D002 Python for Everyone

Lesson 4: Function

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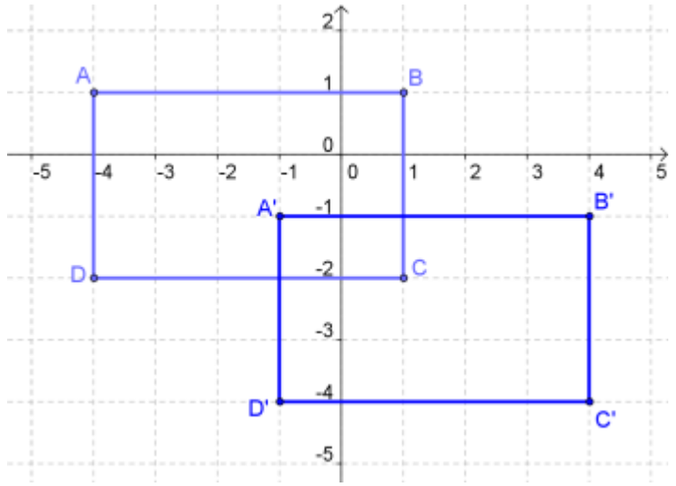
What we have covered so far

- Variables
- Basic Operation `= + - * / ** %`
- Comparison symbol `== != > < >= <=`
- Logical Operator `and or not`
- Branching `if` `if else` `if elfi elfi elfi else`
- Loop `while` `for`
- List
    - Index always starts from 0!

Warm up exercise

Open Q1.py and write one line of code for each of the subquestions.

Do you know coordinate system?



Let's define the position and size of a Window using its four corners, or may be just two - A and C.

Question: Can we know if a Window is contained within another Window?

Not Containing, just overlapping

```
# Rectangle 1
a1 = [1, 8]   # b1 = [4, 8] ; d1 = [1, 3]
c1 = [4, 3]
# Rectangle 2
a2 = [3, 11]  # b2 = [6,11] ; d2 = [3, 4]
c2 = [6, 4]
```

Containing

```
# Rectangle 1
a1 = [1, 18]   # b1 = [8, 18] ; d1 = [1, 3]
c1 = [8, 3]
# Rectangle 2
a2 = [3, 11]  # b2 = [6,11] ; d2 = [3, 4]
c2 = [6, 4]
```

Definition of Containing

If all corner points of a rectangle `X` are *inside* another rectangle `Y`, we say `Y` contains `X`

```
#Assume a and c are two points of Y; t is a point
if a[0] < t[0] < c[0] and a[1] > t[1] > c[1]:
   print("t is inside the rectangle formed by a,c")
```

=>

In fact checking only the two diagonal points are sufficient (hmm, slightly better)

It is so messy

```
# Assume we have a1 c1 a2 c2 defined elsewhere

if a2[0] <= a1[0] <= c2[0] and a2[0] <= c1[0] <= c2[0] and \
  a2[1] >= a1[1] >= c2[1] and a2[1] >= c1[1] >= c2[1]:
    print("Rectangle 2 contains Rectangle 1")
elif a1[0] <= a2[0] <= c1[0] and a1[0] <= c2[0] <= c1[0] and \
    a1[1] >= a2[1] >= c1[1] and a1[1] >= c2[1] >= c1[1]:
   print("Rectangle 1 contains Rectangle 2")
```

Codes are repeating, why would we code it again and again?

DRY : Don't Repeat Yourself

Function - to Modularize

- A function is a piece of code in a program. It performs a specific task.
- Good for ‘Do-not-repeat yourself’ (DRY) and ‘divide-n-conquer’ (modular design) of the program
- There are two basic types of functions. Built-in functions and user-defined ones. The built-in functions are part of the Python language.

Example of built-in function that you already know: `ceil`, `sqrt`, `range`, `randint`

Building our own functions

- We create a new function using the `def` keyword followed by optional parameters in parenthesis.
- This defines the function but does not execute the body of the function
- Definition vs. usage: once we have defined a function, we can call (or invoke) it as many times as we like

```
def average(a, b): # function name: average; parameters: a, b
    return (a + b) / 2   # return value

print(average(3, 10))
x = average(5, 10)
y = average(x, 10)
z = average(x, average(x, y))
print(x, y, z)
```

Another example - Fortunate Teller

```
def luck_level(day, month):
    if day + month % 5 > 3:
        print("You have good luck today")
    else:
        print("You should sleep more")

luck_level(15, 3)
luck_level(4, 1)
```

This function does not return any value, we call it a `void` function

Another example - Inside

```
def is_inside(a, c, t):
    if a[0] <= t[0] <= c[0] and a[1] >= t[1] >= c[1]:
        return True    # when it returns, the function stops
    return False

# Rectangle 1
a1 = [1, 18]   # b1 = [8, 18] ; d1 = [1, 3]
c1 = [8, 3]
t = [4 ,4]
if is_inside(a1, c1, t):
    print("t is inside rectangle 1")
else:
    print("t is outside rectangle 1")
```

```
def is_inside(a, c, t):
   if a[0] <= t[0] <= c[0] and a[1] >= t[1] >= c[1]:
       return True    # when it returns, the function stops
   return False

# Rectangle 1
a1 = [1, 8]   # b1 = [4, 8] ; d1 = [1, 3]
c1 = [4, 3]
# Rectangle 2
a2 = [3, 11]  # b2 = [6,11] ; d2 = [3, 4]
c2 = [6, 4]

if is_inside(a1, c1, a2) and is_inside(a1, c1, c2):
    print("Rectangle 2 is inside Rectangle 1")
elif is_inside(a2, c2, a1) and is_inside(a2, c2, c1):
    print("Rectangle 1 is inside Rectangle 2")
```

Return Values

- Often a function will take its arguments, do some computation and return a value to be used as the value of the function call in the calling expression.
- The `return` keyword is used for this.
- The return statement ends the function execution and "sends back" the result of the function
- A **void** function does not return a value, but it can also use return statement

```
def void_function(x):
    if x == 1:
       print(x)
       return
    while x >= 1
       x = x / 2
       print(x)
```

Parameters

- A function can have 0 or more parameters. It is less likely to have no parameter, but indeed it is possible.

```
def option():  # you need () even there is no parameter
    print("Option 1: Pass\nOption 2: Shoot\nOption 3: Dribble")
    x = input("Please choose between option 1 to 3")
    while x < 1 or x > 3:
        x = input("Wrong input, type again")
    return x
```

Q2

Write a void function called `factors` that find all factors of an integer `n`

```
_________________  # Your code here
    for x in range(1, n + 1):
        if n % x == 0:
            print("%d divides %d" % (x, n))


# Example of calling
factors(40)
factors(5)
```

Q3

Write a function called `factors` that find all factors of an integer `n`

It returns all factors as a list

```
_________________  # Your code here
    result = []
    for x in range(1, n + 1):
        if n % x == 0:
            ________________
    _____________

# Example of calling
print(factors(40))
a = factors(30)
if 5 in a:
    print("5 is a factor of 30")
```

Q4

Write a function called `checker` that reveals the index(s) of the sentence of which a letter is located. It returns an empty list if the letter is not insider the sentence.

```
def checker(sentence, letter):
     result = []
     # Your code here


     return result




a = checker("Apple", "p") # a = [1, 2]
b = checker("Banana", "p") # b = []
c = checker("Cat", "a") # c = [1]
```

Q5

Write a void function called `printer` that takes two parameters: `secret` and `opened`. `secret` is a string and `opened` is a list of indexes. The function prints all letter of the string `secret` by masking all indexes that is *not* in `opened` as `_`.

```
def printer(secret, opened):
    i = 0
    while i < len(secret):
        # Your code here



        i = i + 1
        print()
# Note: You might use print(x , end="") to print x without changing line

printer("apple", [1, 2]) # _pp__
printer("orange", [0, 5]) # o____e
printer("cat", []) # ___
```