

Example of how to use Algorithm2e

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Below we illustrate the formatting as pseudo code of some sample of simple algorithms. The goal is not to entice you to use L^AT_EX for formatting your algorithms as currently the best possible formatting tool for algorithms. Please carefully check the source files and learn how to use this style. Importantly:

- Always state your input
- State the output if any
- Always number your lines for quick referral.
- Always declare and initialize your local variables
- Always use `\gets` for assignments
- Always end with “return” even when not returning any values
- Use common functions and operands such as UNION, POWERSET, etc. as often as needed, unless you are asked to define them.

Algorithm 1 will find the maximum element in a finite sequence (Slide 14 in Class Slides).

Algorithm 1: MAX finds the maximum number

Input: A finite set $A = \{a_1, a_2, \dots, a_n\}$ of integers

Output: The largest element in the set

```
1  $max \leftarrow a_1$ 
2 for  $i \leftarrow 2$  to  $n$  do
3   if  $a_i > max$  then
4      $max \leftarrow a_i$ 
5 return  $max$ 
```

Algorithm 2 is a greedy change-making algorithm (Slide 19 in Class Slides).

Algorithm 3 and Algorithm 4 will find the first duplicate element in a sequence of integers.

Algorithm 2: CHANGE Makes change using the smallest number of coins

Input: A set $C = \{c_1, c_2, \dots, c_r\}$ of denominations of coins, where $c_i > c_2 > \dots > c_r$ and a positive number n

Output: A list of coins d_1, d_2, \dots, d_k , such that $\sum_{i=1}^k d_i = n$ and k is minimized

```
1  $C \leftarrow \emptyset$ 
2 for  $i \leftarrow 1$  to  $r$  do
3   while  $n \geq c_i$  do
4      $C \leftarrow C \cup \{c_i\}$ 
5      $n \leftarrow n - c_i$ 
6 return  $C$ 
```

Algorithm 3: FINDDUPLICATE

Input: A sequence of integers $\langle a_1, a_2, \dots, a_n \rangle$

Output: The index of first location with the same value as in a previous location in the sequence

```
1  $location \leftarrow 0$ 
2  $i \leftarrow 2$ 
3 while  $i \leq n$  and  $location = 0$  do
4    $j \leftarrow 1$ 
5   while  $j < i$  and  $location = 0$  do
6     if  $a_i = a_j$  then
7        $location \leftarrow i$ 
8     else
9        $j \leftarrow j + 1$ 
10   $i \leftarrow i + 1$ 
11 return  $location$ 
```

Algorithm 4: FINDDUPLICATE2

Input: A sequence of integers $\langle a_1, a_2, \dots, a_n \rangle$

Output: The index of first location with the same value as in a previous location in the sequence

```
1 location  $\leftarrow$  0
2 i  $\leftarrow$  2
3 while  $i \leq n \wedge \textit{location} = 0$  do
4   j  $\leftarrow$  1
5   while  $j < i \wedge \textit{location} = 0$  do
6     if  $a_i = a_j$  then location  $\leftarrow$  i
7     else j  $\leftarrow$  j + 1
8   end while
9   i  $\leftarrow$  i + 1
10 end while
11 return location
```
