Exercises on Python

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Very first steps

1. Create a program that prints

   `Hello World!`

   on the computer screen.

2. Create a program that creates the following variables and then prints them on the computer screen:

   (a) A numerical variable (`integer` and `float`).
   (b) A string variable.
   (c) A boolean variable.
   (d) Use function `type` to confirm the type of the variables.

Lists

3. Create a program that defines a variable containing the numbers from `0` to `10`, inclusive.

   (a) Making explicit all numbers.
   (b) Using function `range`.
   (c) Confirm that you have *really* created a list.

4. Create a program that defines a variable containing the numbers from `0` to `210`, inclusive.

   (a) Making explicit all numbers.
   (b) Using function `range`.
   (c) Confirm that you have *really* created a list.

FOR loop

5. Create a program that, given the following two lists, write on the screen the name and the respective marks of each student:

```
names = ['Mary', 'John', 'Catherine']
marks = [9, 18, 19]
```

6. Do the same as asked for in the previous question, but now adding, to what is written on the computer screen, the words `Keep studying!` if marks below 10 else `Congratulations!`

7. Create a program that, given the following lists, write on the screen the name and the respective weighted (by the respective credits) average of the score of each student:

```
names = ['Mary', 'John', 'Catherine']
course1 = [15, 18, 19]
course2 = [18, 19, 14]
course3 = [14, 16, 17]
credits = [6, 4.5, 3]  # of the above courses, respectively
```

List comprehension

8. Create a program that, given the following lists

   ```
   mylist = [4, 3, 1, 5]
   ```

   uses list comprehension to create a list with the square roots of the numbers of `mylist`.

Dictionaries

9. Create a program that, given the following lists

   ```
   names = ['Mary', 'John', 'Catherine']
   marks = [15, 18, 19]
   ```

   creates a dictionary with the names as keys and the marks as values, and uses:

   (a) Manual enumeration.
   (b) The `zip` function.
   (c) Dictionary comprehension.

Numpy arrays

10. Write a program that creates the following numpy array:

    ```
    array([1, 2, 3, 4])
    ```

    (a) Using manual enumeration.
    (b) Using function `range`.
    (c) Using function `np.arange`.

11. Write a program that creates the following 2D numpy array:

    ```
    array([[1, 2, 3, 4],
           [8, 9, 6, 5]])
    ```

    (a) Using manual enumeration.

(b) Using manual function `np.reshape`.

12. Write a program that creates a 2D numpy array (`3 x 4`), whose elements are randomly drawn from the discrete uniform distribution between 2 (inclusive) and 30 (inclusive).

    (a) Obtain a numpy array, which contains the sums of each row of the numpy array.
    (b) Obtain a numpy array, which contains the sums of each column of the numpy array.
    (c) Obtain a numpy array, which, per row, counts the number of elements greater than 15.
    (d) Obtain a numpy array, which, per column, counts the number of elements lower than 20.

13. Approach, with numpy, Exercise 7 of Section For loop.

14. Write a program that creates a 3D numpy array (`4 x 2 x 5`), whose elements are randomly drawn from the integer uniform distribution between 2 (inclusive) and 30 (inclusive). Use `np.random.seed(124)`.

    (a) What instruction, that uses the created numpy array, would produce the following numpy array:

```
array([[55, 67, 80, 47, 44],
       [88, 35, 70, 72, 87]])
```

    (b) What instruction, that uses the created numpy array, would produce the following numpy array:

```
array([[27, 32, 41, 31, 34],
       [45, 34, 47, 40, 48],
       [30, 30, 14, 13, 19],
       [41,  6, 48, 35, 30]])
```

    (c) What instruction, that uses the created numpy array, would produce the following numpy array:

```
array([[ 78,  87],
       [116,  98],
       [ 38,  68],
       [ 61,  99]])
```

15. Write a program that creates a 3D numpy array (`2 x 4 x 3`), whose elements are randomly drawn from the integer uniform distribution between 2 (inclusive) and 30 (inclusive). Use `np.random.seed(212)`.

    (a) What instruction, that uses the created numpy array, would produce the following numpy array:

```
array([[81, 52, 47],
       [60, 51, 50]])
```

(b) What instruction, that uses the created numpy array, would produce the following numpy array:

```
array([[36, 30, 62, 52],
       [47, 39, 52, 23]])
```

(c) What instruction, that uses the created numpy array, would produce the following numpy array:

```
array([[41, 22, 20],
       [14, 28, 27],
       [55, 33, 26],
       [31, 20, 24]])
```

Pandas dataframes

16. Write a program that creates a dataframe, `df`, with the following information:

    (a) Using a dictionary.
    (b) Using a 2D numpy array.

Reading and writing data files

17. Create a program that reads to a pandas dataframe the file: `car_radios.xlsx`.
18. Create a program that reads to a pandas dataframe the file: `car_radios.csv`.
19. Write a program that writes the pandas dataframe `df` created in Question 16 to the `csv` file: `mydf.csv`.
20. Write a program that writes the pandas dataframe `df` created in Question 16 to the Excel file: `mydf.xlsx`.

Functions

21. Consider the dataset `course_marks.csv`. The three tests have the weights 25%, 40% and 35%, respectively.

    (a) Write a function that adds a column, named Final, to the dataframe with the final marks for each student.
    (b) Add the same column, using pandas only.
    (c) Add the same column, using numpy only.

22. Considering the dataset `warehouse_sales.csv`:

    (a) Write a function that adds a column, named `Total`, to the dataframe, which contains, for each sale, the total amount to pay including VAT.

(b) Add the same column, using pandas only.

(c) Add the same column, using numpy only.