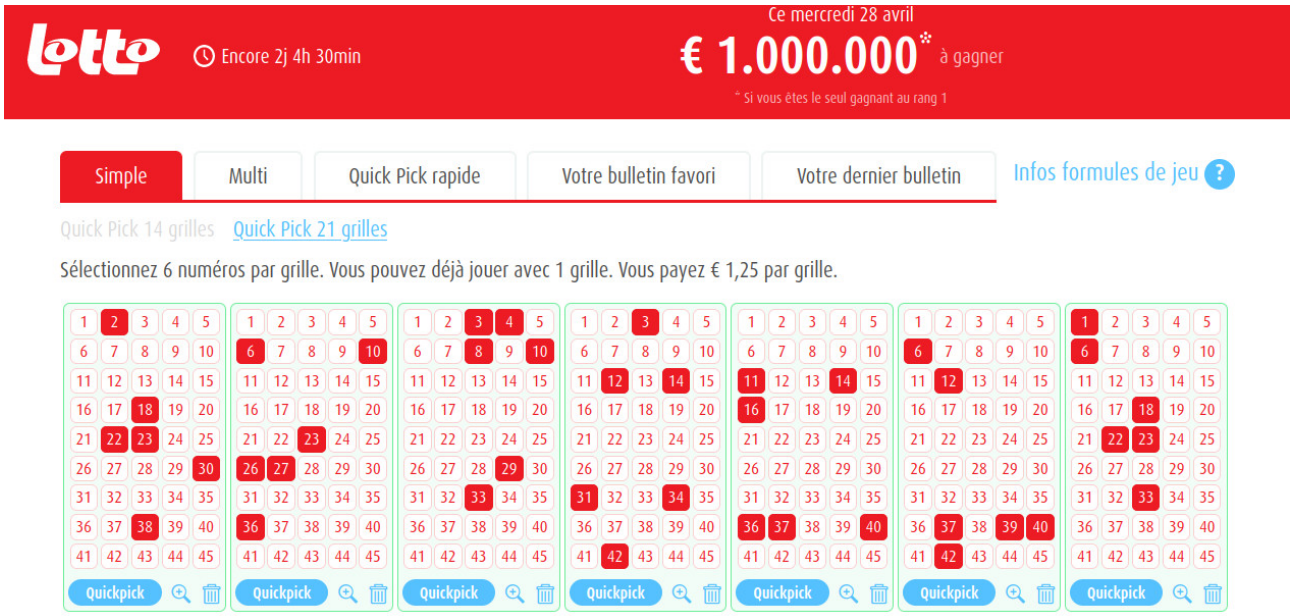
Overview on arrays and loops — Lotto

The Belgian "Loterie Nationale" organizes many games, one of them is the Lotto. In this game, there are 45 different numbers on 45 different balls, and 6 balls are chosen, randomly. When you play this game, you choose 6 numbers, and you win if you have chosen the 6 numbers that are on the 6 random balls. See https://en.wikipedia.org/wiki/Six-number_lottery_game.



Source: https://www.e-lotto.be/FR/drawGames/lotto/play/single/board

The objective of this project is to program different ways to play this game.

1 Without Python

First, we consider the function "naive_random_integers", in Figure 1.

Variables:
i is an integer.
$chosenIntegers$ is an array of integers.

Instructions of the function:
1 $chosenIntegers \leftarrow 6 * [0]$ (An array of size 6 filled with 0)
2 For i from 0 to 5
3 $\quad chosenIntegers[i] \leftarrow randint(1, 45)$ (A random integer between 1 and 45)
4 End For
5 Return $chosenIntegers$

Figure 1: Algorithm "naive_random_integers".

1. Explain what does the algorithm "naive_random_integers". What constraint of the real Lotto is missing here? What should this algorithm do to overcome this limitation? (it is not asked to modify the algorithm)

To overcome the limitation of our first algorithm, we will use an auxiliary array to remember which numbers were already chosen by the algorithm, to avoid choosing them once more.

We now consider the function "random_booleans", in Figure 2. In this algorithm, `nbIntegers` represents the number of integers chosen; `result` represents a random integer; `hasBeenChosen` is an array of 45 booleans: it is initially filled with False, and a cell is changed to True when the number corresponding to the index of the cell is chosen by the algorithm).

```
Variables:
nbIntegers and result are integers.
hasBeenChosen is an array of booleans.

Instructions of the function:
1    hasBeenChosen ← 45 * [False] (An array of size 45 filled with False)
2    nbIntegers ← 0
3    While nbIntegers < 6
4        result ← randint(1, 45)
5        If not(hasBeenChosen[result − 1]), Then
6            hasBeenChosen[result − 1] ← True
7            nbIntegers ← nbIntegers + 1
8        Enf If
9    End While
10   Return hasBeenChosen
```

Figure 2: Function "random_booleans".

2. What is the purpose of the condition "If not(hasBeenChosen[result - 1])" on line 5?

3. Please complete the function "random_integers" in Figure 3. This function uses the function "random_booleans" given in the previous question.

```
Variables:
idBool and idInt are integers.
randomBooleans is an array of booleans.
randomIntegers is an array of integers.

Instructions of the function:
1    randomBooleans ← random_booleans() (A call to the previous algorithm)
2    randomIntegers ← [0, 0, 0, 0, 0, 0]
3    idInt ← 0
4    For idBool from 0 to 44, Do
5        If randomBooleans ....., Then
6            randomIntegers[idInt] ← idBool + 1
7            idInt ← idInt + 1
8        Enf If
9    End For
10   Return randomIntegers
```

Figure 3: Function "random_integers".

2 With Python

4. Write in Python the functions "random_booleans" and "random_integers".

5. Write in Python a new function that asks the user 6 numbers (the ones they wish to play), runs the function "random_integers" to get another array of 6 random numbers, compare the two arrays, and displays the numbers that are in both arrays.

BONUS Output an error when the user gives twice the same number in their input.