CSIT110

Fundamental Programming with Python

Loop Statements (1)

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In this lecture

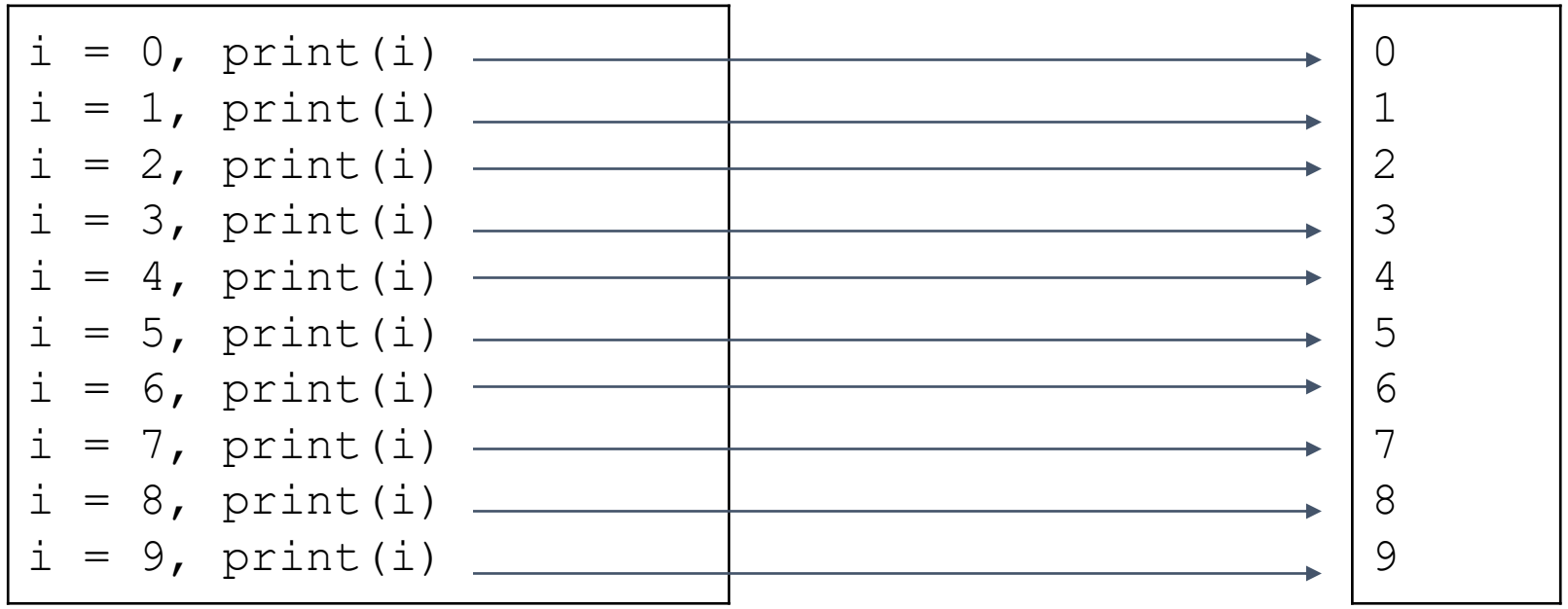
- For loop
- More on string data type

How does it look like?

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

The first for-loop example

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

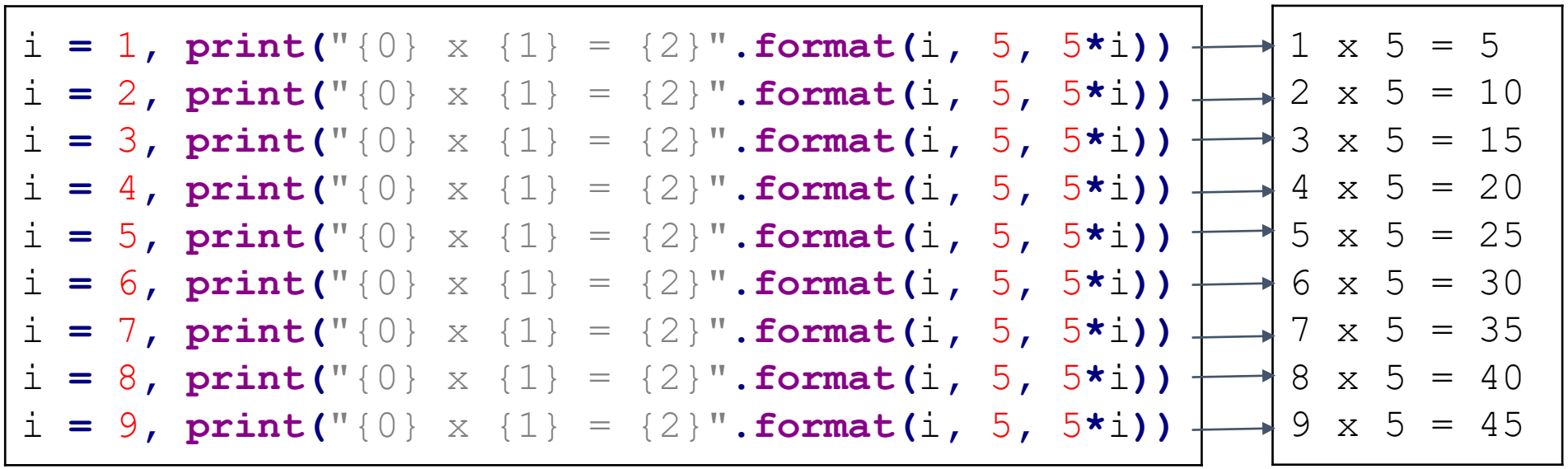


`range(0,10)` number 10 is excluded!!!

Times table example

```
for i in range(1,10):
  print("{0} x {1} = {2}".format(i, 5, 5*i))
```

Program output:



Times table example 2

```
for i in range(1,10):
  print("{0} x {1} = {2}".format(i, 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("{0} x {1} = {2}".format(i, 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("{0} + {1} = {2}".format(i, second, 10))
```


```
for i in range(0,11):
  print("{0} + {1} = {2}".format(i, second, 10))
```

Friend of 10 table

What is this `second` number?

`second = 10 - i`

```
print("{0} + {1} = {2}".format(i, second, 10))
```


```
for i in range(0,11):
    second = 10 - i
    print("{0} + {1} = {2}".format(i, second, 10))
```

Friend of 10 table

What is this `second` number?

`second = 10 - i`

```
print("{0} + {1} = {2}".format(i, second, 10))
```

or simply

```
for i in range(0,11):
  print("{0} + {1} = {2}".format(i, 10 - i, 10))
```

Friend of 10 table

```
print("{0:>2} + {1:>2} = {2:>2}".format(i, 10 - i, 10))
```

Better display

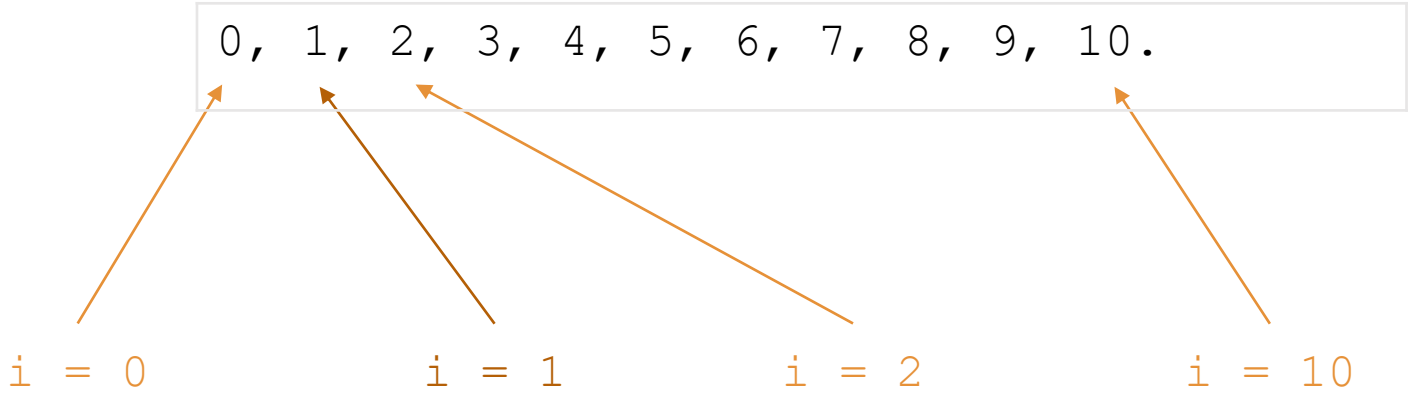
```
for i in range(0,11):
  print("{0:>2} + {1:>2} = {2:>2}".format(i, 10 - i, 10))
```

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

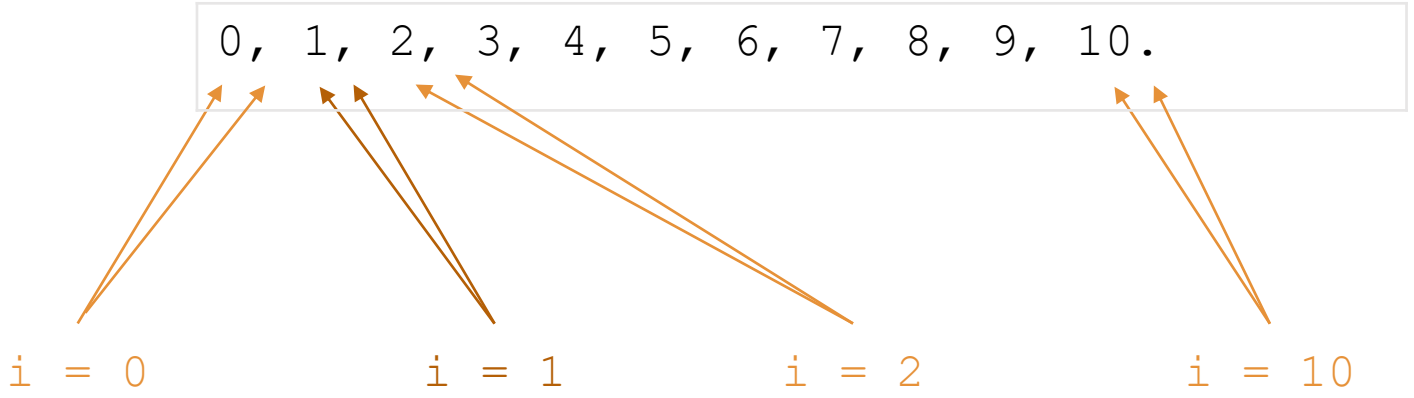



```
for i in range(0,11):
    # print the number
    print(i, end="")
    # print trailing word
    trailing = "frog"
    print(trailing, end="")
```

Output:

```
0frog1frog2frog3frog4frog5frog6frog7frog8frog9frog10frog
```

Consecutive Numbers

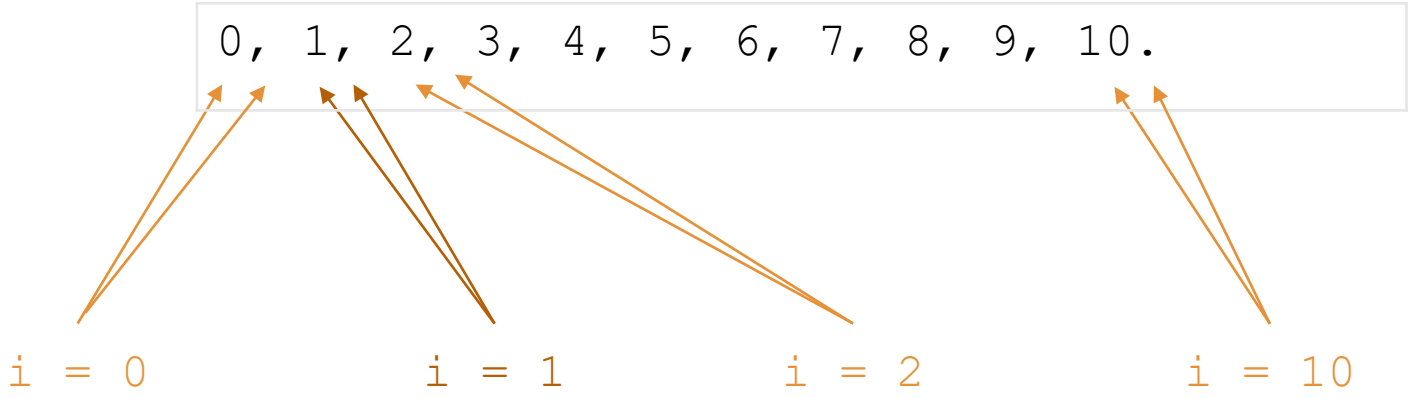



```
for i in range(0,11):
  # print the number
  # print the trailing
```

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




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

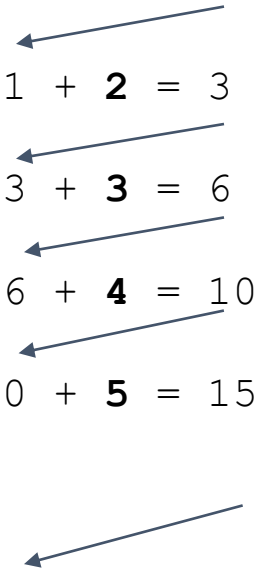
Sum of Numbers

1 + 2 + 3 + 4 + … + 10 = ?

```
Adding one number of 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 = ?

```
# 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("The sum of 1 to 10 is {0}".format(result))
```

Sum of Numbers

1 + 2 + 3 + 4 + … + 10 = ?

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

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
          ...
```

```
# display 5 lines of pattern
for i in range(1, 6):
  # display the ith line
  # the first number on line i is 2i
  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`** 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!
```

More on String data type

String methods

Accessing characters

Splicing

String data type

Upper case:

```
name = "John Smith"
name_uppercase = name.upper()
print(name_uppercase)
```

```
JOHN SMITH
```

Lower case:

```
name = "John Smith"
name_lowercase = name.lower()
print(name_lowercase)
```

```
john smith
```

String data type

Searching for a substring:

```
name = "Alexandra"
index = name.find("exa")
print(index)                    → 2
index = name.find("frog")
print(index)                    → -1
index = name.find("Alex")
print(index)                    → 0
```

`find` returns the first index if found, otherwise, it return -1 if not found

Index 0 means the first character –> ‘Zero-indexed’

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[0])   → i
print(greeting[0])   → 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`

String data type

Slicing a string:

```
sentence = "Python is cool!"
sub_sentence1 = sentence[1:4]
# "yth"
```

[i:j] gives substring from index i up to index (j-1), so altogether, there are (j-i) characters

```
sub_sentence2 = sentence[1:]
# "ython is cool!"
```

[i:] gives substring from index i up to the end

```
sub_sentence3 = sentence[:4]
# "Pyth"
```

[:j] is the same as [0:j] gives substring from index 0 up to index (j-1), so altogether, there are j characters

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 username
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
```

Any questions?