

Copy and paste rules — why functions?

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123456.txt

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Update the files

1. 123313: 11% salary raise
2. 123790: moved to Polarna street in Katowice
3. 123856: 10% salary raise

What to do

For each person/file:

- read the file contents
- find the right line
- replace the piece of information
- update the file contents

```
f = open('123313.txt', 'r')
lines = f.read().splitlines()
f.close()
```

```
f = open('123313.txt', 'w')
f.write('\n'.join(lines))
f.close()
```

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```
f = open('123313.txt', 'r')  
lines = f.read().splitlines()  
f.close()
```

```
old_salary = int(lines[3])  
new_salary = 1.11 * old_salary  
lines[3] = str(new_salary)
```

```
f = open('123313.txt', 'w')  
f.write('\n'.join(lines))  
f.close()
```

```
f = open('123790.txt', 'r')
lines = f.read().splitlines()
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lines[2] = 'Katowice, Polarna'

f = open('123313.txt', 'w')
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lines = f.read().splitlines()
f.close()
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lines[2] = 'Katowice, Polarna'
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```
f = open('123790.txt', 'w')
f.write('\n'.join(lines))
f.close()
```

```
f = open('123856.txt', 'r')
lines = f.read().splitlines()
f.close()
```

```
old_salary = int(lines[3])
new_salary = 1.10 * old_salary
lines[3] = str(new_salary)
```

```
f = open('123856.txt', 'w')
f.write('\n'.join(lines))
f.close()
```



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old_salary = int(lines[3])
new_salary = 1.11 * old_salary
lines[3] = str(new_salary)

f = open('123313.txt', 'w')
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f = open('123856.txt', 'r')
lines = f.read().splitlines()
f.close()

old_salary = int(lines[3])
new_salary = 1.10 * old_salary
lines[3] = str(new_salary)

f = open('123856.txt', 'w')
f.write('\n'.join(lines))
f.close()
```

Similar task

- 697123: 12% salary raise
- 112001: 33% salary raise

```
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```
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lines[3] = str(new_salary)
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f = open('123313.txt', 'w')
f.write('\n'.join(lines))
f.close()
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```
# ---
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f = open('123790.txt', 'r')
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f.close()
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```
lines[2] = 'Katowice, Polarna'
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f = open('123790.txt', 'w')
f.write('\n'.join(lines))
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# ---
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f = open('123856.txt', 'r')
lines = f.read().splitlines()
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lines[3] = str(new_salary)
```

```
f = open('123856.txt', 'w')
f.write('\n'.join(lines))
f.close()
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```
# READ FILE
f = open('123313.txt', 'r')
lines = f.read().splitlines()
f.close()
```

```
# CHANGE SALARY
old_salary = int(lines[3])
new_salary = 1.11 * old_salary
lines[3] = str(new_salary)
```

```
# WRITE FILE
f = open('123313.txt', 'w')
f.write('\n'.join(lines))
f.close()
```

```
# ---
```

```
# READ FILE
f = open('123790.txt', 'r')
lines = f.read().splitlines()
f.close()
```

```
# CHANGE ADDRESS
lines[2] = 'Katowice, Polarna'
```

```
# WRITE FILE
f = open('123790.txt', 'w')
f.write('\n'.join(lines))
f.close()
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```
# ---
```

```
# READ FILE
f = open('123856.txt', 'r')
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f.close()
```

```
# CHANGE SALARY
old_salary = int(lines[3])
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lines[3] = str(new_salary)
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# WRITE FILE
f = open('123856.txt', 'w')
f.write('\n'.join(lines))
f.close()
```

Function

$$f(x) = x + 1$$

$$f(x) = x + 1$$

$$g(x) = 2x - x + 1$$

$$h(x) = \frac{42+x^2 \cdot x}{x^3+42} - x + 1$$

$$f(x) = x + 1$$

```
def f(x):  
    return x + 1
```

```
def f(x):  
    print("Hi, how are you?")  
    return x + 1
```



```
def f(x, y):  
    print("Hi, how are you?")  
    return x - y + 1
```

```
def f():  
    print("Hi, how are you?")
```

```
# READ FILE
```

```
f = open('123856.txt', 'r')  
lines = f.read().splitlines()  
f.close()
```

```
def read_file(person):  
    f = open(person + '.txt', 'r')  
    lines = f.read().splitlines()  
    f.close()
```

```
# READ FILE
```

```
f = open('123856.txt', 'r')  
lines = f.read().splitlines()  
f.close()
```

```
def read_file(person):  
    f = open(person + '.txt', 'r')  
    lines = f.read().splitlines()  
    f.close()  
    return lines
```

```
# CHANGE SALARY
```

```
old_salary = int(lines[3])  
new_salary = 1.10 * old_salary  
lines[3] = str(new_salary)
```

```
def change_salary(lines, x):  
    old_salary = int(lines[3])  
    new_salary = x * old_salary  
    lines[3] = str(new_salary)
```

```
# CHANGE ADDRESS
```

```
lines[2] = 'Katowice, Polarna'
```

```
def change_address(lines, new_address):  
    lines[2] = new_address
```

```
# WRITE FILE
```

```
f = open('123313.txt', 'w')
```

```
f.write('\n'.join(lines))
```

```
f.close()
```

```
def write_file(person, lines):
```

```
    f = open(person + '.txt', 'w')
```

```
    f.write('\n'.join(lines))
```

```
    f.close()
```

```
# READ FILE
```

```
f = open('123313.txt', 'r')
lines = f.read().splitlines()
f.close()
```

```
# CHANGE SALARY
```

```
old_salary = int(lines[3])
new_salary = 1.11 * old_salary
lines[3] = str(new_salary)
```

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# WRITE FILE
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f = open('123313.txt', 'w')
f.write('\n'.join(lines))
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```
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```

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# READ FILE
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lines[2] = 'Katowice, Polarna'
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# READ FILE
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f = open('123856.txt', 'r')
lines = f.read().splitlines()
f.close()
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# CHANGE SALARY
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old_salary = int(lines[3])
new_salary = 1.10 * old_salary
lines[3] = str(new_salary)
```

```
# WRITE FILE
```

```
f = open('123856.txt', 'w')
f.write('\n'.join(lines))
f.close()
```



```
# READ FILE
```

```
lines = read_file('123313')
```

```
# CHANGE SALARY
```

```
change_salary(lines, 1.11)
```

```
# WRITE FILE
```

```
write_file('123313', lines)
```

```
# ---
```

```
# READ FILE
```

```
lines = read_file('123790')
```

```
# CHANGE ADDRESS
```

```
change_address(lines, 'Katowice, Polarna')
```

```
# WRITE FILE
```

```
write_file('123790', lines)
```

```
# ---
```

```
# READ FILE
```

```
lines = read_file('123856')
```

```
# CHANGE SALARY
```

```
change_salary(lines, 1.10)
```

```
# WRITE FILE
```

```
write_file('123856', lines)
```

```
lines = read_file('123313')  
change_salary(lines, 1.11)  
write_file('123313', lines)
```

```
lines = read_file('123790')  
change_address(lines, 'Katowice, Polarna')  
write_file('123790', lines)
```

```
lines = read_file('123856')  
change_salary(lines, 1.10)  
write_file('123856', lines)
```

Function call/return costs resources!

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```
def f(x):  
    return 2 * x + 3 * x + 1
```

```
def twice(x):  
    return 2 * x
```

```
def thrice(x):  
    return 3 * x
```

```
def g(x):  
    return twice(x) + thrice(x) + 1
```

Function call/return costs resources!

```
def f(x):  
    return 2 * x + 3 * x + 1
```

```
def twice(x):  
    return 2 * x
```

```
def thrice(x):  
    return 3 * x
```

```
def g(x):  
    return twice(x) + thrice(x) + 1
```

0.18 μ s vs 0.32 μ s (1.8 \times)

```
def fib(i):  
    if i == 0 or i == 1:  
        return 1  
    else:  
        return fib(i-1) + fib(i-2)  
  
print(fib(40))
```

```
#include <stdio.h>  
  
int fib(int i) {  
    if (i == 0 || i == 1)  
        return 1;  
    else  
        return fib(i-1) + fib(i-2);  
}  
  
int main(void) {  
    printf("%u\n", fib(40));  
    return 0;  
}
```

```
def fib(i):  
    if i == 0 or i == 1:  
        return 1  
    else:  
        return fib(i-1) + fib(i-2)  
  
print(fib(40))
```

37 s vs 0.1 s (370×)

```
#include <stdio.h>  
  
int fib(int i) {  
    if (i == 0 || i == 1)  
        return 1;  
    else  
        return fib(i-1) + fib(i-2);  
}  
  
int main(void) {  
    printf("%u\n", fib(40));  
    return 0;  
}
```

Pure vs “dirty” functions


```
def payEmployee(employeeId, hours):  
    connectionId = 12332  
  
    today = datetime.date.today()  
    weekday = today.isoweekday() # 1 for Monday, 7 for Sunday  
  
    if weekday == 7:  
        r = paySundayTime(connectionId, employeeId, hours)  
    else:  
        r = payNormalTime(connectionId, employeeId, hours)  
    return r
```

```
def payEmployee(employeeId, hours, today):  
    connectionId = 12332  
  
    weekday = today.isoweekday() # 1 for Monday, 7 for Sunday  
  
    if weekday == 7:  
        r = paySundayTime(connectionId, employeeId, hours)  
    else:  
        r = payNormalTime(connectionId, employeeId, hours)  
    return r
```

```
# def payEmployee(employeeId, hours, today)
```

```
r1 = payEmployee(1434, 8, datetime.date(2022, 4, 1))
```

```
r2 = payEmployee(1434, 8, datetime.date(2022, 4, 2))
```

```
r3 = payEmployee(1434, 8, datetime.date(2022, 4, 3))
```

```
r4 = payEmployee(1434, 8, datetime.date(2022, 4, 4))
```

Pure function

- DOES NOT modify arguments

Pure function

- DOES NOT modify arguments
- DOES NOT depend on the outer world

Pure function

- DOES NOT modify arguments
- DOES NOT depend on the outer world
- DOES NOT modify the world

```
import sys

print("I was called with those arguments:")
print(sys.argv)
sys.exit(24)
```

```
> python args.py 123 445 9080
I was called with those arguments:
['args.py', '123', '445', '9080']
```

```
> echo %errorlevel%
24
```

"Clean up" the code using functions

```
import sys

# the first element in 'sys.argv' (at index 0) is always the script file name;
# therefore look for the numbers starting with the second element (index 1)
if len(sys.argv) == 2:
    arg1 = int(sys.argv[1])
    if arg1 < 0:
        print("Sorry, expected non-negative integers")
        sys.exit(1) # end with 1 to indicate error
    result = arg1 + 42 - 4
    print("Result of the function is: ", result)
elif len(sys.argv) == 3:
    arg1 = int(sys.argv[1])
    if arg1 < 0:
        print("Sorry, expected non-negative integers")
        sys.exit(1) # end with 1 to indicate error
    arg2 = int(sys.argv[2])
    if arg2 < 0:
        print("Sorry, expected non-negative integers")
        sys.exit(1) # end with 1 to indicate error
    result = arg1 + arg2 - 4
    print("Result of the function is: ", result)
elif len(sys.argv) == 4:
    arg1 = int(sys.argv[1])
    if arg1 < 0:
        print("Sorry, expected non-negative integers")
        sys.exit(1) # end with 1 to indicate error
    arg2 = int(sys.argv[2])
    if arg2 < 0:
        print("Sorry, expected non-negative integers")
        sys.exit(1) # end with 1 to indicate error
    arg3 = int(sys.argv[3])
    if arg3 < 0:
        print("Sorry, expected non-negative integers")
        sys.exit(1) # end with 1 to indicate error
    result = arg1 + arg2 - arg3
    print("Result of the function is: ", result)
else:
    print("Invalid arguments - expected 1..3 non-negative integer numbers")
    sys.exit(1) # end with 1 to indicate error
```