TP 1
Discovering
Python

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Goal : Discovering Python, data type,

1 Variable & data type

Exercice 1.
For each of the following expression, predict the result and the type. Then check with Python. Notice the importance of parenthesis

1. `2**3.0+4`
2. `2**3+4`
3. `(2**3.0)+4`
4. `2**(3.0+4)`
5. `True or 4>3 and 3>4`
6. `True or (4>3 and 3>4)`
7. `(True or 4>3) and 3>4`
8. `5%3*5`
9. `(5%3)*5`
10. `5%(3*5)`
11. `5//3*5`
12. `(5//3)*5`
13. `5//(3*5)`
14. `8.6 + 2`
15. `int(8.6) + 2`
16. `int(8.6) + 2.4`
17. `int(8.6 + 2.4)`
18. `2 * 3`
19. `2.0 * 3`
20. `float(2) * 3`

What does `**`, `%`, `//`,`or`, `and`, `float`, `int` ?

2 List

Exercice 2 : Creation
Using 4 different methods, create the list of integers between 0 and 9. Print the 4 lists created and verify that they are equal.

Exercice 3 : Slicing
Using only the list defined in the exercice 2, slicing and concatenation create the following list:

1. `[0, 1, 2]`
2. `[9]`
3. `[0, 2, 4, 6, 8]`
4. `[9, 8, 7, 6, 5, 4, 3, 2, 1, 0]`
5. `[0, 1, 2, 3, 4, 5, 0, 1, 2, 3, 4, 5, 0, 1, 2, 3, 4, 5]`
6. `[0, 1, 2, 6, 7, 8, 9]`
7. `[8, 6, 4, 2]`

Exercice 4 : List comprehension Using only the list comprehension method create the following list :

1. List of the square of even integer between 0 and 100.
2. List of the square root of integer between 0 and 1000.
3. List of the pairs (x, y) with x and y between 0 and 10.
4. List of list of the multiplication table. The i-th list must be the multiplication table of i. So we have `list[i][j] = i * j`.

3 For Loop

```
for i in range(n,m):
        instructions
        ....
```

```
s = 0
for i in range(1,20):
        s += i**2
```

Exercice 5. For each of the following sum, use a for loop to verify the following equality :

1. $\frac{n(n+1)}{2} = 1 + 2 + 3 + ... + n$
2. $\frac{n(n+1)(2n+1)}{6} = 1^2 + 2^2 + 3^2 + ... + n^2$
3. $\frac{\pi^2}{6} = 1 + \frac{1}{4} + \frac{1}{9} + ... + \frac{1}{n^2}$
4. $\log(2) = 1 - \frac{1}{2} + \frac{1}{3} + ... + \frac{(-1)^n}{n+1}$
5. $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} + ... + \frac{(-1)^n}{2*n+1}$
6. $e = 2 + \frac{1}{2} + \frac{1}{6} + ... + \frac{1}{n!}$

Exercice 6.

- Create a function `sum_list(list)`, which take a list as an argument and return the sum of the list. Use a for loop. For instance if `list=[1,2,3]`, the output will be `1+2+3`.
- Create a list `list fibo = [0, 1]`, and put in the list the 100 first terms of the fibbonacci list. Reminder the fibbonacci list is defined by $U_{i+2} = U_{i+1} + U_i$
- Calculate the sum of the previous list with the function `sum`. Print it. The value should be `573147844013817084100`.
- Create a list `list_triangular = [0]`, and put in the list the 100 first terms of the triangular list. Reminder the i-th triangular number is the sum of the integers from 0 to i.
- Calculate the sum of the previous list with the function `sum_list`. Print it. The value should be `166650`.

Exercice 7.

- Let define `num = math.factorial(1000)`. Define a fonction to calculate the sum of the digits of num. Two method are possible. The result is `10539`.

Aide : import math, math.pi, math.exp, math.log, str, %, //, str, int

4 Conditionnal Loop : If/While

Exercice 8 : If Loop

- Using a if loop, create a function wich print the bigger number between to float `a` and `b`.
- Create a program which take as input an integer `n` and print if the integer is even or odd.
- Create a program which take a grade between 0 and 20, and return if the person fail the exam (< 10), pass the exam (> 10), did good job (> 15) or did really good job (> 18). The program should print an error message, if the grade is not between 0 and 20
- Create a program wich take as input three float `a`, `b` and `c` and return the root of the polynom $ax^2 + bx + c$. The program should handle the case where $a = 0$.

Exercice 9 : Bissextile year

Before 1582, the bissextile years were all the years divisible by 4. After 1582, the bissextile year were the year divisible by 4 or 400 but not by 100.

- Using the If, Then, Else loop, create a program which tell if a year is bissextile or not.
- Use this program to print all the bissextile years between 2000 and 2020.
- Create a program which give the first bissextile year after a giving year.

Exercice 10 : While Loop

- Using a while loop, print all the multiplier of 3 inferior to 25.
- How can you implement without a while loop ?
- Using a while loop find the maximum value of `n` such as `n**2 + 3n` is inferior to 1000. How to implement it with a for loop ?
- Using a while loop find the maximal value `n` such as the sum $1 + 2 + ... + n$ is inferior to 1000. What is the value of the sum ? Of `n` ?
- We have a capital of 2000 €with a interest rate of 2.25 %. In which year the capital will be bigger than 3000 €? 10000 €?

5 Dictionnary

```
scores = {'John': 10, 'Eleonor': 12, 'Angela': 18, 'Nicolas': 15}

for key in scores.keys():
    print('{}'.format(key))

for value in scores.values():
    print('{}'.format(value))

for key, value in scores.items():
        print('{} ::{}'.format(key, value))
```

Exercice 11.

- Execute the previous code. What does the functions `.keys()`, `.values()` and `.items()` ?
- Add a new value to the `scores` : Lea 16. Change the score of Angela to 13. Delete the score of Nicolas. Print the dictionnary to see changes.
- Using a for loop, calculate the average score and the minimal and maximal score

Exercice 12.

```
ID = {'John': {'Sex': 'M', 'Size': 155, 'Age': 12, 'City': 'Paris'},
      'Eleonor': {'Sex': 'F', 'Size': 122, 'Age': 8, 'City': 'Londres'},
      'Angela': {'Sex': 'F', 'Size': 180, 'Age': 16, 'City': 'Berlin'},
      'Nicolas': {'Sex': 'M', 'Size': 140, 'Age': 18, 'City': 'Londres'},
      'Lea': {'Sex': 'F', 'Size': 165, 'Age': 10, 'City': 'Porto'},
      'Isidore': {'Sex': 'M', 'Size': 110, 'Age': 12, 'City': 'Rome'},
      'Joaquim': {'Sex': 'M', 'Size': 170, 'Age': 15, 'City': 'Madrid'}}
```

- Create the dictionnary
- Using a for loop, calculate the average age and the average size. Print it.
- Calculate the number of boy and girl. Print it.

- Calculate the average size and age of the boy and the girl, using a for loop and a if loop. Print it.
- Create a list `list_unique_City` and add each city in the dictionary only once.
- Add inside the dictionary :

```
ID['Donald'] = {'Sex' : 'M'}
```

  Relaunch the script for all the questions of the exercice. What happens? How to correct the script if there is a problem without changing the dictionnary ?

Aide : .keys() , .items(), .values(), if, print