

**MITx:** 6.00.1x Introduction to Computer Science and Programming Using Python

<u>Help</u>

Course > Week 6: Algorithmic Complexity > 11. Computational Complexity > Exercise 2

# **Exercise 2**

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#### Exercise 2

6/6 points (graded)

#### **ESTIMATED TIME TO COMPLETE: 12 minutes**

For the following programs, fill in the best-case and the worst-case number of steps it will take to run each program.

For these questions, you'll be asked to write a mathematical expression. Use +, -, / signs to indicate addition, subtraction, and division. Explicitly indicate multiplication with a \* (ie say "6\*n" rather than "6n"). Indicate exponentiation with a caret (^) (ie "n^4" for  $n^4$ ). Indicate base-2 logarithms with the word log2 followed by parenthesis (ie "log2(n)").

#### 1. Program 1:

```
def program1(x):
    total = 0
    for i in range(1000):
        total += i

while x > 0:
        x -= 1
        total += x
```

What is the number of steps it will take to run Program 1 in the best case? Express your answer in terms of n, the size of the input  $\boxed{\mathbf{x}}$ .

```
1+3*1000 + 1 +1
```

 $1 + 3 \cdot 1000 + 1 + 1$ 

What is the number of steps it will take to run Program 1 in the worst case? Express your answer in terms of n, the size of the input x.

1 + 3 \* 1000 + n\*5 + 1+ 1
$$1 + 3 \cdot 1000 + n \cdot 5 + 1 + 1$$

#### 2. Program 2:

```
def program2(x):
    total = 0
    for i in range(1000):
        total = i

while x > 0:
        x = x//2
        total += x

return total
```

What is the number of steps it will take to run Program 2 in the best case? Express your answer in terms of n, the size of the input x.

$$1 + 2*1000 + 1 + 1$$
 $1 + 2 \cdot 1000 + 1 + 1$ 

What is the number of steps it will take to run Program 2 in the worst case? Express your answer in terms of n, the size of the input x.

1 + 2\*1000 + (log2(n) + 1) \* 5 + 1 + 1
$$1 + 2 \cdot 1000 + (\log_2(n) + 1) \cdot 5 + 1 + 1$$

### 3. Program 3:

```
def program3(L):
    totalSum = 0
    highestFound = None
    for x in L:
        totalSum += x

for x in L:
    if highestFound == None:
        highestFound = x
    elif x > highestFound:
        highestFound = x

return (totalSum, highestFound)
```

What is the number of steps it will take to run Program 3 in the best case? Express your answer in terms of n, the number of elements in the list  $\square$ .



What is the number of steps it will take to run Program 3 in the worst case? Express your answer in terms of n, the number of elements in the list  $\square$ .

$$2 + n*3 + 3 + (n-1)*4 + 1$$

$$2 + n \cdot 3 + 3 + (n-1) \cdot 4 + 1$$

Reminder: You do not lose points for trying a problem multiple times, nor do you lose points if you hit "Show Answer". If this problem has you stumped after you've tried it a few times, feel free to reveal the solution.

Click the "Reset" button to clear your answers.

### Submit

✓ Correct (6/6 points)

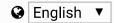
## Exercise 2

**Show Discussion** 

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