ends and a value is "sent back" to the caller, the value is put into the variable you specify.

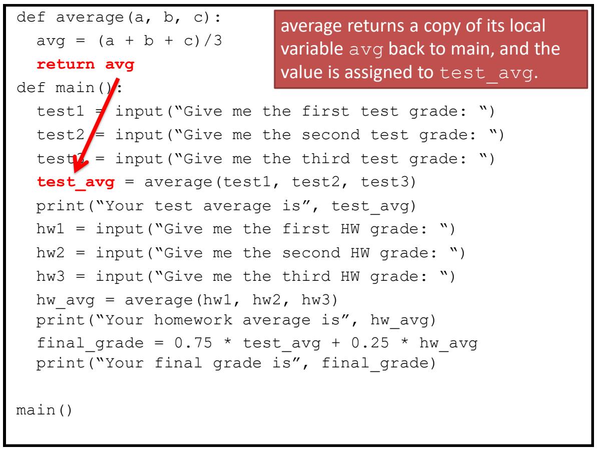
```
def average(a, b, c):
  avg = (a + b + c)/3
  return avg
def main():
  test1 = input(“Give me the first test grade: “)
  test2 = input(“Give me the second test grade: “)
  test3 = input(“Give me the third test grade: “)
  test_avg = average(test1, test2, test3)
  print(“Your test average is”, test_avg)
  hw1 = input(“Give me the first HW grade: “)
  hw2 = input(“Give me the second HW grade: “)
  hw3 = input(“Give me the third HW grade: “)
  hw_avg = average(hw1, hw2, hw3)
  print(“Your homework average is”, hw_avg)
  final_grade = 0.75 * test_avg + 0.25 * hw_avg
  print(“Your final grade is”, final_grade)

main()
```

Notice `average` now returns the local variable `avg`, and the print statement is removed.



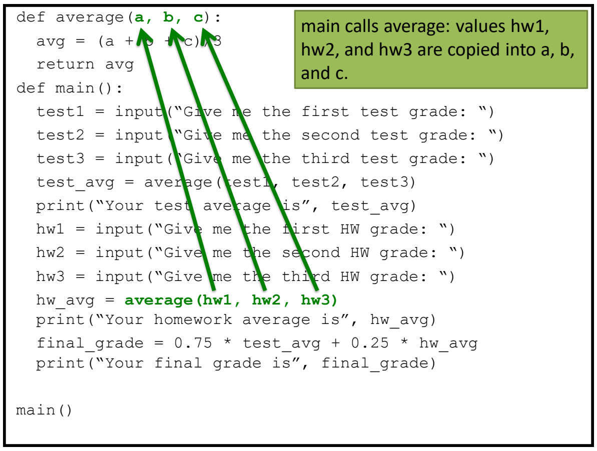
```
def average(a, b, c):
  avg = (a + b + c)/3
  return avg
def main():
  test1 = input(“Give me the first test grade: “)
  test2 = input(“Give me the second test grade: “)
  test3 = input(“Give me the third test grade: “)
  test_avg = average(test1, test2, test3)
  print(“Your test average is”, test_avg)
  hw1 = input(“Give me the first HW grade: “)
  hw2 = input(“Give me the second HW grade: “)
  hw3 = input(“Give me the third HW grade: “)
  hw_avg = average(hw1, hw2, hw3)
  print(“Your homework average is”, hw_avg)
  final_grade = 0.75 * test_avg + 0.25 * hw_avg
  print(“Your final grade is”, final_grade)

main()
```

main calls average: values test1, test2, and test3 are copied into a, b, and c.



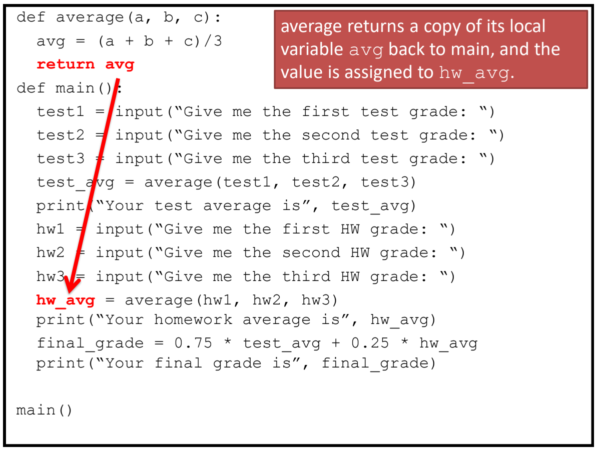
```
def average(a, b, c):
  avg = (a + b + c)/3
  return avg
def main():
  test1 = input(“Give me the first test grade: “)
  test2 = input(“Give me the second test grade: “)
  test3 = input(“Give me the third test grade: “)
  test_avg = average(test1, test2, test3)
  print(“Your test average is”, test_avg)
  hw1 = input(“Give me the first HW grade: “)
  hw2 = input(“Give me the second HW grade: “)
  hw3 = input(“Give me the third HW grade: “)
  hw_avg = average(hw1, hw2, hw3)
  print(“Your homework average is”, hw_avg)
  final_grade = 0.75 * test_avg + 0.25 * hw_avg
  print(“Your final grade is”, final_grade)

main()
```

average returns a copy of its local variable avg back to main, and the value is assigned to test_avg.



```
def average(a, b, c):
  avg = (a + b + c)/3
  return avg
def main():
  test1 = input(“Give me the first test grade: “)
  test2 = input(“Give me the second test grade: “)
  test3 = input(“Give me the third test grade: “)
  test_avg = average(test1, test2, test3)
  print(“Your test average is”, test_avg)
  hw1 = input(“Give me the first HW grade: “)
  hw2 = input(“Give me the second HW grade: “)
  hw3 = input(“Give me the third HW grade: “)
  hw_avg = average(hw1, hw2, hw3)
  print(“Your homework average is”, hw_avg)
  final_grade = 0.75 * test_avg + 0.25 * hw_avg
  print(“Your final grade is”, final_grade)

main()
```

main calls average: values hw1, hw2, and hw3 are copied into a, b, and c.



```
def average(a, b, c):
  avg = (a + b + c)/3
  return avg
def main():
  test1 = input(“Give me the first test grade: “)
  test2 = input(“Give me the second test grade: “)
  test3 = input(“Give me the third test grade: “)
  test_avg = average(test1, test2, test3)
  print(“Your test average is”, test_avg)
  hw1 = input(“Give me the first HW grade: “)
  hw2 = input(“Give me the second HW grade: “)
  hw3 = input(“Give me the third HW grade: “)
  hw_avg = average(hw1, hw2, hw3)
  print(“Your homework average is”, hw_avg)
  final_grade = 0.75 * test_avg + 0.25 * hw_avg
  print(“Your final grade is”, final_grade)

main()
```

average returns a copy of its local variable avg back to main, and the value is assigned to hw_avg.

- When writing functions, you should test them to make sure they work in all kinds of situations.
  - Does average() work with negative numbers? Floating point numbers?
- You can write a program to do testing, by calling the function with varying arguments.
- Or, you can test your function using the Python Shell (the window where every line starts with >>>)

Class Exercise

Write a program that computes the annual household income for a family with 2 working adults.

1. Prompt the user for their and their partner's hourly wage, as well as the tax rate.

2. Calculate the total income for each of the adults after taxes. (Assume 40 hours/week and 52 weeks/year).

3. Output the total household income.

Practice

Write a function called direction that takes two float arguments, x and y. Consider an arrow on the Cartesian plane pointing from (0,0) to (x, y). This function should **return** the string "NE", "SE", "SW", or "NW" depending on the direction that the arrow points. Assume x and y will never be 0.

- The def line will be: `def direction(x, y):`
- Do not write a main() function. Test your function from the Python shell.