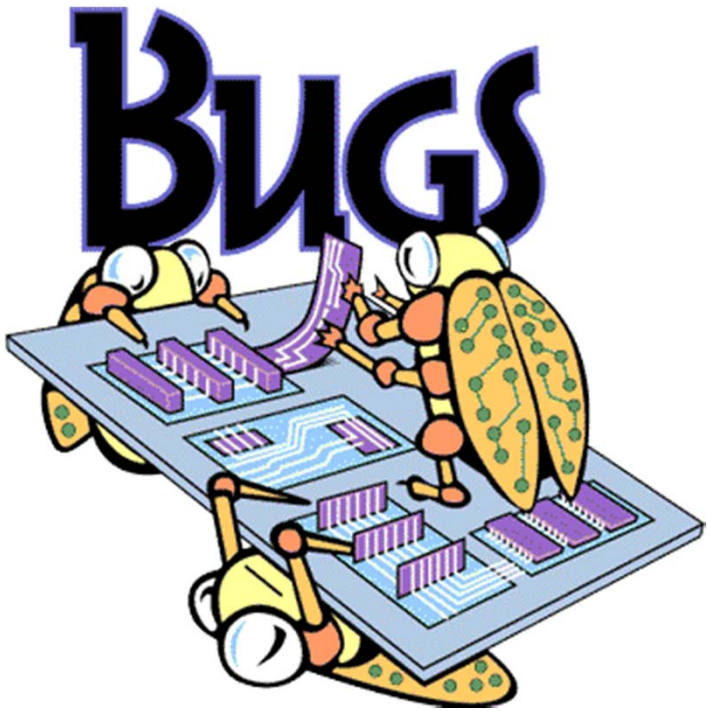
IT1007 INTRODUCTION TO PROGRAMMING

Python and C

Bugs?

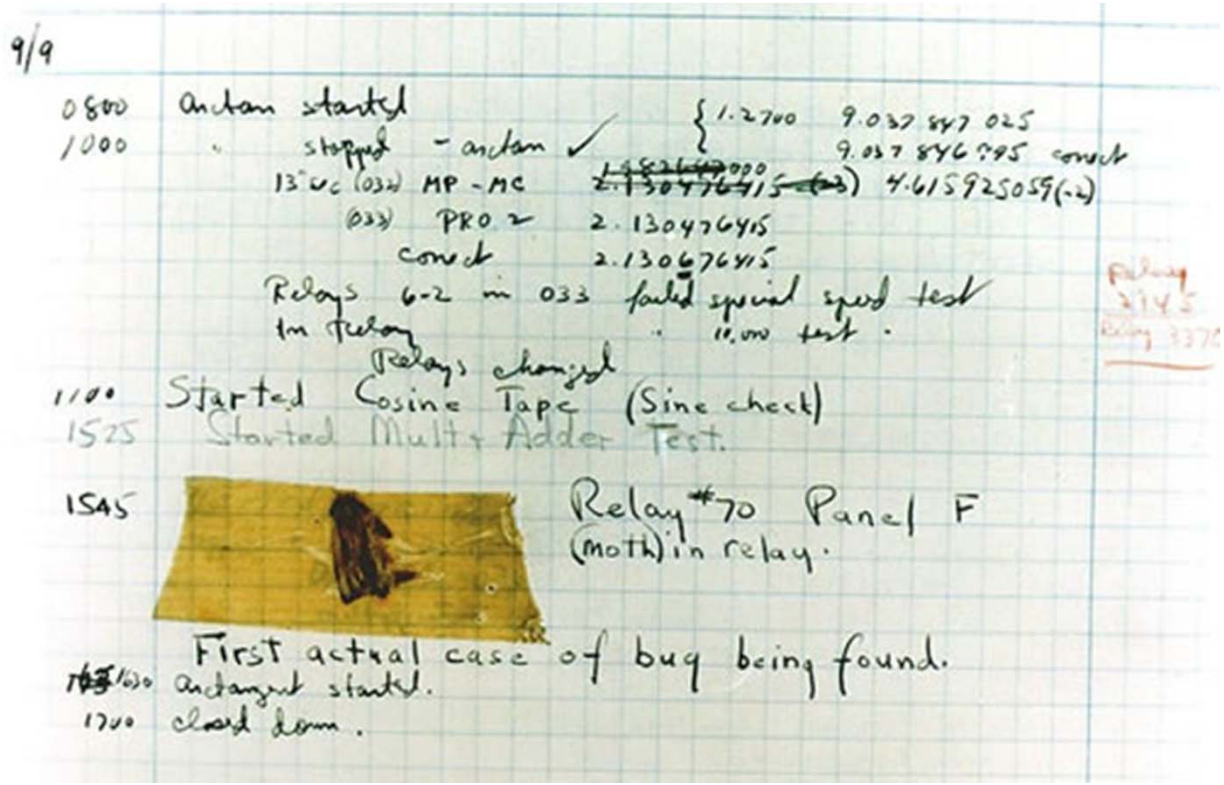
- In 1947, Grace Murray Hopper was working on the Harvard University Mark II Aiken Relay Calculator (a primitive computer).

- On the 9th of September, 1947, when the machine was experiencing problems, an investigation showed that there was a moth trapped between the points of Relay #70, in Panel F.



Bugs?

- The operators removed the moth and affixed it to the log. (See the picture above.) The entry reads: "First actual case of bug being found."



W02 debug1.py

W02 debug 1.py - C:\Users\dcsch...

File Edit Format Run Options Window Help

```
def p1(x, y):
    a = p2(x,y)
    b = p3(x,y)
    return a + b

def p2(z, w):
    return z * w

def p3(a, b):
    return p2(a) + p2(b)
```

Ln: 1 Col: 0

Python 3.6.0 Shell

File Edit Shell Debug Options Window Help

```
Python 3.6.0 (v3.6.0:41df79263a11, Dec
v.1900 64 bit (AMD64)] on win32
Type "copyright", "credits" or "license
n.
>>>
 RESTART: C:\Users\dcschl\Google Drive\Courses\IT1007\Lectures
\W02 debug 1.py
>>> p1(1,2)
Traceback (most recent call last):
  File "<pyshell#0>", line 1, in <module>
    p1(1,2)
  File "C:\Users\dcschl\Google Drive\Courses\IT1007\Lectures\W
02 debug 1.py", line 3, in p1
    b = p3(x,y)
  File "C:\Users\dcschl\Google Drive\Courses\IT1007\Lectures\W
02 debug 1.py", line 10, in p3
    return p2(a) + p2(b)
TypeError: p2() missing 1 required positional argument: 'w'
>>> |
```

```
>>> p1(1,2)
Traceback (most recent call last):
  File "<pyshell#0>", line 1, in <module>
    p1(1,2)
  File "C:\Users\dcschl\Google Drive\Cours
02 debug 1.py", line 3, in p1
    b = p3(x,y)
  File "C:\Users\dcschl\Google Drive\Course
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    return p2(a) + p2(b)
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```

W02 debug 1.py - C:\Users\dcsch...

File Edit Format Run Options Window Help

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    return z * w

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```

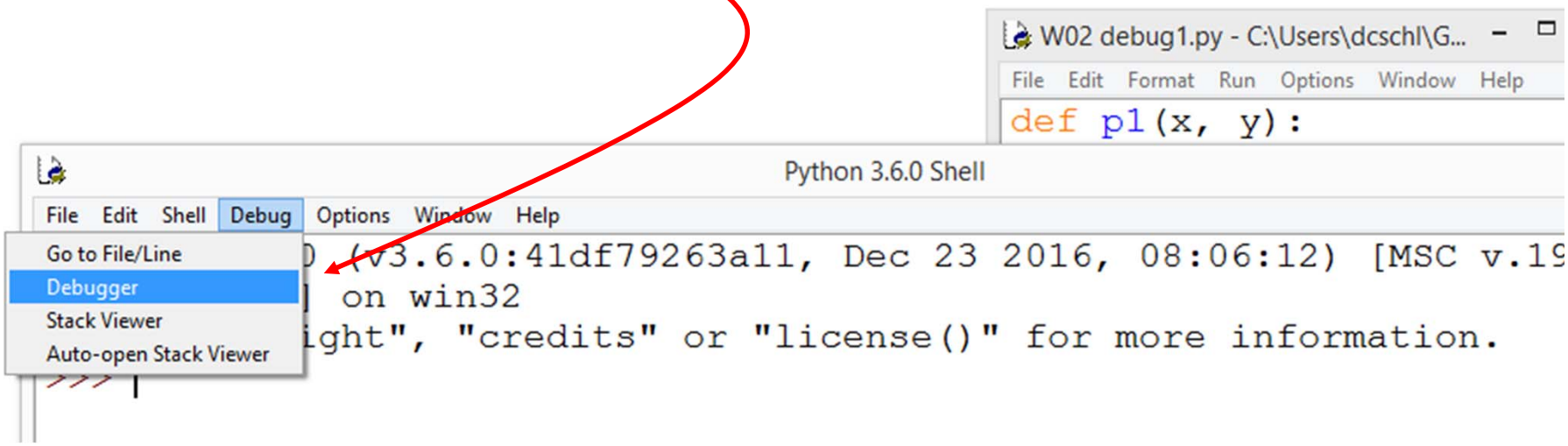
Ln: 1 Col: 0

```
Traceback (most recent call last):
  File "<pyshell#0>", line 1, in <module>
    p1(1,2)
  File "C:\Users\dcschl\Google Drive\Courses\IT1007\Lectures\W02 debug 1.py",
line 3, in p1
    b = p3(x,y)
  File "C:\Users\dcschl\Google Drive\Courses\IT1007\Lectures\W02 debug 1.py",
line 10, in p3
    return p2(a) + p2(b)
TypeError: p2() missing 1 required positional argument: 'w'
```

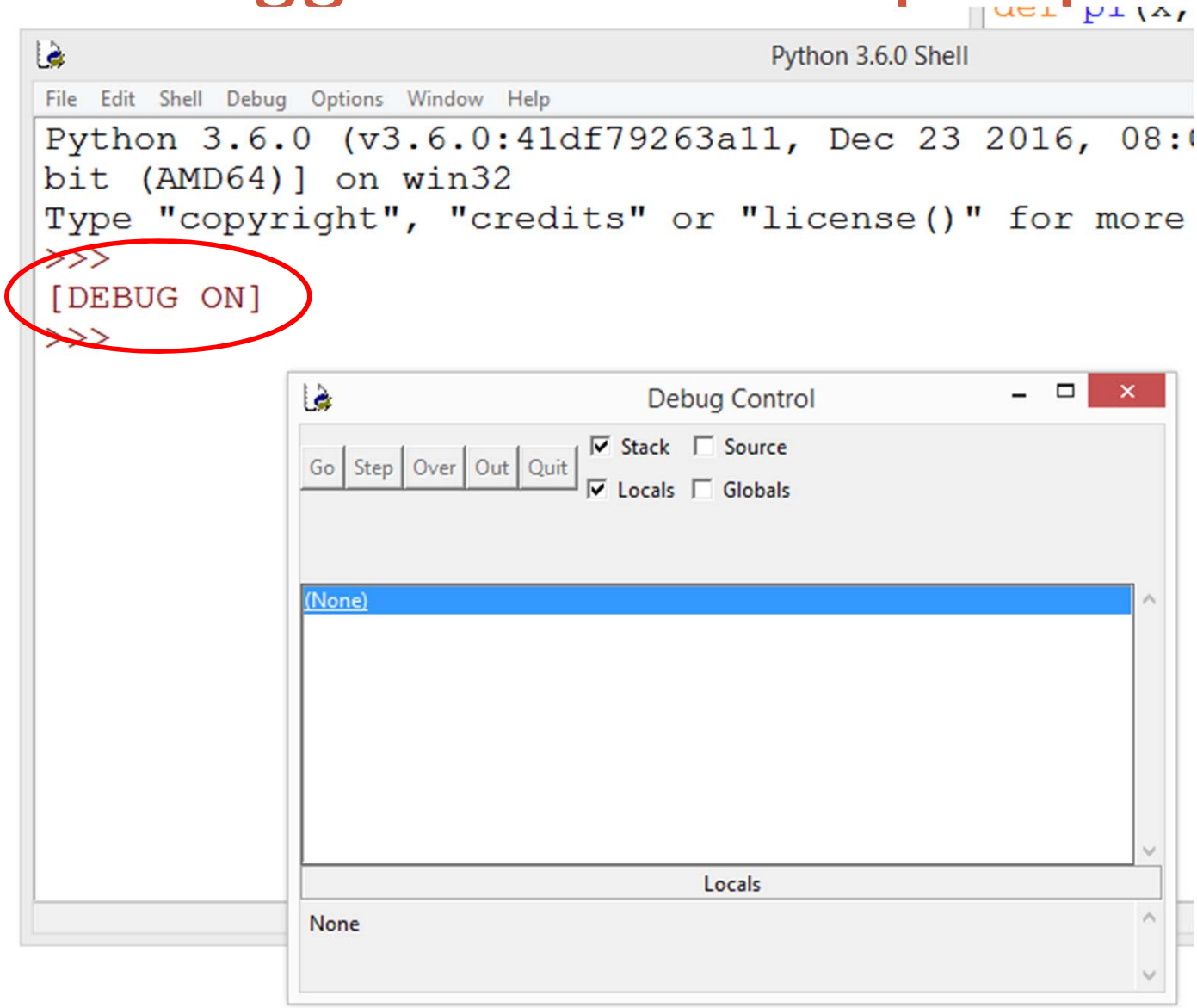
THE IDLE DEBUGGER

Using the IDLE Debugger

- Load in your source code
- Turn on the debugger by

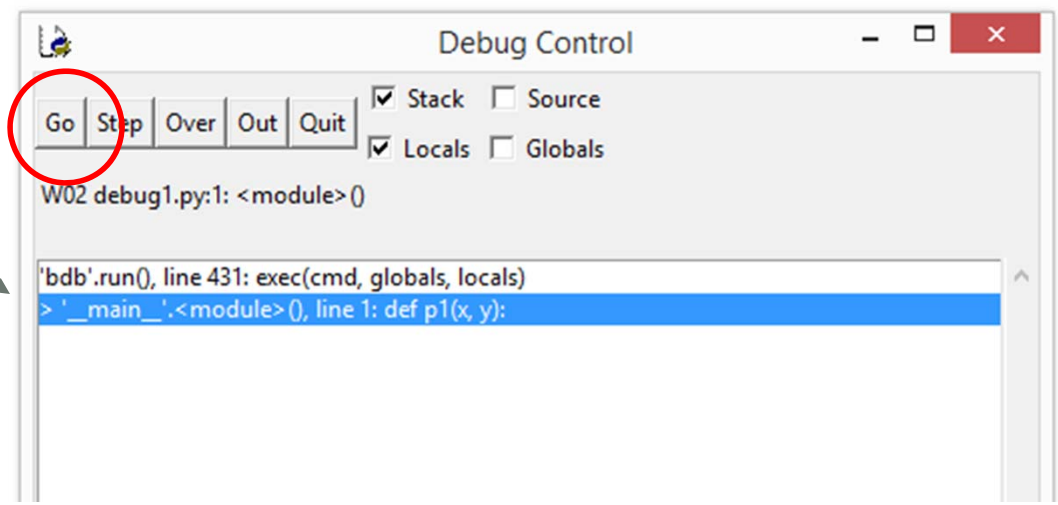


The Debugger Window Pops up



Using the IDLE Debugger

- Go to your source code window to “run”
- Then the debugger will pause the program at the first line of code and wait for you
- You can click the button “Go”
  - That will make the program run
  - At this point we don’t have any error
    - Because by “running” the code, we just define the three functions

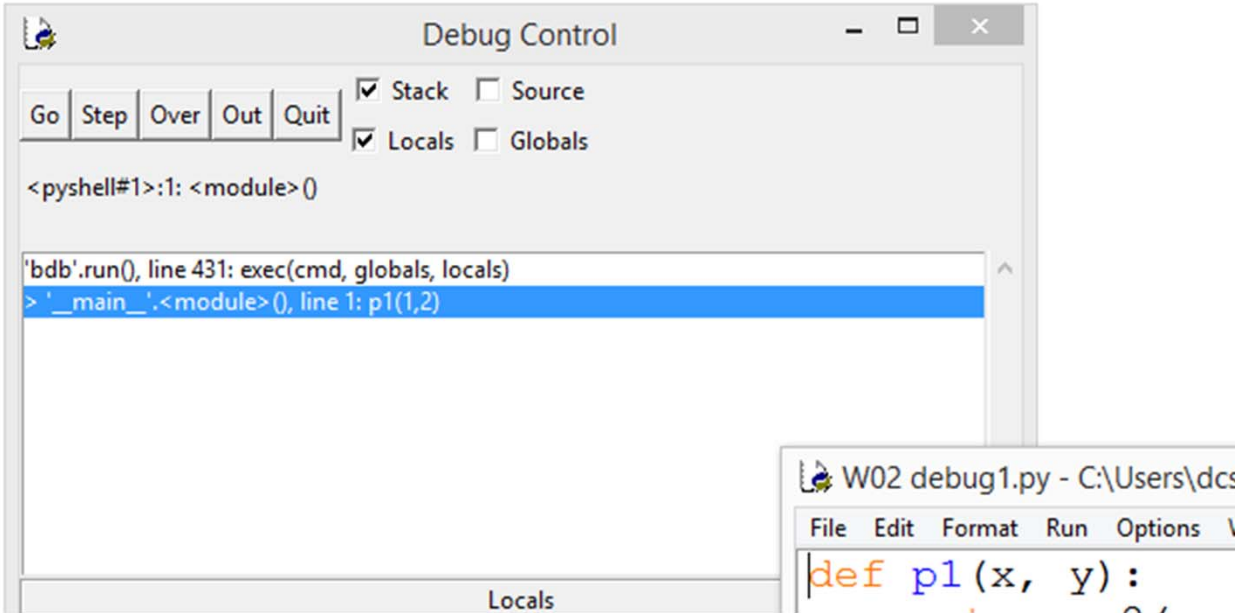


Using the IDLE Debugger

- Let's execute the function in debug mode
- In the shell, type

```
p1(1,2)
```

- Then the debugger will pause at the first line of p1
  - If you type "go" now, you will get an error like the last time

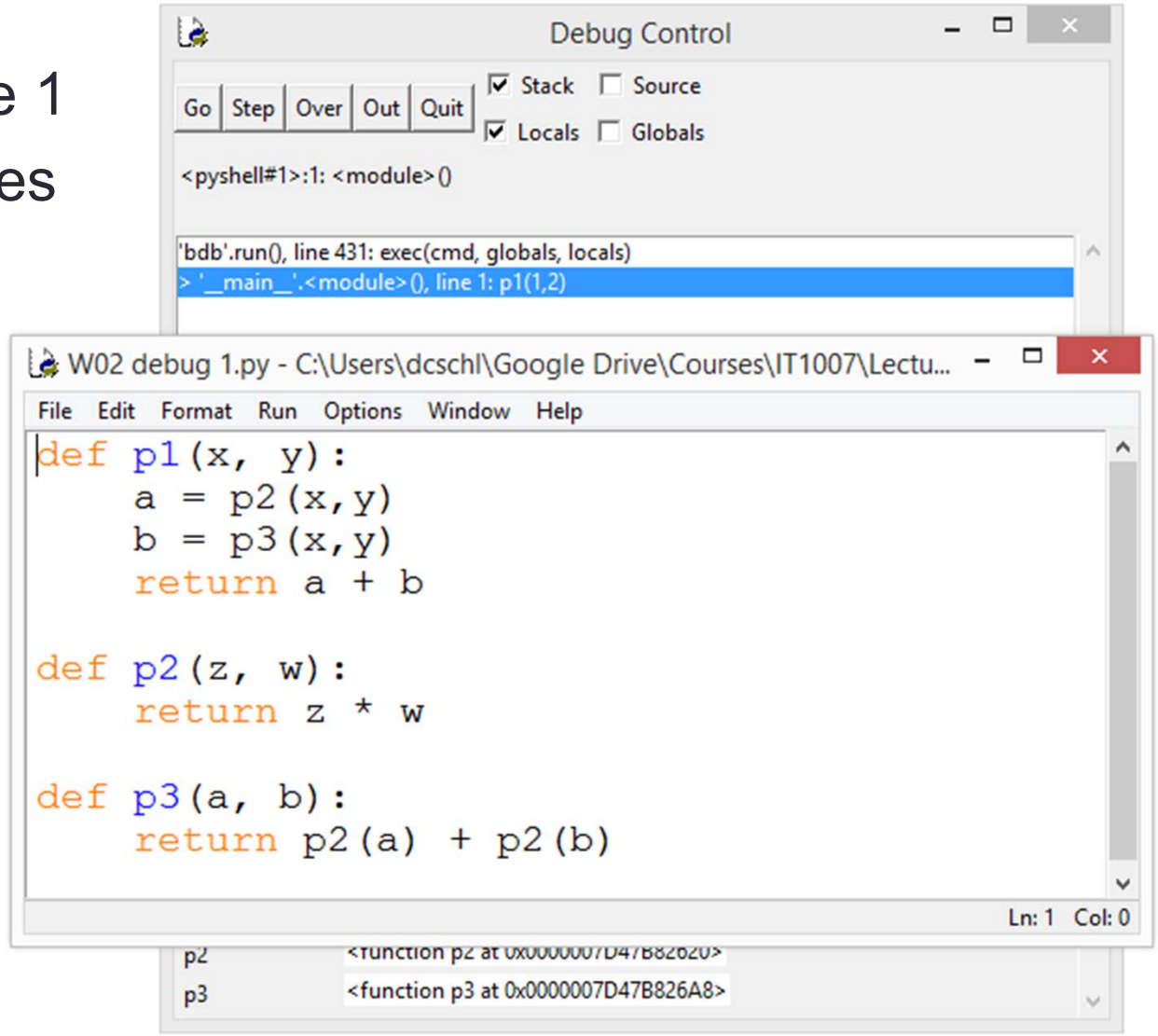


Using the IDLE Debugger

- Go
  - Clicking this will run the program until the next break point is reached. You can insert break points in your code by right clicking and selecting Set Breakpoint. Lines that have break points set on them will be highlighted in yellow.
- Step
  - This executes the next statement. If the statement is a function call, it will enter the function and stop at the first line.
- Over
  - This executes the next statement just as Step does. But it does not enter into functions. Instead, it finishes executing any function in the statement and stops at the next statement in the same scope.
- Out
  - This exits the current function and stops in the caller of the current function.
  - After using Step to step into a function, you can use Out to quickly execute all the statements in the function and get back out to the outer function.
- Quit: This terminates execution.

Using the IDLE Debugger

- Currently in line 1
- Click “Step” goes to line 2



Using the IDLE Debugger

Current position

Step: Go into functions, otherwise “over”

Out: run until the current function ends

Over: run until next line

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```
def p1(x, y):
    a = p2(x,y)
    b = p3(x,y)
    return a + b

def p2(z, w):
    return z * w

def p3(a, b):
    return p2(a) + p2(b)
```

Ln: 1 Col: 0

More Debugging (BuggyAddNum)

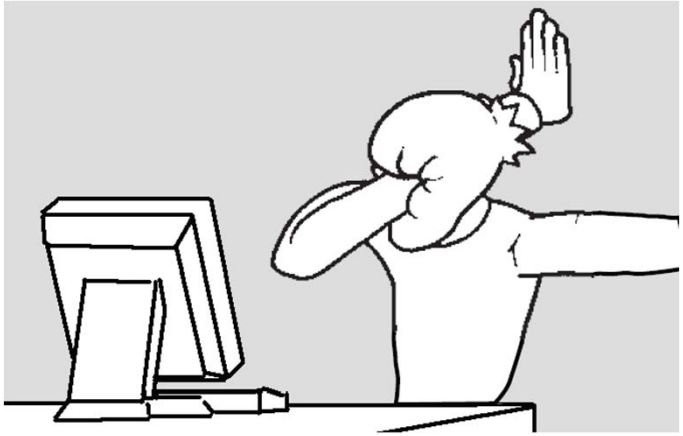
```
import random

def add2Num():
    number1 = random.randint(1, 10)
    number2 = random.randint(1, 10)

    print('What is ' + str(number1) + ' + ' + str(number2) + '?')
    answer = input()
    if answer == number1 + number2:
        print('Correct!')
    else:
        print('Nope! The answer is ' + str(number1 + number2))
```

```
>>> add2Num()
What is 4 + 9?
10
Nope! The answer is 13
>>> |
```

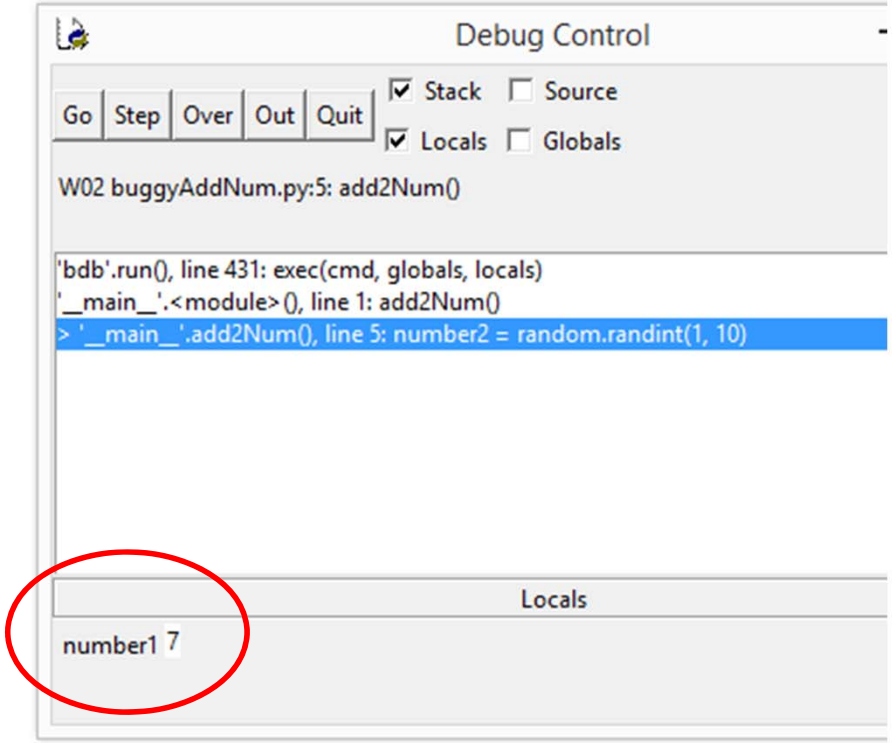
```
>>> add2Num()
What is 6 + 5?
11
Nope! The answer is 11
>>> add2Num()
What is 5 + 9?
14
Nope! The answer is 14
>>> |
```

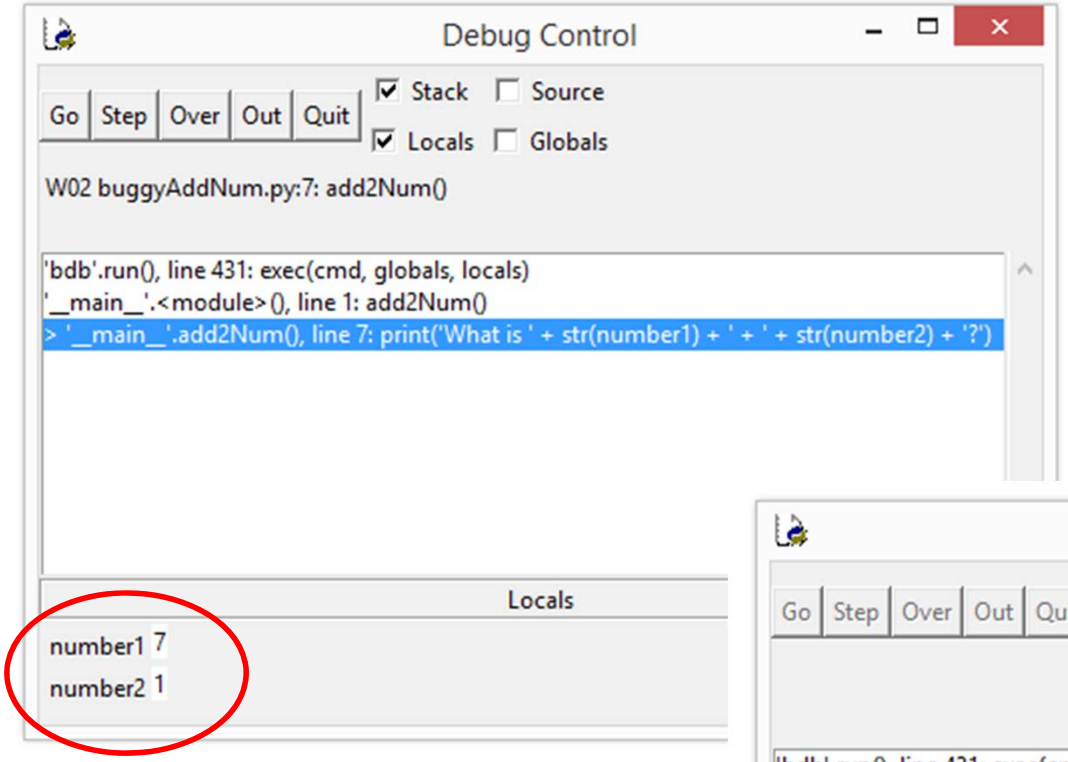


```python
import random

def add2Num():
    number1 = random.randint(1, 10)
    number2 = random.randint(1, 10)

    print('What is ' + str(number1) + ' + ' + str(number2) + '?')
    answer = input()
    if answer == number1 + number2:
        print('Correct!')
    else:
        print('Nope! The answer is ' + str(number1 + number2))
```

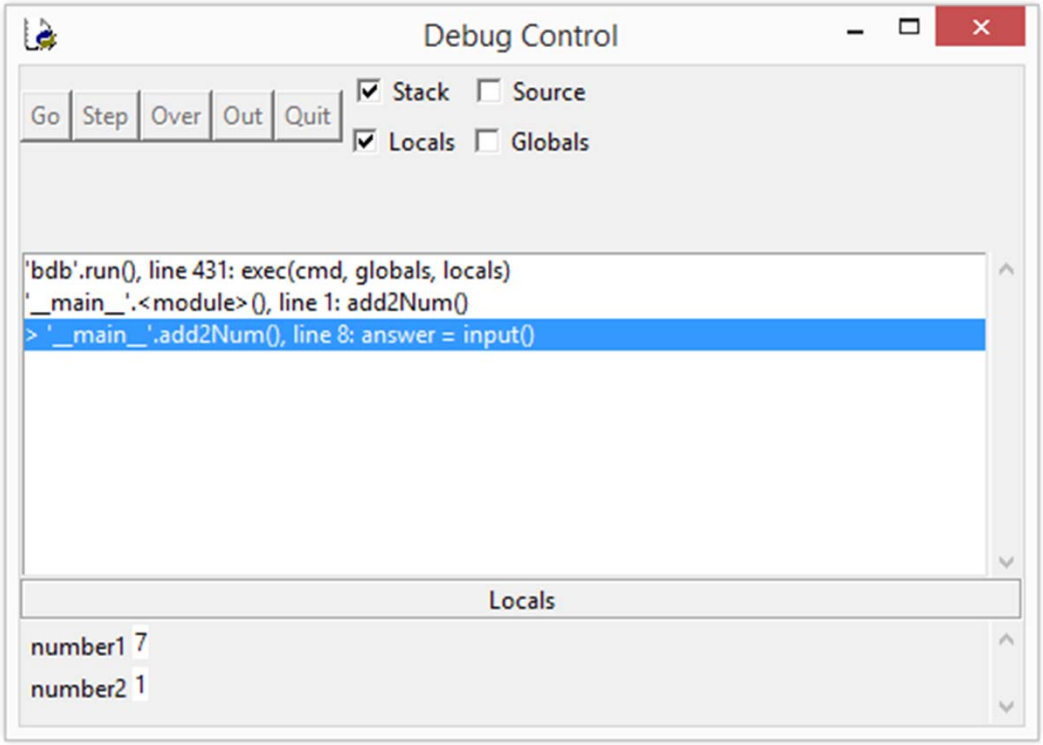
Turn on Debugger

- After a few steps

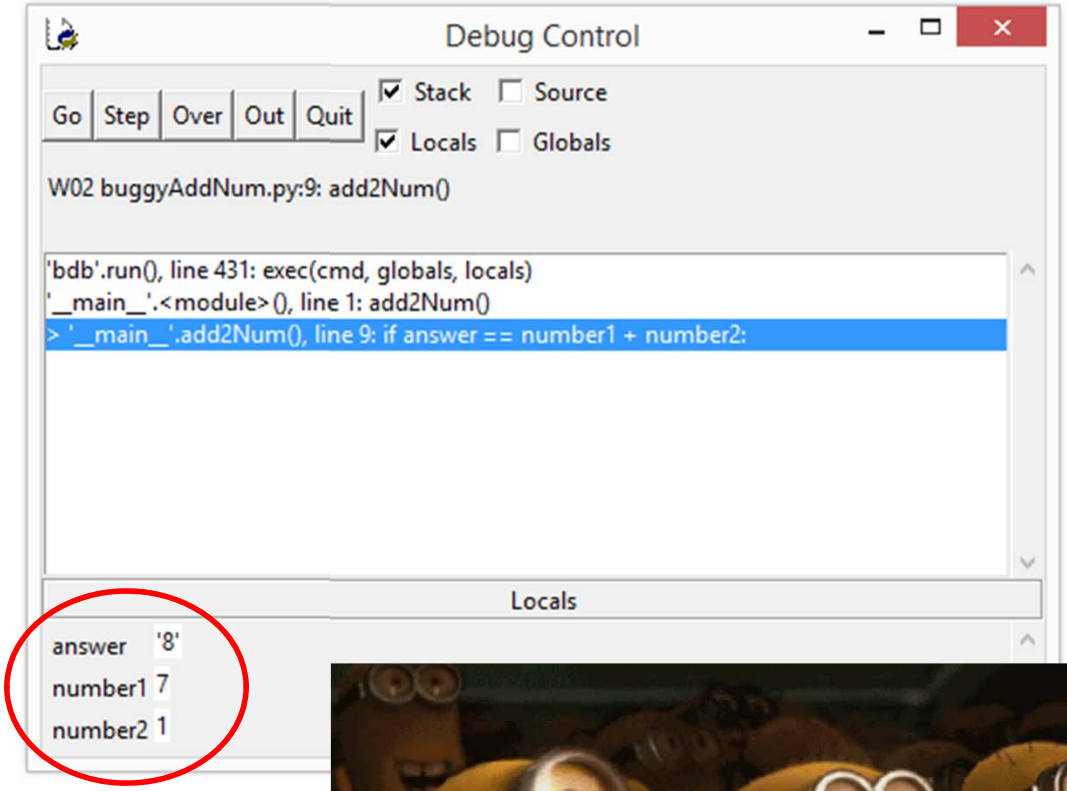


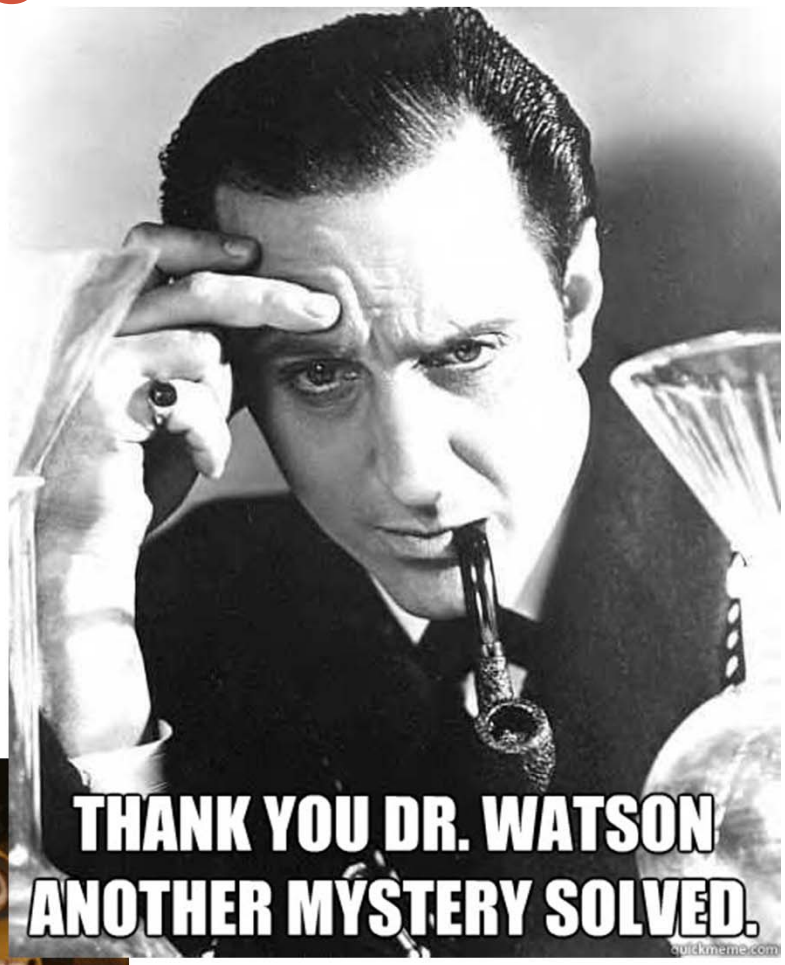


```
>>> add2Num()
What is 7 + 1?
8
```



Using the IDLE Debugger





Another Debugger: Pythontutor.com

Start shared session

What are shared sessions?

Write code in Python 3.6

```
def p1(x, y):
    a = p2(x,y)
    b = p3(x,y)
    return a + b

def p2(z, w):
    return z * w

def p3(a, b):
    return p2(a) + p2(b)

p1(1,2)
```

Support our research and practice Python by trying our new debugging skill test!

Start shared session

What are shared sessions?

Python 3.6

```
1  def p1(x, y):
2      a = p2(x,y)
3      b = p3(x,y)
4      return a + b
5
6  def p2(z, w):
7      return z * w
8
9  def p3(a, b):
10     return p2(a) + p2(b)
11
12 p1(1,2)
```

Edit code | Live programming

line that has just executed

next line to execute

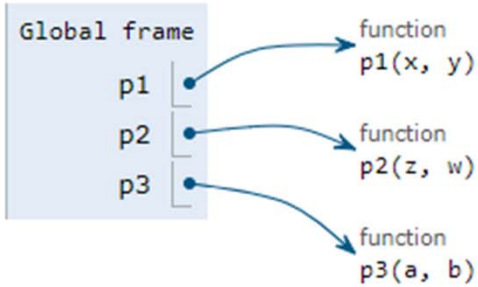
Click a line of code to set a breakpoint; use the Back and Forward buttons to jump there.

<< First | < Back | Program terminated | Forward > | Last >>

TypeError: p2() missing 1 required positional argument: 'w'

Visualized using Python Tutor by Philip Guo (@pgbovine)

Frames | Objects



Debugging is an Art

Maths vs CS vs Engineering

- Three good friends, an engineer, a mathematician and a computer scientist, are driving on a highway that is in the middle of no where. Suddenly one of the tires went flat and they have no spare tire.

Maths vs CS vs Engineering

- Engineer
  - “Let’s use bubble gum to patch the tire and use the strew to inflate it again”
- Mathematician
  - “I can prove that there is a good tire exists in somewhere this continent”
- Computer Scientist
  - “Let’s remove the tire, put it back, and see if it can fix itself again”