CSIT110

Fundamental Programming with Python

Loop Statements (1)

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In this lecture

- For loop
- More on string data type
- print(…, end=…)
- The break keyword

- More about str

How does it look like?

```
for i in <iterator>:
  # statements using i
  print(i)
```

Definition

To iterate: *verb*

- To perform or utter repeatedly

Example of an iterator – range()

```
range(start, stop, step)
```

start – optional. stop – required. step - optional

Returns a sequence of numbers,

starting from 0 by default,

increments by 1 by default,

stops **BEFORE** a specified number.

```
range(4)        -> 0,1,2,3
range(7, 10)    -> 7,8,9
range(3, 8, 2)  -> 3,5,7
```

Taken from www.w3school.com

The first for-loop example

```
for i in range(0,10):
  print(i)
```

Program output:

```
i = 0, print(i)
i = 1, print(i)
i = 2, print(i)
i = 3, print(i)
i = 4, print(i)
i = 5, print(i)
i = 6, print(i)
i = 7, print(i)
i = 8, print(i)
i = 9, print(i)
```

```
0
1
2
3
4
5
6
7
8
9
```

`range(0,10)`

number 10 is excluded!!!

Times table example

```
for i in range(1,10):
  print(f"{i} x 5 = {5*i}")
```

Program output:

```
i = 1, print(f"{i} x 5 = {5*i}"))
i = 2, print(f"{i} x 5 = {5*i}"))
i = 3, print(f"{i} x 5 = {5*i}"))
i = 4, print(f"{i} x 5 = {5*i}"))
i = 5, print(f"{i} x 5 = {5*i}"))
i = 6, print(f"{i} x 5 = {5*i}"))
i = 7, print(f"{i} x 5 = {5*i}"))
i = 8, print(f"{i} x 5 = {5*i}"))
i = 9, print(f"{i} x 5 = {5*i}"))
```

```
1 x 5 = 5
2 x 5 = 10
3 x 5 = 15
4 x 5 = 20
5 x 5 = 25
6 x 5 = 30
7 x 5 = 35
8 x 5 = 40
9 x 5 = 45
```

Times table example 2

```
for i in range(1,10):
  print(f"{i} x 5 = {5*i}")
```

We want to print times table based on user input

```
number_input = input("Enter a number: ")
number = int(number_input)
for i in range(1,10):
  print(f"{i} x {number} = {number*i}")
```

```
Enter a number: 6
1 x 6 = 6
2 x 6 = 12
3 x 6 = 18
4 x 6 = 24
5 x 6 = 30
6 x 6 = 36
7 x 6 = 42
8 x 6 = 48
9 x 6 = 54
```

Friend of 10 table

```
0 + 10 = 10
1 + 9 = 10
2 + 8 = 10
3 + 7 = 10
4 + 6 = 10
5 + 5 = 10
6 + 4 = 10
7 + 3 = 10
8 + 2 = 10
9 + 1 = 10
10 + 0 = 10
```

Friend of 10 table


```
for i in range(0,11):
```

Friend of 10 table

What is this `second` number?

```
print(f"{i} + {second} = {10}")
```

i = 0	0 + 10 = 10
i = 1	1 + 9 = 10
i = 2	2 + 8 = 10
i = 3	3 + 7 = 10
i = 4	4 + 6 = 10
i = 5	5 + 5 = 10
i = 6	6 + 4 = 10
i = 7	7 + 3 = 10
i = 8	8 + 2 = 10
i = 9	9 + 1 = 10
i = 10	10 + 0 = 10

```
for i in range(0,11):
  print(f"{i} + {second} = {10}")
```

Friend of 10 table

What is this `second` number?

`second = 10 - i`

```
print(f"{i} + {second} = {10}")
```

i = 0	0 + 10 = 10
i = 1	1 + 9 = 10
i = 2	2 + 8 = 10
i = 3	3 + 7 = 10
i = 4	4 + 6 = 10
i = 5	5 + 5 = 10
i = 6	6 + 4 = 10
i = 7	7 + 3 = 10
i = 8	8 + 2 = 10
i = 9	9 + 1 = 10
i = 10	10 + 0 = 10

```
for i in range(0,11):
  second = 10 - i
  print(f"{i} + {second} = {10}")
```

Friend of 10 table

What is this `second` number?

`second = 10 - i`

```
print(f"{i} + {second} = {10}")
```

i = 0	0 + 10 = 10
i = 1	1 + 9 = 10
i = 2	2 + 8 = 10
i = 3	3 + 7 = 10
i = 4	4 + 6 = 10
i = 5	5 + 5 = 10
i = 6	6 + 4 = 10
i = 7	7 + 3 = 10
i = 8	8 + 2 = 10
i = 9	9 + 1 = 10
i = 10	10 + 0 = 10

or
simply

```
for i in range(0,11):
  print(f"{i} + {10 - i} = {10}")
```

Friend of 10 table

```
print(f"{i:>2} + {second:>2} = 10")
```

Better display

```
for i in range(0,11):
  print(f"{i:>2} + {10 - i:>2} = 10")
```

print(…,**end=…**)

print(…,**end=…**)

Default:
`end="\n"`

```
for i in range(0,11):
    # print the number
    print(i, end="")
    # print trailing word
    trailing = "frog"
    print(trailing, end="")
```

```
0frog1frog2frog3frog4frog5frog6frog7frog8frog9frog10frog
```

Consecutive Numbers

We want to write a program to print the following output

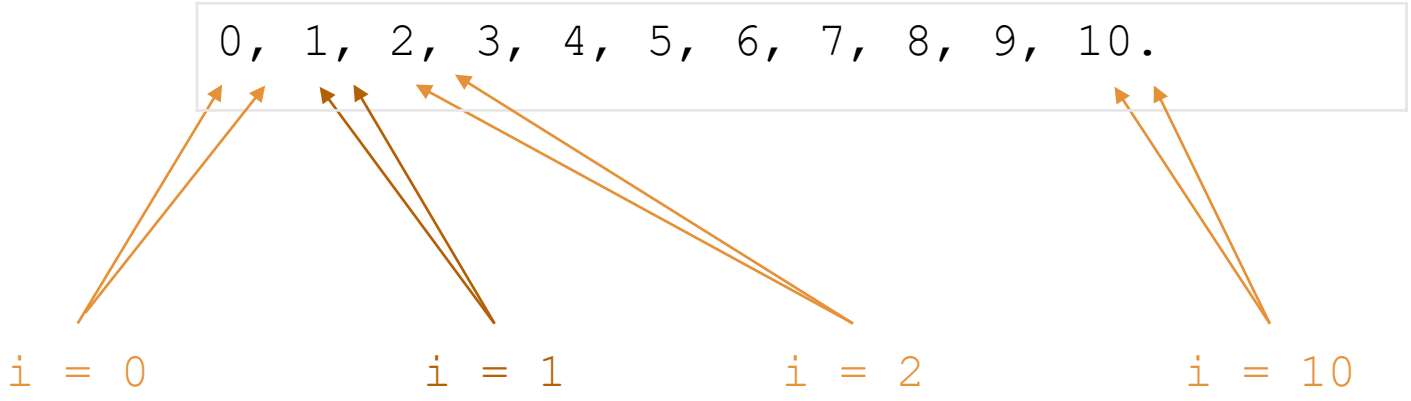
```
0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
```

Consecutive Numbers

```
0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
```

i = 0 i = 1 i = 2 i = 10

Consecutive Numbers




```
for i in range(0,11):
  # print the number
  # print the trailing
```

The **trailing** depends on the index `i`:

- `i = 0, 1,..., 9`: the trailing is the comma
- `i = 10`: the trailing is the full-stop

Consecutive Numbers

```
0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10.
```

i = 0 i = 1 i = 2 i = 10

```python
for i in range(0,11):
  if (i < 10):
    trailing = ", "
  else:
    trailing = "."
  print(i, end= trailing) # prints the number
# while replacing the newline with the trailing variable
```

Sum of Numbers

1 + 2 + 3 + 4 + … + 10 = ?

```
Adding one number at a time:

result = 0

i = 1  →  result = result + 1          0 + 1 = 1

i = 2  →  result = result + 2          1 + 2 = 3

i = 3  →  result = result + 3          3 + 3 = 6

i = 4  →  result = result + 4          6 + 4 = 10

i = 5  →  result = result + 5         10 + 5 = 15

…

i = 10 →  result = result + 10 = ?    45 + 10 = 55
```

Sum of Numbers

1 + 2 + 3 + 4 + … + 10 = ?

```python
# initialise the result to zero
result = 0

# keep adding the result with number from 1 to 10
for i in range(1,11):
  result = result + i
  # display the result
print(f"The sum of 1 to 10 is {result}")
```

The sum of 1 to 10 is 55

Sum of Numbers – one step at a time

1 + 2 + 3 + 4 + … + 10 = ?

```python
result = 0
for i in range(1,11):
  result = result + i
  print(result)
```

```
1
3
6
10
15
21
28
36
45
55
```

Adding one number of a time:

```
result = 0

i = 1  →  result = 0 + 1 = 1

i = 2  →  result = 1 + 2 = 3

i = 3  →  result = 3 + 3 = 6

i = 4  →  result = 6 + 4 = 10

i = 5  →  result = 10 + 5 = 15

…

i = 10 →  result = result + 10 = ?
```

Number Pattern

```
2 1
4 3 2 1
6 5 4 3 2 1
8 7 6 5 4 3 2 1
10 9 8 7 6 5 4 3 2 1
```

```
i = 1 → 2 1
i = 2 → 4 3 2 1
i = 3 → 6 5 4 3 2 1
i = 4 → 8 7 6 5 4 3 2 1
i = 5 → 10 9 8 7 6 5 4 3 2 1
```

What is the pattern?

```
for each i from 1 to 5
        start_number = 2 * i

        print from the start_number down to 1
        that is:
          start_number - 0
          start_number - 1
          start_number - 2
          start_number - 3
          ...
```

```python
# display 5 lines of pattern
for i in range(1, 6):
    # display the ith line
    # the first number on line i is 2*i
    start_number = 2 * i
    # print from start number down to 1
    for j in range(0, start_number):
      number = start_number - j
      print(number, end=" ") # no newline
    # print a new line to complete the line I
    print()
```

```
2 1
4 3 2 1
6 5 4 3 2 1
8 7 6 5 4 3 2 1
10 9 8 7 6 5 4 3 2 1
```

The `break` keyword

The **break** keyword

The **break** statement terminates the closest enclosing loop.

```
# a flag to indicate user has answered YES
user_say_yes = False

# patiently ask the user 10 times until they say YES
for i in range(0, 10):
    answer = input("Would you like green eggs and ham? (Y/N): ")
    if (answer == "Y"):
        user_say_yes = True
        print("That's a smart choice!")
        break

# if the user has not said yes
if (user_say_yes == False):
    print("Oh well, you don't know what you're missing!")
```

*use **break** to stop the loop*

The `break` keyword

```
Would you like green eggs and ham? (Y/N): N
Would you like green eggs and ham? (Y/N): N
Would you like green eggs and ham? (Y/N): N
Would you like green eggs and ham? (Y/N): N
Would you like green eggs and ham? (Y/N): N
Would you like green eggs and ham? (Y/N): N
Would you like green eggs and ham? (Y/N): N
Would you like green eggs and ham? (Y/N): N
Would you like green eggs and ham? (Y/N): N
Would you like green eggs and ham? (Y/N): N
Oh well, you don't know what you're missing!
```

```
Would you like green eggs and ham? (Y/N): N
Would you like green eggs and ham? (Y/N): N
Would you like green eggs and ham? (Y/N): Y
That's a smart choice!
```

Str

Can be used as an iterator:

```
text = "hi there!"
for i in text:
    print(i)
```

```
h
i

t
h
e
r
e
!
```

String data type

Find the length of a string:

```
greeting = "Hi there!"
greeting_length = len(greeting) → 9
```

Get one character at a time:

```
print(greeting[0])   → H
print(greeting[1])   → i
print(greeting[2])   → space
print(greeting[3])   → t
print(greeting[4])   → h
print(greeting[5])   → e
print(greeting[6])   → r
print(greeting[7])   → e
print(greeting[8])   → !
```

Question. What is the last index?
Answer. `len(greeting)-1`

Display characters of string

```
greeting = "Hi there!"
for i in range(0, len(greeting)):

  # get the ith character
  letter = greeting[i]

  # display the ith character
  print(letter)
```

Question. What is the last index?
Answer. `len(greeting)-1`

Output:

```
H
i

t
h
e
r
e
!
```

Example: generate password

In an online game, the initial password is generated from the username by replacing each letter i to 1, r to 7, s to 5, and z to 2.

Write a program to generate this initial password.

```
Enter username: Superman123
Password is 5upe7man123
```

```
Enter username: zebra8
Password is 2eb7a8
```

```
Initially set password = ""
Username letter   Password letter
     z                 2            password = "2"
     e                 e            password = "2e"
     b                 b            password = "2eb"
     r                 7            password = "2eb7"
     a                 a            password = "2eb7a"
     8                 8            password = "2eb7a8"
```

Example: generate password

```
# ask user to enter usernameh
username = input("Enter username: ")

# construct the password


Initially set password = ""
Username letter   Password letter
     z                  2            password = "2"
     e                  e            password = "2e"
     b                  b            password = "2eb"
     r                  7            password = "2eb7"
     a                  a            password = "2eb7a"
     8                  8            password = "2eb7a8"


# display password result
print("Password is " + password)
```

Example: generate password

```
# initialize password as empty string
password = ""
for i in range(0, len(username)):
    # get the ith character from username
    letter = username[i]
    # construct corresponding character for password
    if (letter == "i") or (letter == "I"):
        password_letter = "1"
    elif (letter == "r") or (letter == "R"):
        password_letter = "7"
    elif (letter == "s") or (letter == "S"):
        password_letter = "5"
    elif (letter == "z") or (letter == "Z"):
        password_letter = "2"
    else:
        password_letter = letter

    # adding a character to password
    password = password + password_letter
```

Example: generate password

Or use string as an iterator

```
# initialize password as empty string
password = ""
for letter in username:
    # get the ith character from username
    letter = username[i]
    # construct corresponding character for password
    if (letter == "i") or (letter == "I"):
        password_letter = "1"
    elif (letter == "r") or (letter == "R"):
        password_letter = "7"
    elif (letter == "s") or (letter == "S"):
        password_letter = "5"
    elif (letter == "z") or (letter == "Z"):
        password_letter = "2"
    else:
        password_letter = letter

    # adding a character to password
    password = password + password_letter
```

Any questions?