

## Introduction to Program Tracing

The linked document on the course webpage has my solutions written

1.

x = 5  
y = x  
x = 7

← Each time a variable is created or reassigned it should be reflected in the variables column

Scratch

Variables

The scratch work side is for you to work out any arithmetic or logical steps you need. It is never graded - but can help me follow your reasoning

~~x = 7~~  
y = 5

2.

x = 5  
y = x  
x = x + 3  
y = y + x  
z = y - 3

Scratch

Variables

x = ~~5~~ 8

y = ~~5~~ 13

z = 10

x = x + 3  
x = 5 + 3 = 8

y = y + x = 5 + 8 = 13

z = y - 3 = 13 - 3

↑  
Important: we always have  
variable\_name = value

Never  
variable\_name = mathematical expression  
on this side!

3.

quizzes

(Note: This code purposefully has a runtime error. This will not happen on ~~Exam~~ or anything, but is designed to show you how tracing can help catch such mistakes.)

```
a = 3
b = 3 // 2
a = c + 1
b = a + b
```

Scratch	Variables
$b = 3 // 2$ ↑ Integer division! $3 // 2 = 1$	$a = 3$  $b = 1$
$a = c + 1$ ↑ ? There is no c on the variables side!  Error!	

4.

```
a = 7
b = 2
b *= a
c = a + b

if a < b:
    c = 100
elif b > c:
    c = 7
elif c == 7:
    d = 123
else:
    c = 12
```

Scratch

$b * = a$  means

$$b = b * a = 2 * 7 = 14$$

$$\text{if } a < b \Rightarrow 7 < 14 \checkmark$$

Since "if" ran, the  
elifs + else are  
skipped!

Variables

$$a = 7$$

$$b = \cancel{2} \quad 14$$

$$c = \cancel{21} \quad 100$$

5.

```
a = -3
b = 2
b *= a
c = a + b

if a < b:
    c = 100
elif b > c:
    c = 7
elif c == 7:
    d = 123
else:
    c = 12
```

Scratch

Variables

if  $a < b$   ~~$-3 < -9$~~  No

elif  $b > c$   ~~$-6 > -9$~~  ✓

$a = -3$

$b = 2 - 6$

$c = -9 \quad 7$

Note: while c  
is indeed 7 here,  
in any if, elif, elif, ...  
else block at most  
ONE part can run!

6.

```
s = 'hi'  
t = 'bye'  
u = 'hello'  
  
if s >= t:  
    u = 'seeya'  
    t = 'zzz'  
elif s < t:  
    u = 'abcd'  
else:  
    u = 'xyz'
```

Scratch

if  $s \geq t$      'hi' > 'bye'  
yes! 'h' comes  
after 'b'

Variables

$s = 'hi'$   
 ~~$t = 'bye'$~~      'zzz'  
 ~~$u = 'hello'$~~      'seeya'

7.

```
s = 'hi'  
t = 'bye'  
u = 'hello'  
  
if s >= t:  
    u = 'seeya'  
    t = 'zzz'  
  
if s > t:  
    u = 'abcd'  
else:  
    u = 'xyz'
```

Scratch

Variables

$s \geq t$ ? yes!

This is a  
new block!

$s > t$ ? No.  
So the else  
runs

$s = 'hi'$		
$t = 'bye'$	$'zzz'$	
$u = 'hello'$	$'seeya'$	$'xyz'$