Analyzing function calls

Stack diagrams - allow us to visualize the memory and state of the program

Steps for writing stack diagrams:

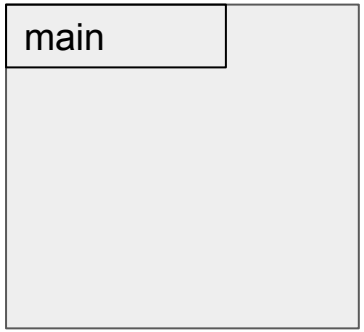
1. Pause when you see the function call
2. Create a stack frame for the called function
    a. parameters allocated
    b. local variables in scope stored here
3. Copy argument values to parameters
4. Execute the function, line by line, until the return
5. Send back the return value
6. Pop the function off the stack
7. Resume the calling function

Tip: Use Python Tutor to check your answers!

Exercise - add.py

Function Stack

Heap



add.py — ~/CS21/cs21-devel/examples/inclass/w05 — Atom

File Edit View Selection Find Packages Help

add.py | add2.py | add3.py | tip.py | fancify.py

```
"""
A program that adds two numbers using a function
"""

def add(x,y):
    print(x, y)
    return x + y

def main():
    n = 2
    out = add(n, 4)
    print(out)

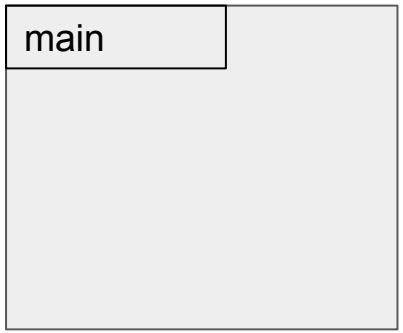
main()
```

add.py 15:1 LF N UTF-8 Python 0 files

Exercise - add.py

Function Stack

Heap



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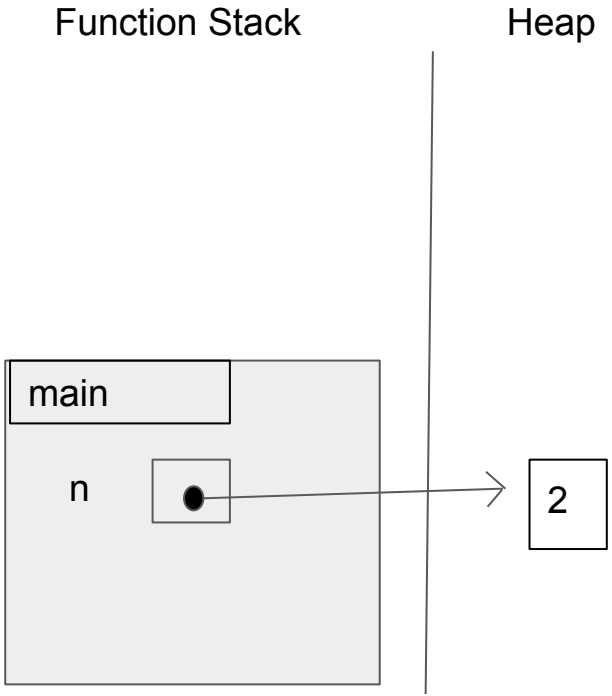

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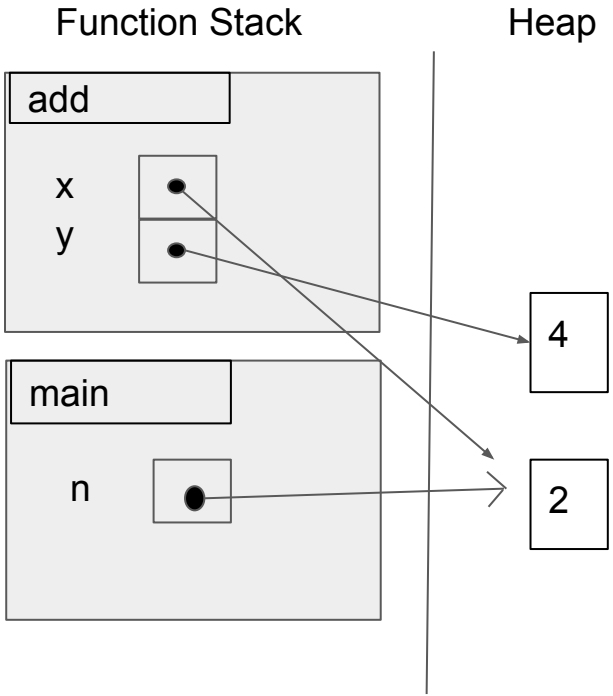

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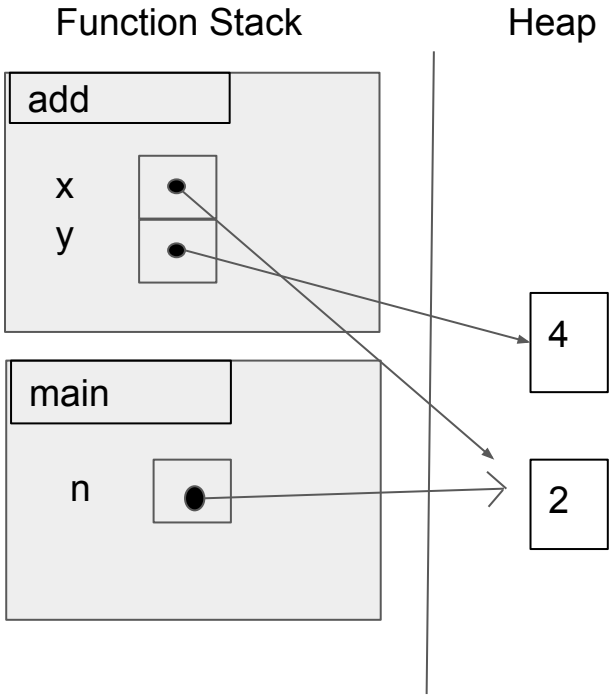

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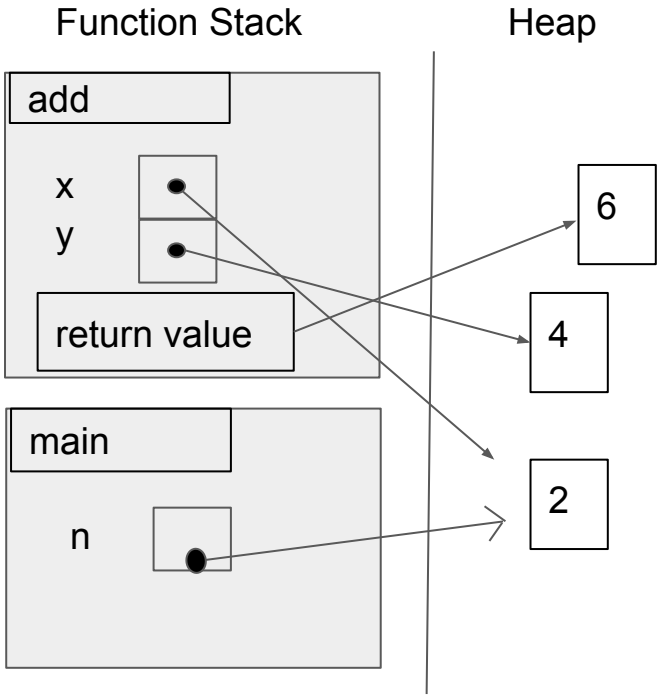

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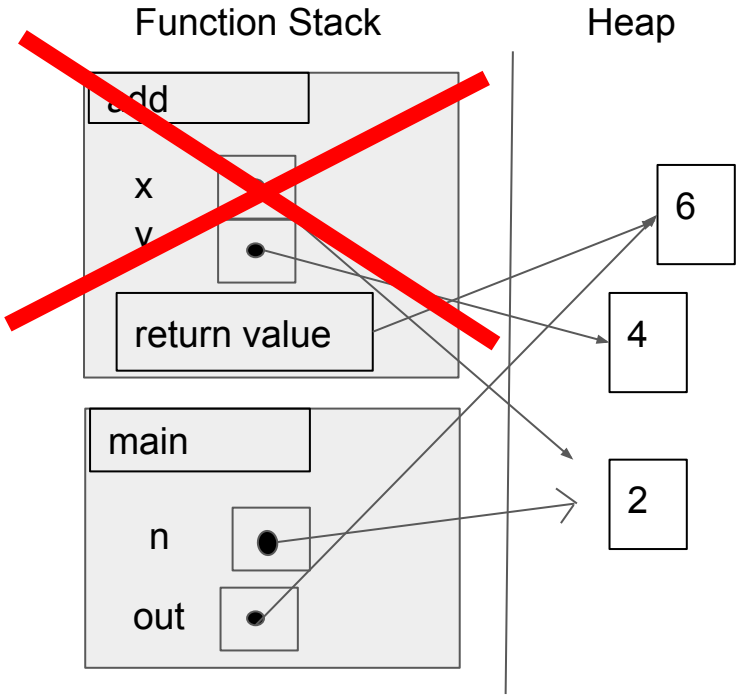

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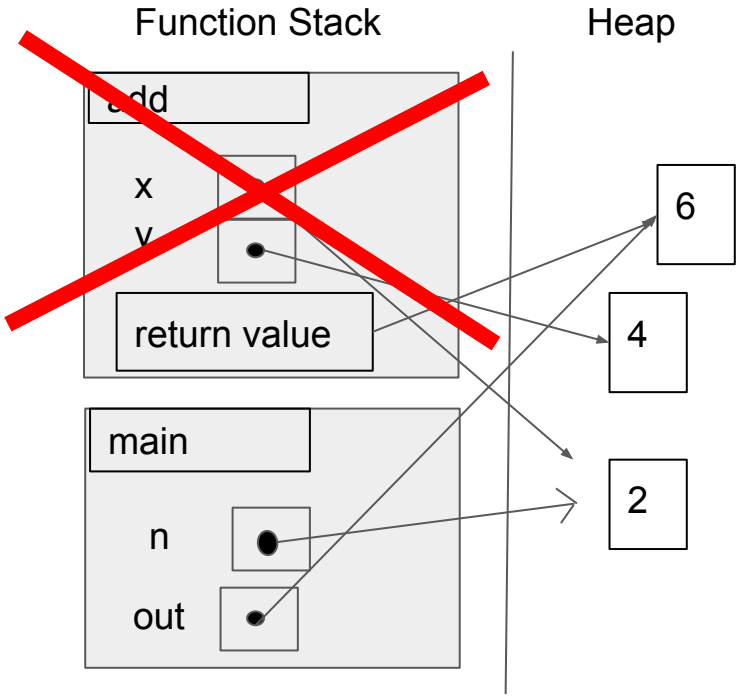

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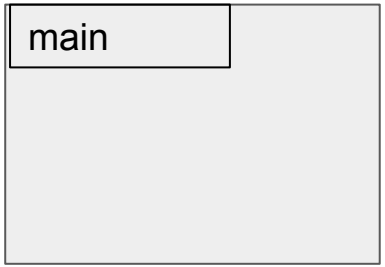
Exercise - add2.py

Function Stack

Heap



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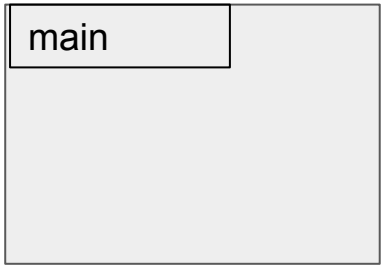
Exercise - add2.py

Function Stack

Heap



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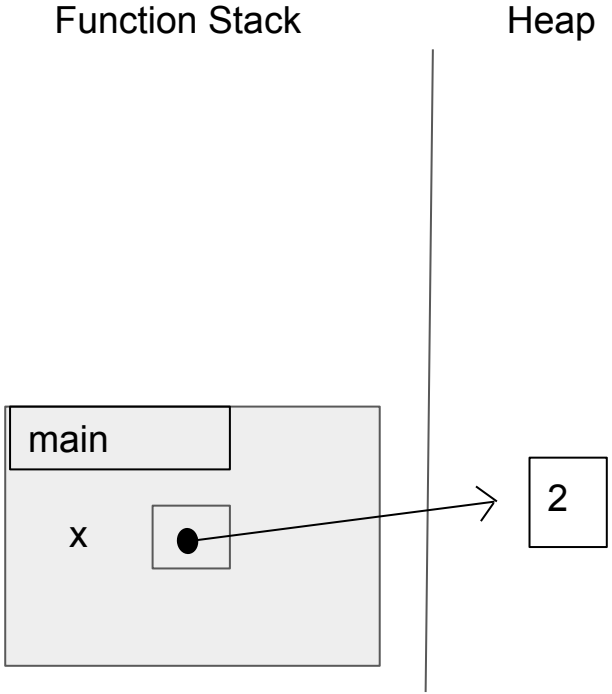

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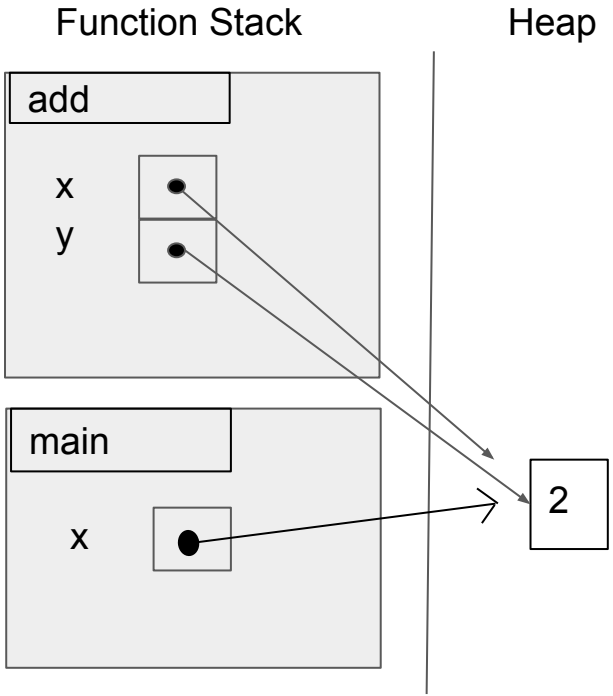

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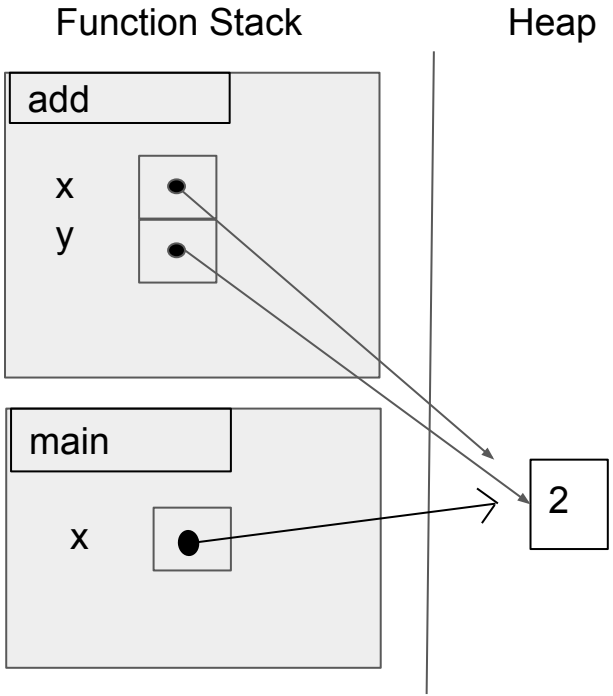

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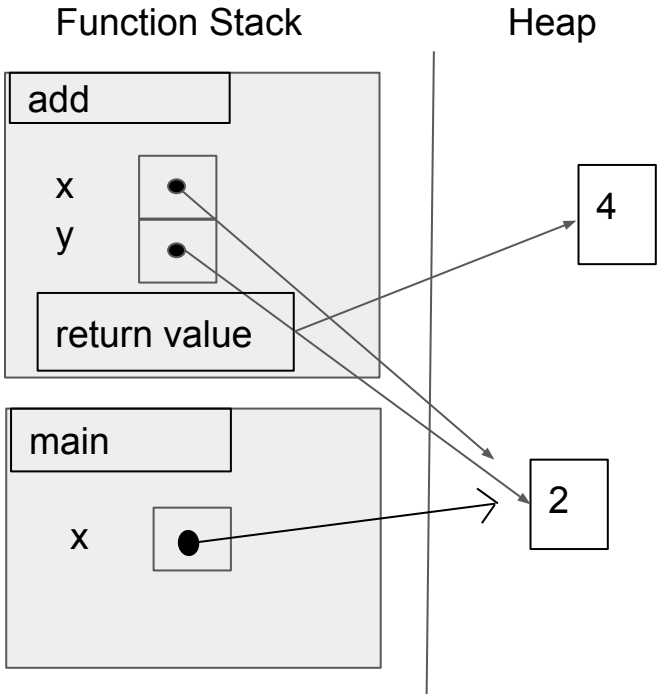

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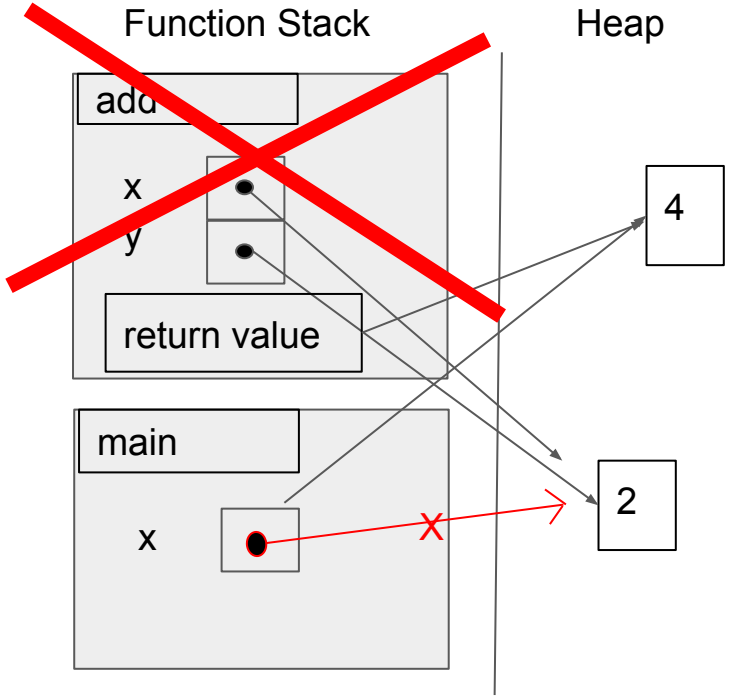

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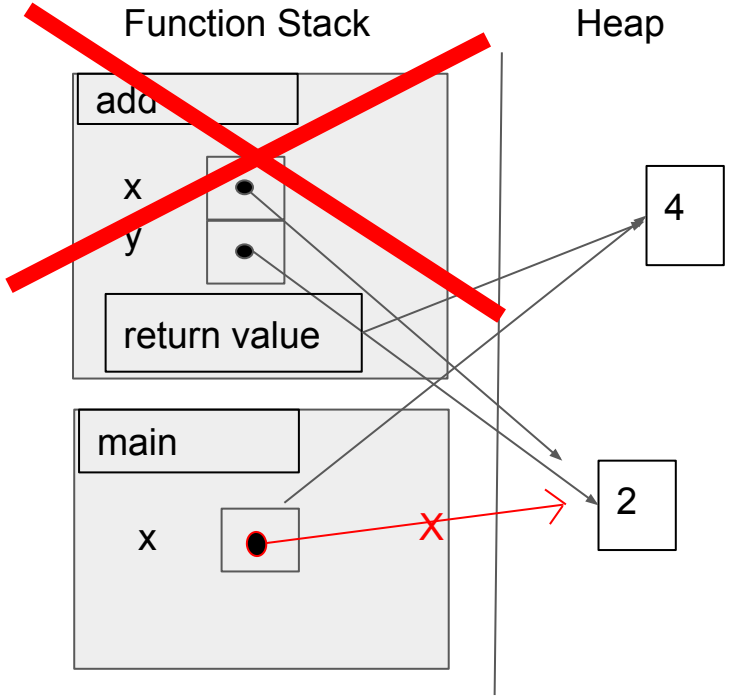

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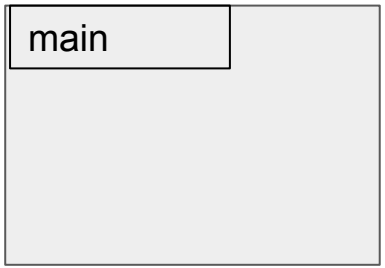
Exercise - add3.py

Function Stack

Heap



add3.py — ~/CS21/cs21-devel/examples/inclass/w05 — Atom

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def add(x,y):
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def main():
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main()
```

add3.py 8:9 LF N UTF-8 Python 0 files

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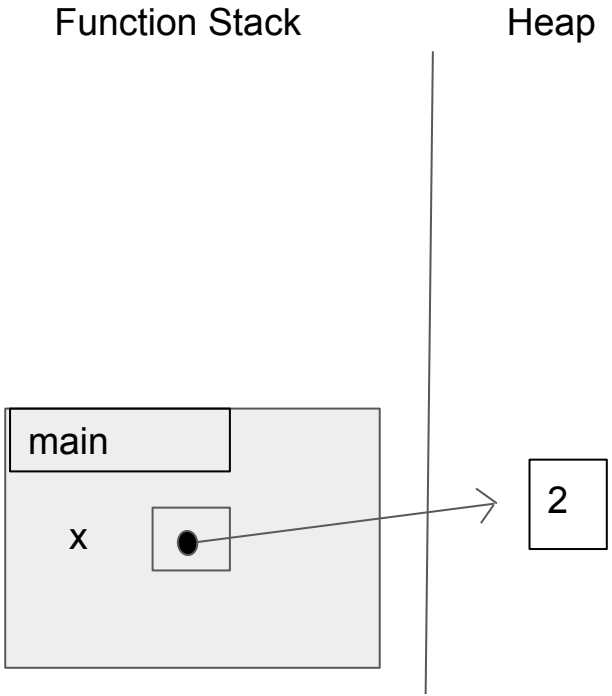

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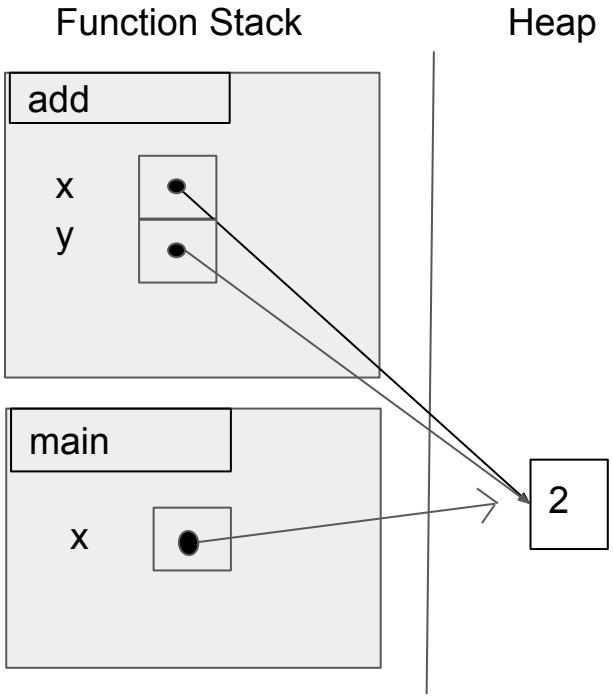

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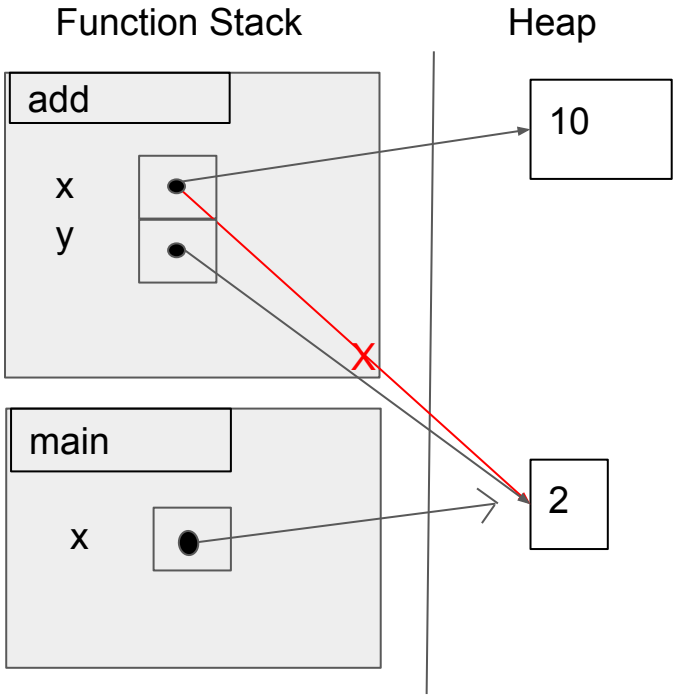

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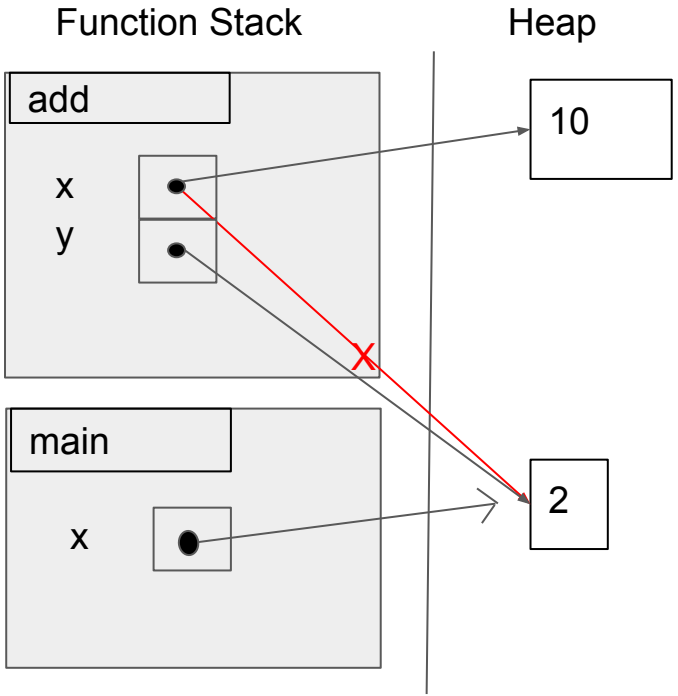

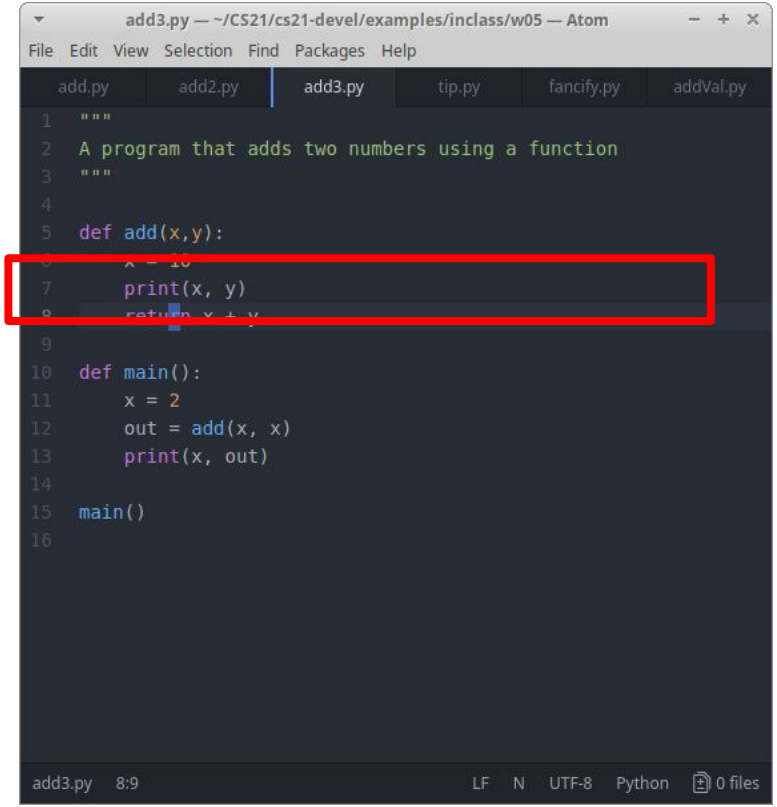

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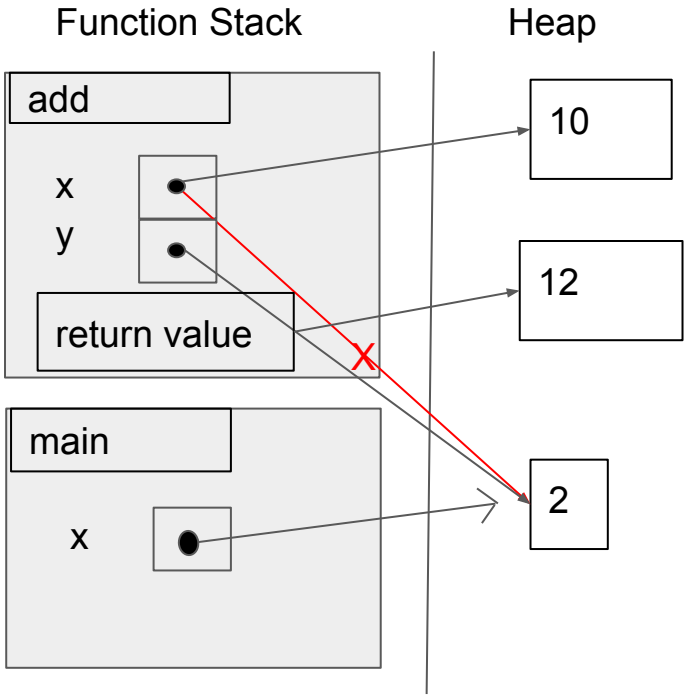

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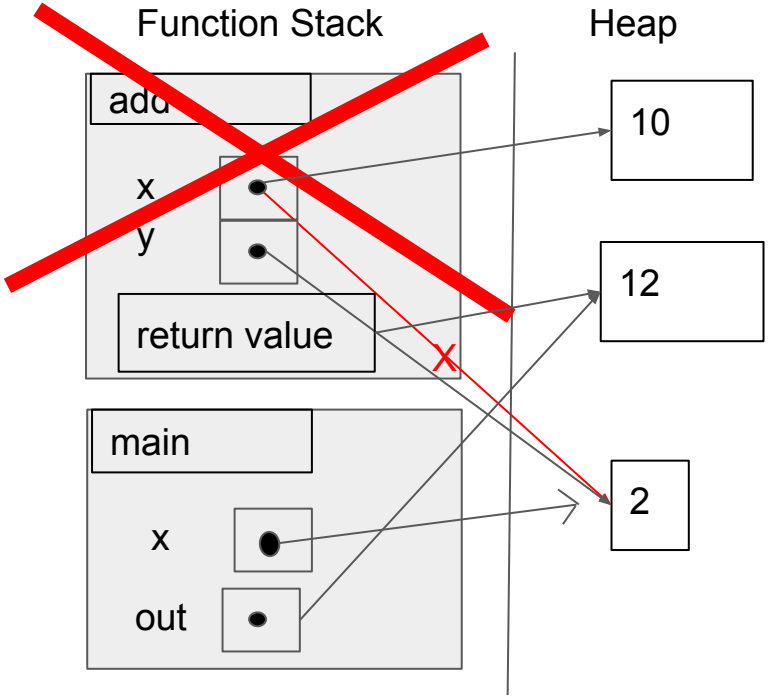

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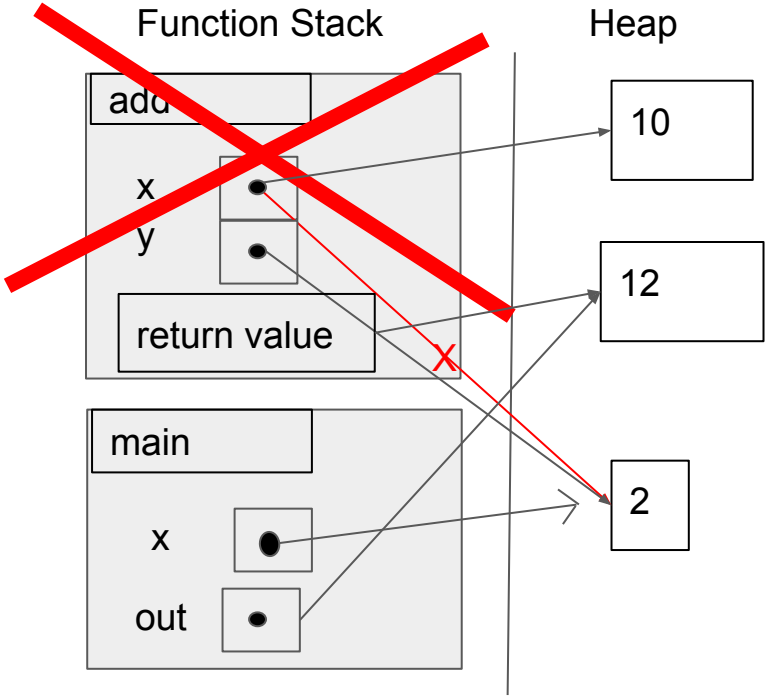
add3.py 8:9 LF N UTF-8 Python 0 files

Note that x has the same value in main() after add() returns!

Exercise - add3.py



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Exercise - tip.py

Function Stack

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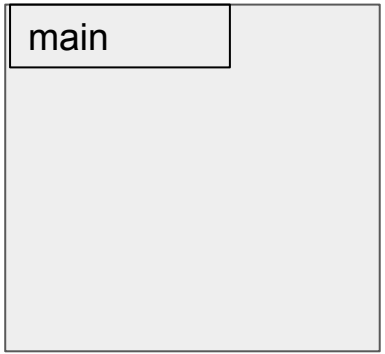
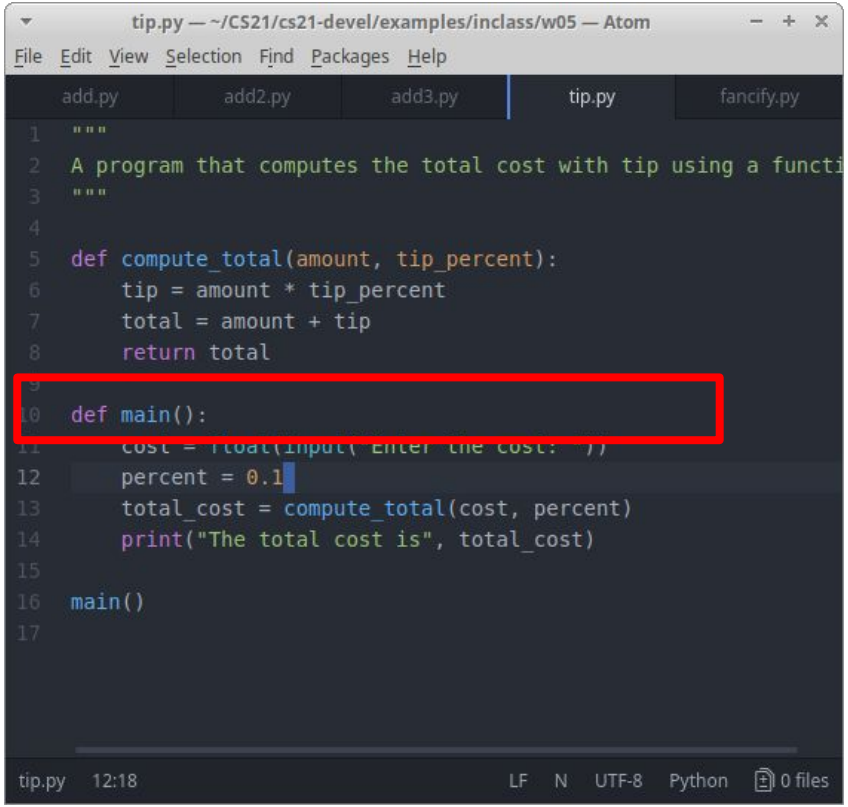
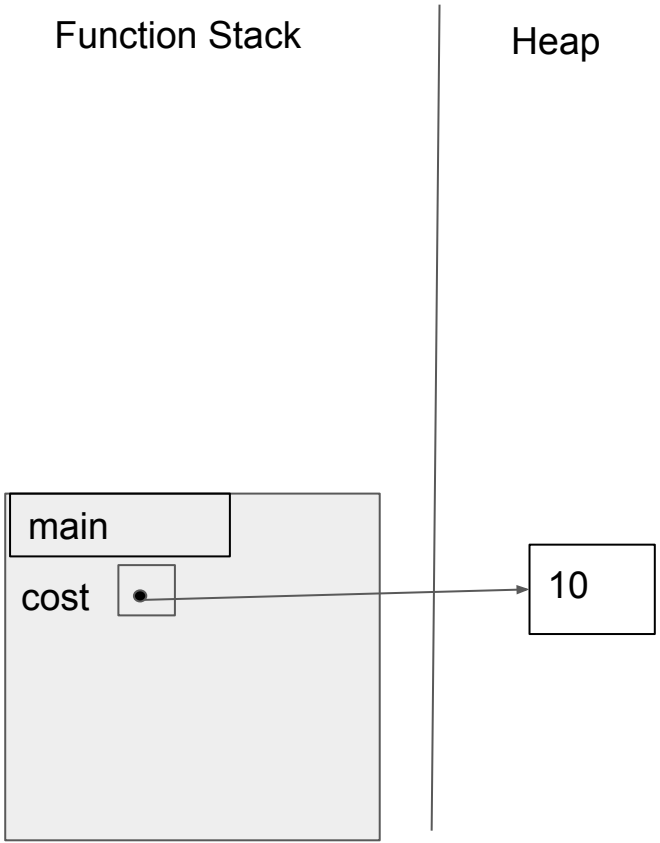




Exercise - tip.py



tip.py — ~/CS21/cs21-devel/examples/inclass/w05 — Atom

File Edit View Selection Find Packages Help

add.py | add2.py | add3.py | tip.py | fancify.py

```
"""
A program that computes the total cost with tip using a functi
"""

def compute_total(amount, tip_percent):
    tip = amount * tip_percent
    total = amount + tip
    return total

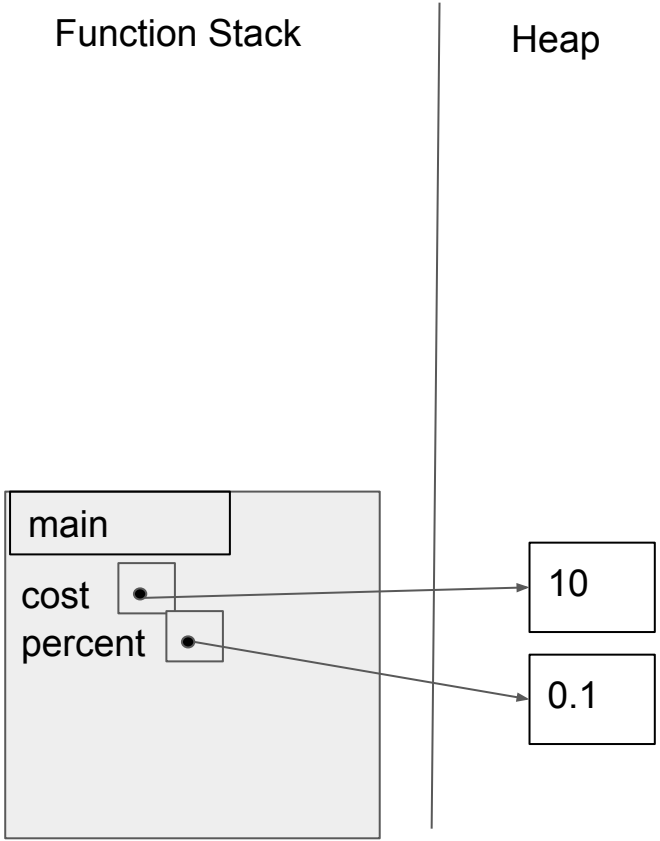
def main():
    cost = float(input("Enter the cost: "))
    percent = 0.1
    total_cost = compute_total(cost, percent)
    print("The total cost is", total_cost)

main()
```

tip.py 12:18 LF N UTF-8 Python 0 files

Assume
cost = 10

Exercise - tip.py



tip.py — ~/CS21/cs21-devel/examples/inclass/w05 — Atom

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tip.py 12:18 LF N UTF-8 Python 0 files

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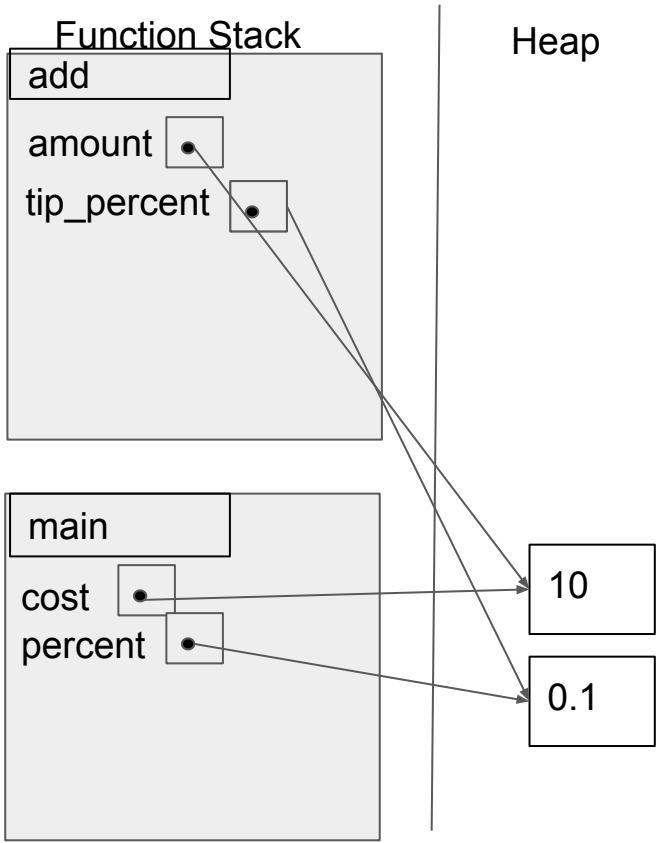

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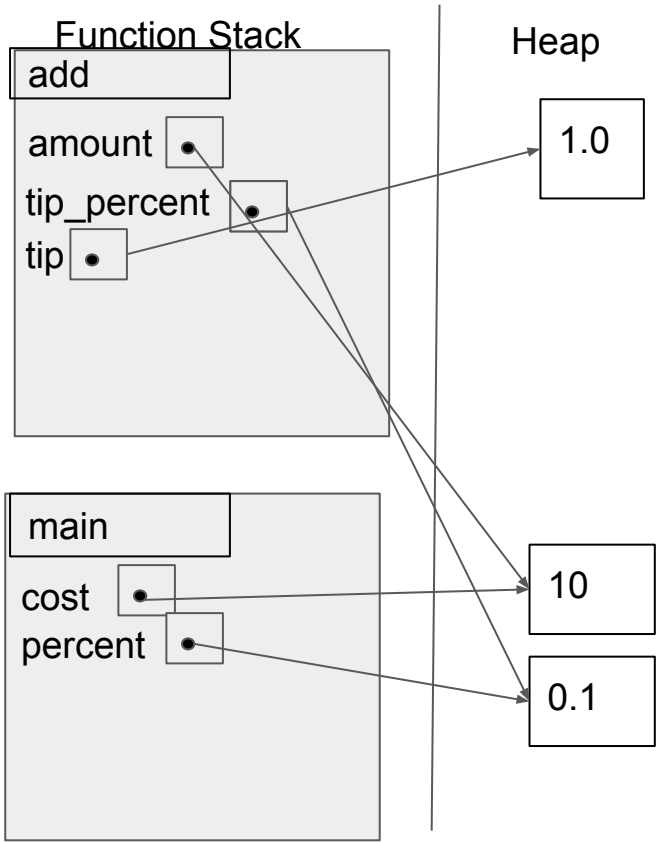

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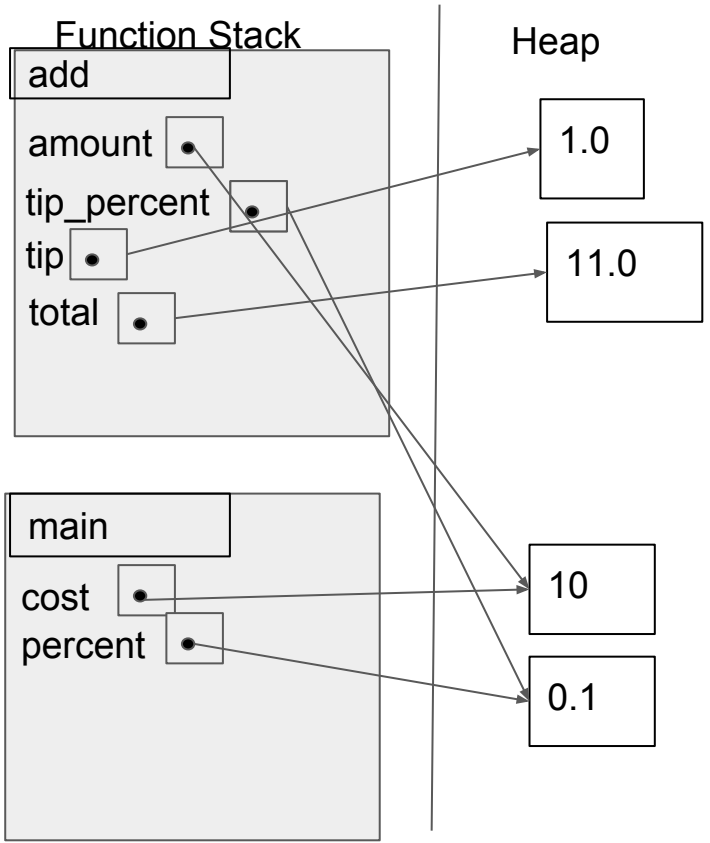

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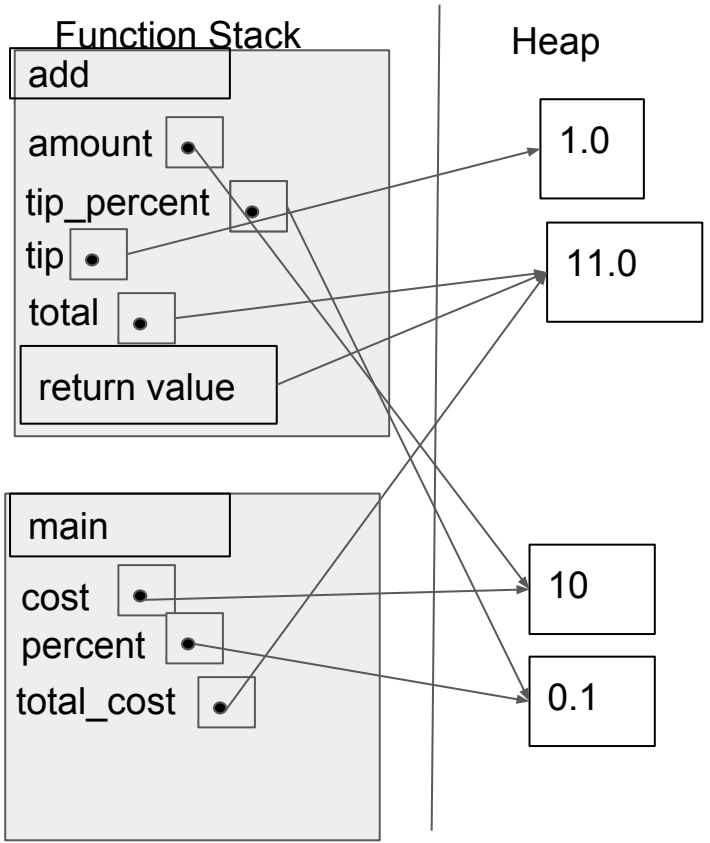

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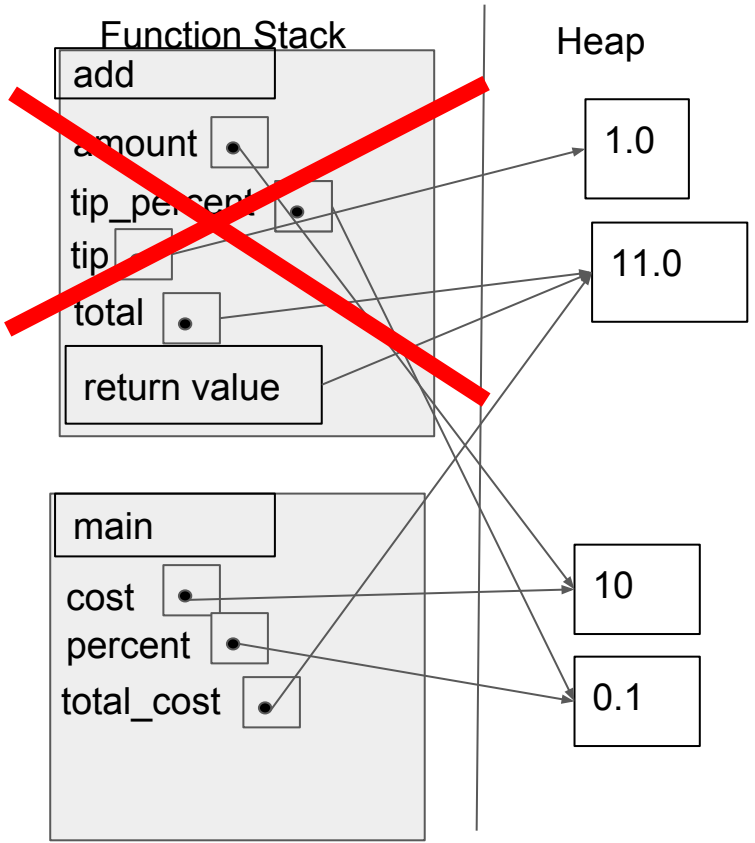

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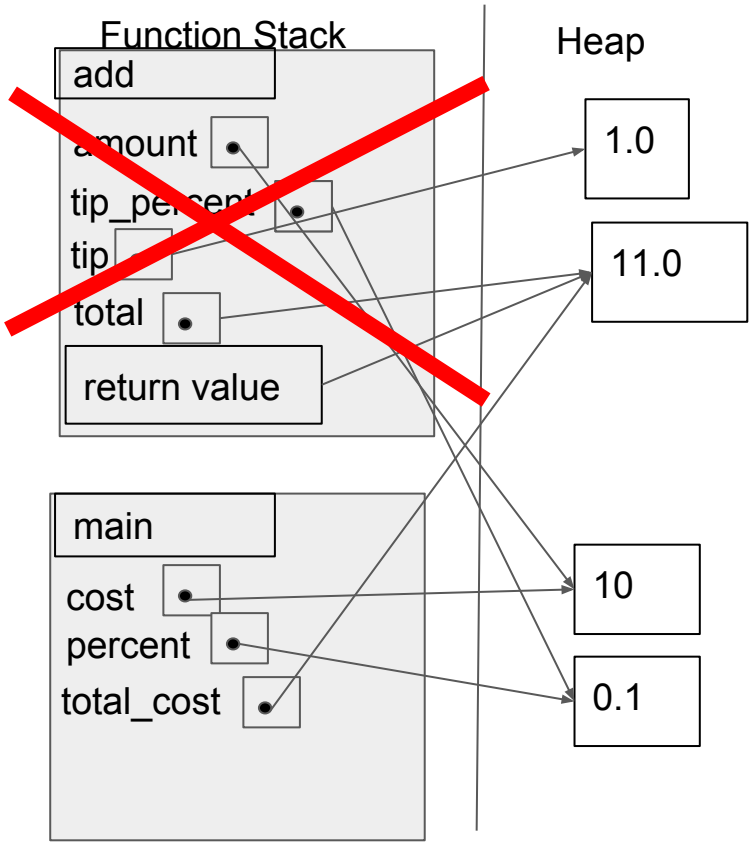

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