

# **Scientific Computing with Python Lab**

**3rd Session(Feb 6th)**

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# Today

**we are going to talk about**

**#for\_loop** : for operator, indices

**#for\_and\_if\_conditionals** : practices

# For loop

## Usages

- Iterative process that has a pattern with regard to indices

$$S_n = \sum_{i=1}^n a_i \Rightarrow S_0 = 0, S_{n+1} = S_n + \mathbf{a}_{n+1}$$

or

$$\pi_n = \prod_{i=1}^n a_i \Rightarrow \pi_0 = 1, \pi_{n+1} = \pi_n \times \mathbf{a}_{n+1}$$

# For loop

## How to use it

for **i** in **A**:

    operation on **i**

How to manipulate the indices

- `range(n)` : 0 ~ n-1      ex) `range(10)` : 0 to 9 (10 numbers)
- `range(a,b)` : a ~ b-1      ex) `range(3,10)` : 3 to 9
- `range(a,b,n)` : a, a+n, a+2n, ... <b ex) `range(5,15,3)` : 5,8,11,14  
ex) `range(10,3,-1)`: 10,9,8,...,4

# For loop

## How to use it

for i in **range(n)**:

operation on i

operation on i = 0

operation on i = 1

.

.

.

operation on i = n-1

for i in **range(a,b)**:

operation on i

operation on i = a

operation on i = a+1

.

.

.

operation on i = b-1

for i in **range(a,b,n)**:

operation on i

operation on i = a

operation on i = a+n

operation on i = a+2n

.

.

operation on i = largest(a+kn)<b

# Exercise

**For loop : check indices**

# For loop

## The simplest example

$$S_n = \sum_{i=1}^n i$$

Then, make a code for  $S_{20}$

# For loop

## The simplest example

$$S_n = \sum_{i=1}^n i$$

Then, make a code for  $S_{20}$

```
s = 0
```

```
for i = 1 ~ 20:
```

```
    s += i
```



$$S_n = \sum_{i=0}^n 2 \times 3^i \Rightarrow S_{15} = ?$$

# Exercise

Find the value of  $S_{15}$

# For loop

## The simplest example

$$S_n = \prod_{i=1}^n f(i)$$

Then, make a code for  $S_{20}$

```
prod = 1
```

```
for i = 1 ~ 20:
```

```
    prod *= f(i)
```

$$S_n = n! \Rightarrow S_8 = ?$$

Without using built-in factorial function

# Practice

**Find the value of  $S_8$**

# For loop

**Examples : for loop in for loop**

$$S_{n,m} = \sum_{i=1}^n \sum_{j=1}^m f(i,j)$$

# For loop in for loop

Examples : i,j are independent

$$S_{n,m} = \sum_{i=1}^n \sum_{j=1}^m f(i,j)$$

sum = 0

for i in range(1, n+1):

    for j in range(1, m+1):

        sum+= f(i,j)

# Exercise

**For loop : check indices**

$$S_{n,m} = \sum_{i=0}^n \sum_{j=0}^m \log(i^2 + j^2 + 4ij + 1) \Rightarrow S_{5,6} = ?$$

# Exercise

# For loop in for loop

Examples : i,j are dependent

$$S_{n,m} = \sum_{i=1}^n \sum_{j=1}^{m(i)} f(i,j)$$

sum = 0

for i in range(1, n+1):

    for j in range(1, m(i)+1):

        sum+= f(i,j)



$$S_n = \sum_{i=0}^n \frac{5^i}{i!} \Rightarrow S_{100} = ?$$

Without built in `math.factorial` function

Compare the value with  $e^5$

# Practice

# Combination of loop and conditional

## Examples : for loop in for loop

If we are given conditions for each index,

ex)  $S_n = \sum_{i=1}^n f(i)$  where  $f(i)$  is 1 if it is even, otherwise 0

```
for i in range:
```

```
    if conditional(i) :
```

```
        operation
```

Exercise

$$\sum_{x=1}^{10} \sum_{y=1}^{15} 8xy \mathbf{I}_{0 < x < y}$$

# Practice

**Complicated exercise**