Functions Advanced

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#python-advanced

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*args
**kwargs

Packing Arguments

*args and **kwargs

What is Packing?

```
def some_func(*args, **kwargs):
    pass
```

- This operation is called **packing**
- We pack all the arguments into one **single variable**
- We use packing when we don't know how many arguments need to be passed to a function

Packing Arguments into Tuple

- We use ***args** to pack arguments into tuple

```
def some_func(*args):
    print(args)

some_func(1, 2, 3)           # (1, 2, 3)
some_func("peter", "george") # ("peter", "george")
some_func(True, False)       # (True, False)
some_func()                  # ()
```

Packing Arguments into Dictionary

- ****kwargs** allows you to pass **keyworded** variable length of arguments to a function

```
def greet_me(**kwargs):
    for key, value in kwargs.items():
        print(f"{value}, {key}")

greet_me(Peter="Hello", George="Bye")
# Hello, Peter
# Bye, George
```

Formal Args, *args and **kwargs

- You can also use **keyword** arguments and ***args**

```
def some_func (arg1, *rest_args):
    print(arg1 + sum(rest_args))
some_func(5, 5, 10)    # 20
some_func()            # Error
```

The function requires at least 1 argument

- So, if you want to use all three of these in argument types then the order is

```
some_func(fargs, *args, **kwargs)
```

Problem: Multiplication Function

- Write a function called **multiply()** that can receive any number of numbers (integers) as different parameters
- The function should return the result of the multiplication of all of them
- Submit only your function in judge

```
print(multiply(1, 4, 5))
print(multiply(4, 5, 6, 1, 3))
print(multiply(2, 0, 1000, 5000))
```

```
20
360
0
```

Solution: Multiplication Function

```python
def multiply(*args):
    result = 1
    for num in args:
        result *= num
    return result
```

*

**

Unpacking Arguments

Unpack Lists, Tuples and Dictionaries

What is Unpacking?

- We can use * to unpack the list so that all elements of it can be passed as **different parameters**
- And we can use ** to unpack a dictionary, so all of its elements are passed as **keyworded arguments**

Unpacking Lists

- Note that the **length** of the list, that you unpack, must be **the same** as the number of **parameters** in the function

```
def print_nums(a, b, c):
    print(a, b, c)
nums = [1, 2, 3]
print_nums(*nums)   # 1 2 3
```

Unpacking Dictionaries

- Note that the **keys** of the dictionary must **match** the **names** of the **parameters** of the function
- The **order** of the keys in the dictionary does **not matter**

```
def some_func(name, age):
    print(f"{name} is {age} years old")
person = {'age': 20, 'name': "Peter"}
some_func(**person) # Peter is 20 years old
```

Problem: Person Info

- Write a function called **get_info** that receives a name, age and town, and returns a string in the format: **"This is {name} from {town} and he is {age} years old"**
- Use **dictionary unpacking** when testing your function

```
kwargs = {"name": "John", "town": "Sofia", "age": 20}
print(get_info(**kwargs))
```

```
This is John from Sofia and he is 20 years old
```

Solution: Person Info

```python
def get_info(name, age, town):
    return f"This is {name} from {town} and he is {age} years old"

# TEST CODE
print(get_info(**{"name": "George", "town": "Sofia", "age": 20}))
```

Advanced Sorting

sorted()

- The **sorted()** method sorts the elements of a given iterable - Ascending or Descending

By default

```
sorted(iterable, key=None, reverse=False)
```

By default

- **iterable** - sequence or collection or any iterator
- **key** - function that serves as a key for the sort comparison
- **reverse** - If =True, the sorted list is reversed (or sorted in Descending order)

Sorting Dictionary by Key

- Using **lambda** to sort by key element

```
my_dict = {'Peter': 21, 'George': 18, 'John': 45}
sorted_dict = sorted(my_dict.items(), key=lambda x: x[0])
# [('George', 18), ('John', 45), ('Peter', 21)]
```

- Using **reverse** to sort dictionary by key in descending order

```
reversed_dict = sorted(my_dict.items(),
                       key=lambda x: x[0],
                       reverse=True)
# [('Peter', 21), ('John', 45), ('George', 18)]
```

Sorting Dictionary by Value

- Using **lambda** to sort by value element

```
my_dict = {'Peter': 21, 'George': 18, 'John': 45}
sorted_dict = sorted(my_dict.items(), key=lambda x: x[1])
# [('George', 18), ('Peter', 21), ('John', 45)]
```

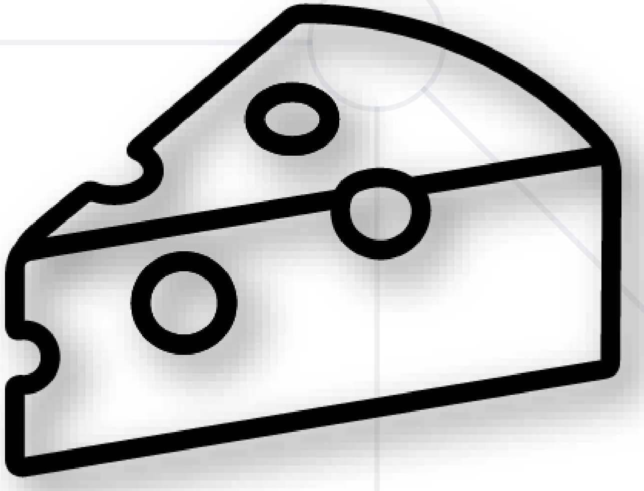
- You could use "-" instead of reverse when sorting descending

```
reversed_dict = sorted(my_dict.items(), key=lambda x: -x[1])
# [('John', 45), ('Peter', 21), ('George', 18)]
```

Works only with numbers

Problem: Cheese Showcase

- Read the problem description **here**
- Create a function as described in the problem description and test it with the given examples
- Submit only your function in the Judge system



Solution: Cheese Showcase

```python
def sorting_cheeses(**cheeses_dict):
    cheeses_dict = sorted(
        cheeses_dict.items(),
        key=lambda x: (-len(x[1]), x[0]))

    result = []

    for (cheese_name, quantities) in cheeses_dict:
        result.append(cheese_name)
        quantity_list = sorted(quantities, reverse=True)
        result += quantity_list

    return "\n".join([str(x) for x in result])
```

Nested Functions

Inner Functions and Closures

Functions Can be Nested

- Defined **inside** other functions
- The inner function does **not exist outside** the function in which it's defined

```
def outside_function():
    ...
    def inside_function():
        ...
    ...
```

Outer Function

Inner Function

Inner Function Example

```python
def factorial(number):
    if not isinstance(number, int) or number < 0:
        return f"Sorry. 'number' is incorrect."
    def inner_factorial(n):
        fact = 1
        for i in range(1, n + 1):
            fact = fact * i
        return fact
    return inner_factorial(number)
```

Return the result of calling the inner function

Functions Can Return Functions

- The inner function is **no longer "hidden"**
- The outer function returns **behavior**

```
def outside_function():
    ...
    def inside_function():
        ...
    return inside_function
```

Function Returning Function Example

```python
def calculator(operator):
    def addition(a, b):
        return a + b
    def subtraction(a, b):
        return a - b
    if operator == "+":
        return addition
    elif operator == "-":
        return subtraction
```

```python
operation = calculator("+")
result = operation(2, 3)
print(result)
# 5
```

Returns a function depending on the operator

Lexical Closures

- The inner function can capture and carry some of the **parent function's** state

```
def outside_function(number):
    def inside_function():
        return number
    return inside_function

print(outside_function(10)()) # 10
```

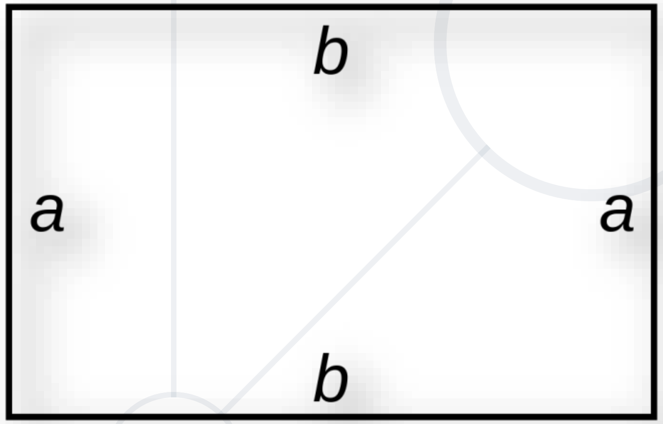
Closures Example

```
def greeting(name):
    hello = "Hello, "
    def say_hi():
        return hello + name
    return say_hi

print(greeting("Peter")())
# Hello, Peter
```

Problem: Rectangle

- Read the problem description **here**
- Create a function as described in the problem description and test it with the given examples
- Submit only your function in the Judge system



Recursion

Function Calling Itself

What is Recursion?

- The process in which a function calls itself is called **recursion**
- The function that is calling itself is called a **recursive function**
- A recursive function has the following structure
  - A **base** case
  - A **recursive** case

Base Case and Recursive Case

- The base case in a recursion returns a value **without** making any other **recursive calls**
  - It is the **condition** for the recursion to stop
- The recursive case is the **central part** of the recursive function
  - It is the **solution** to the bigger problem expressed in terms of **smaller problems**

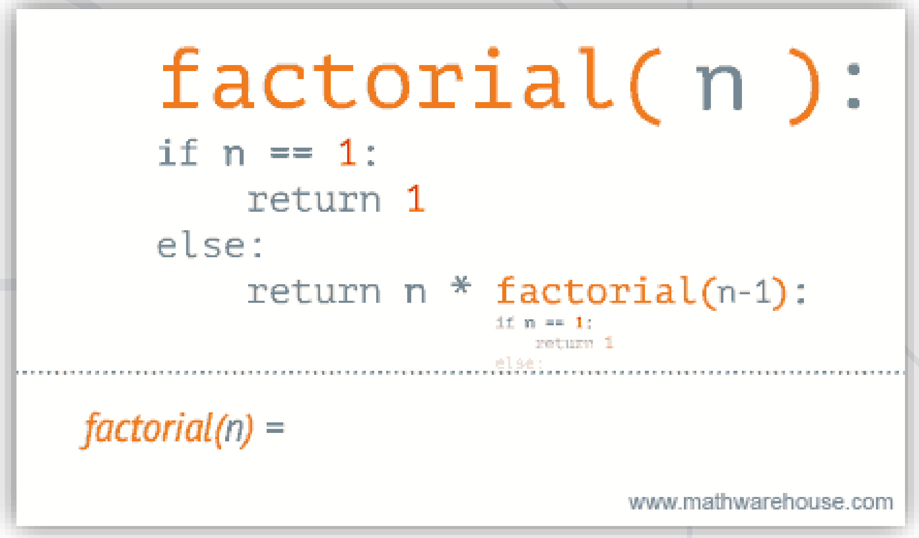
Example

- Factorial recursive representation

```
def fact(n):
    if n == 1:
        return 1
    return n * fact(n - 1)
```

Base Case

Recursive Case



```
factorial( n ):
if n == 1:
    return 1
else:
    return n * factorial(n-1):
               if n == 1:
                   return 1
               else:
```

factorial(n) =

www.mathwarehouse.com

Problem: Recursive Power

- Create a recursive function called **`recursive_power()`**
- It should receive a **number** and a **power**
- Using recursion, return the result of **`number ** power`**
- Submit **only the function** in the judge system

Solution: Recursive Power

```python
def recursive_power(x, y):
    result = 1
    if y == 0:
        return result
    result = x * recursive_power(x, y - 1)
    return result
```

Summary

- **Packing arguments** into:
  - Tuple
  - Dictionary
- **Unpacking arguments** into:
  - Tuple
  - Dictionary

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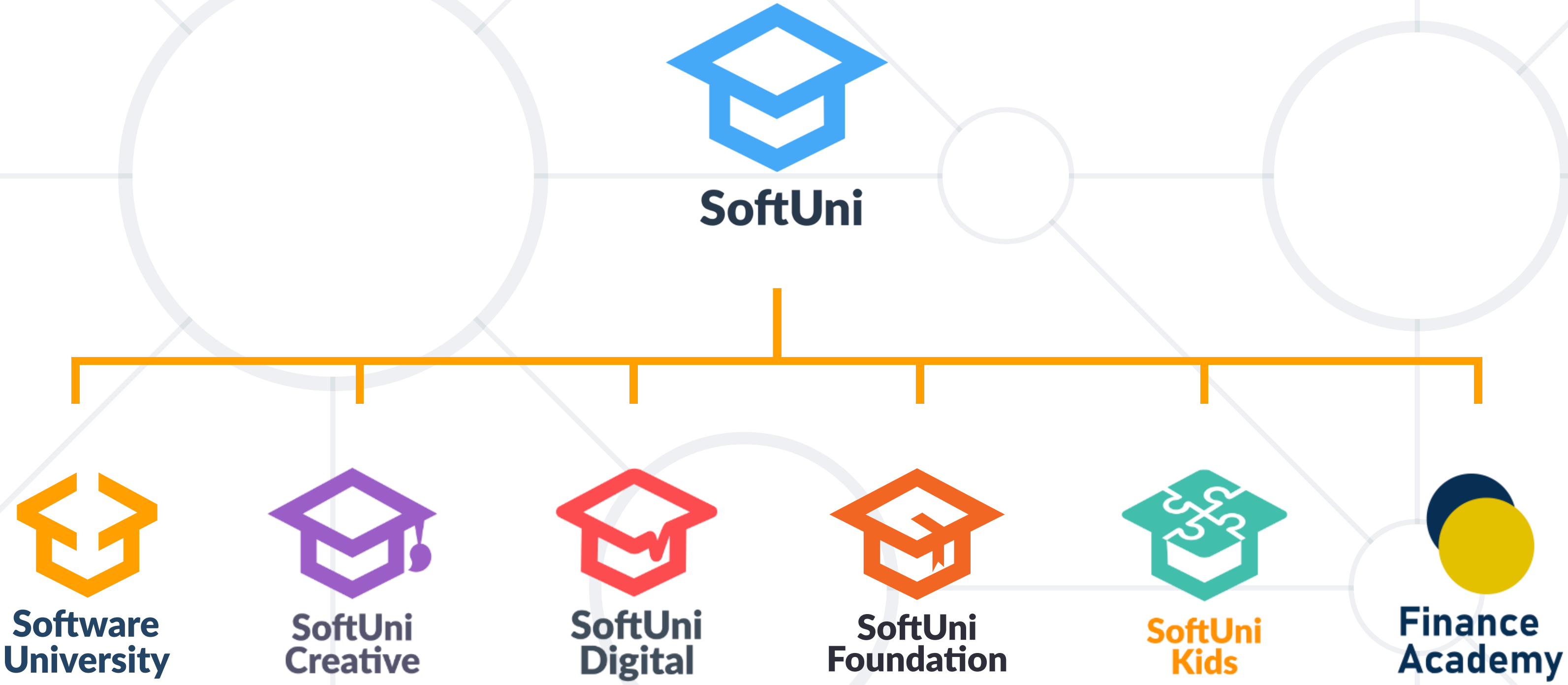
Questions?



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