

## ASSIGNMENTS

**Exercise 1:** What do the variables  $a$  and  $b$  contain after the following sequence of instructions?

**Algorithm 1.**

Variables:

$a$  and  $b$  are two integers.

Instructions of the algorithm:

```
1   $a \leftarrow 3$ 
2   $b \leftarrow 5$ 
3   $a \leftarrow b$ 
4   $b \leftarrow a$ 
```

**Exercise 2:** What do the variables  $a$  and  $b$  contain after the following sequence of instructions?

**Algorithm 2.**

Variables:

$a$  and  $b$  are two integers.

Instructions of the algorithm:

```
1   $a \leftarrow 1$ 
2   $b \leftarrow a + 1$ 
3   $a \leftarrow b + 2$ 
4   $b \leftarrow a + 2$ 
5   $a \leftarrow b + 3$ 
6   $b \leftarrow a + 3$ 
```

**Exercise 3:** What do the variables  $n$  and  $s$  contain after the following sequence of instructions?

**Algorithm 3.**

Variables:

$n$  and  $s$  are two integers.

Instructions of the algorithm:

```
1   $n \leftarrow 1$ 
2   $s \leftarrow n$ 
3   $n \leftarrow n + 1$ 
4   $s \leftarrow s + n$ 
5   $n \leftarrow n + 1$ 
6   $s \leftarrow s + n$ 
7   $n \leftarrow n + 1$ 
8   $s \leftarrow s + n$ 
9   $n \leftarrow n + 1$ 
10  $s \leftarrow s + n$ 
```

**Exercise 4:** What is the effect of the following sequence of instructions on the content of variables  $a$  and  $b$ ? It is possible to test different examples to elaborate the result, before proving it for any possible values of  $a$  and  $b$ .

**Algorithm 4.**

Variables:

$a$  and  $b$  are two integers.

Instructions of the algorithm:

```
1 ...
2  $a \leftarrow a + b$ 
3  $b \leftarrow a - b$ 
4  $a \leftarrow a - b$ 
5 ...
```

**Exercise 5:**

1. What is the effect of the following sequence of instructions on the content of variables  $a$  and  $b$ ? It is possible to test different examples to elaborate the result, before proving it for any possible values of  $a$  and  $b$ .

**Algorithm 5.**

Variables:

$a$ ,  $b$  and  $z$  are three integers.

Instructions of the algorithm:

```
1 ...
2 If ( $a < b$ ) then
3      $z \leftarrow a$ 
4      $a \leftarrow b$ 
5      $b \leftarrow z$ 
6 End If
5 ...
```

2. Use this sequence of instructions as a “black box” and write a new algorithm that takes as input three integers ( $a$ ,  $b$  and  $c$ ) and that sorts them by decreasing order (at the end of the algorithm,  $a$  will contain the biggest of the three values,  $b$  the medium value, and  $c$  the lowest one). This algorithm must call three times this black box (it is possible to use this black box on inputs different than  $a$ ,  $b$  and  $z$ ).

Remark: we saw two ways of exchanging (or swapping) the content of two variables. It can be proven that it is impossible to do this swap by performing less than three assignments, even if in Python, there exist an instruction that seems to perform only one assignment and does this swap.