CS 115 Lecture 12

Functions

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  - If it doesn't return a value: `func(`*`arguments`*`)`
  - If it does return a value: `result = func(`*`arguments`*`)`
- We've even written one of our own!
  - `def main():` defines a function named **main**.

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Now when you call `triangle()`, it prints those three lines.

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- **Return values** send "output" to **the rest of the program**.

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    limit = square(number)
    print("Counting up to", limit)
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def square(x):
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def countto(number):
    for i in range(1, number):
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main()
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Let's try rearranging the functions.

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Suppose we want to check all the numbers in a range to see if they satisfy the Collatz conjecture.

- `collatz2.py`
- Note the changes:
  - Moved the $3n + 1$ loop into a function.
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Remember the three kinds of stepping in the debugger. They have to do with functions.

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  - We'll indicate when we call a function or return from one.
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Tracing functions: example

Let's trace this small program:

```
 1.  def triangular(num):
2.      sum = 0
3.      for i in range(1, num + 1):
4.          sum += i
5.      return sum

6.  def pyramidal(n):
7.      sum = 0
8.      for i in range(1, n + 1):
9.          sum += triangular(i)
10.     return sum

11.  def main():
12.     pyr = pyramidal(2)
13.     print(pyr)

14.  main()
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Trace of the function

main	pyr	Action/Output
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pyramidal(2)	n	sum	i	Action/Output
6	2	–	–	
7	2	0	–	
8	2	0	1	
9	2	0	1	(call `triangular(1)`)

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main	pyr	Action/Output
12	–	(call `pyramidal(2)`)

pyramidal(2)	n	sum	i	Action/Output
6	2	–	–	
7	2	0	–	
8	2	0	1	
9	2	0	1	(call `triangular(1)`)

triangular(1)	num	sum	i	Action/Output
1	1	–	–	
2	1	0	–	
3	1	0	1	
4	1	1	1	
5	1	1	1	(return 1)

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main	pyr	Action/Output
12	–	(call `pyramidal(2)`)

pyramidal(2)	n	sum	i	Action/Output
6	2	–	–	
7	2	0	–	
8	2	0	1	
9	2	0	1	(call `triangular(1)`)

triangular(1)	num	sum	i	Action/Output
1	1	–	–	
2	1	0	–	
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pyramidal(2)	n	sum	i	Action/Output
9	2	1	1	
8	2	1	2	

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main	pyr	Action/Output
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pyramidal(2)	n	sum	i	Action/Output
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9	2	0	1	(call `triangular(1)`)

triangular(1)	num	sum	i	Action/Output
1	1	–	–	
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3	1	0	1	
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pyramidal(2)	n	sum	i	Action/Output
9	2	1	1	
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Trace, continued

pyramidal(2)	n	sum	i	Action/Output
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Trace, continued

pyramidal(2)	n	sum	i	Action/Output
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triangular(2)	num	sum	i	Action/Output
1	1	–	–	
2	1	0	–	
3	1	0	1	
4	1	1	1	
3	1	1	2	
4	1	3	2	
5	1	3	2	(return 3)

Trace, continued

pyramidal(2)	n	sum	i	Action/Output
9	2	1	1	(call `triangular(2)`)

triangular(2)	num	sum	i	Action/Output
1	1	–	–	
2	1	0	–	
3	1	0	1	
4	1	1	1	
3	1	1	2	
4	1	3	2	
5	1	3	2	(return 3)

pyramidal(2)	n	sum	i	Action/Output
9	2	4	1	
10	2	4	1	(return 4)

Trace, continued

pyramidal(2)	n	sum	i	Action/Output
9	2	1	1	(call `triangular(2)`)

triangular(2)	num	sum	i	Action/Output
1	1	–	–	
2	1	0	–	
3	1	0	1	
4	1	1	1	
3	1	1	2	
4	1	3	2	
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pyramidal(2)	n	sum	i	Action/Output
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main	pyr	Action/Output
12	4	
13	4	4

Trace, continued

pyramidal(2)	n	sum	i	Action/Output
9	2	1	1	(call `triangular(2)`)

triangular(2)	num	sum	i	Action/Output
1	1	–	–	
2	1	0	–	
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