# How to pass a variable number of arguments to a function?

PREPARING FOR CODING INTERVIEW QUESTIONS IN PYTHON

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# Argument types

There are two types of arguments:

- 
- 

# Argument types

There are two types of arguments:

- positional arguments
-

# Argument types

There are two types of arguments:

- positional arguments
- keyword arguments

# Argument types

There are two types of arguments:

- **positional arguments**
- keyword arguments

# Positional arguments

```
def func_with_pos_args(arg1, arg2):

    pass
```

```
def multiply(x, y):
    return x * y
```

```
multiply(2, 3)
```

```
6
```

# *args

```
def func_with_var_pos_args(*args):

    pass
```

```
func_with_var_pos_args(1, 2, 'hello')
```

# *args

```
def func_with_var_pos_args(*args):

    print(args)
```

```
func_with_var_pos_args(1, 2, 'hello')
```

```
(1, 2, 'hello')
```

# *args

```
def func_with_var_pos_args(*args):
    for arg in args:
        print(arg)
```

```
func_with_var_pos_args(1, 2, 'hello')
```

```
1
2
'hello'
```

# Redefining multiply()

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

```
multiply(1, 2, 3):
```

```
6
```

```
multiply(1, 2, 3, 4)
```

```
24
```

# Redefining multiply()

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

```
multiply(1, 2, 3):
```

```
6
```

```
multiply(1, 2, 3, 4)
```

```
24
```

# Another use of single asterisk *

```
def multiply(num1, num2, num3):
    return num1 * num2 * num3
```

```
multiply(1, 2, 3)
```

```
6
```

# Another use of single asterisk *

```
def multiply(num1, num2, num3):
    return num1 * num2 * num3
```

```
nums = (2, 3, 4)
```

```
multiply(*nums)
```

```
24
```

```
nums = [2, 3]
multiply(*nums, 4)
```

```
24
```

# Another use of single asterisk *

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

```
nums = (2, 3, 4, 5)
```

```
multiply(*nums)
```

```
120
```

# Argument types

There are two types of arguments:

- positional arguments
- **keyword arguments**

# Keyword arguments

```
def func_with_kwargs(arg1=1, arg2=2):
```

```
def multiply(x=1, y=2):
    print(str(x) + ' : ' + str(y))
```

```
multiply(2, 3)
```

```
2 : 3
```

```
multiply()
```

```
1 : 2
```

# Keyword arguments

```
def func_with_kwargs(arg1=1, arg2=2):
```

```
def multiply(x=1, y=2):
    print(str(x) + " : " + str(y))
```

```
multiply(y=5, x=3)
```

```
3 : 5
```

# **kwargs

**kwargs** - keyword arguments

```
def func_with_var_kwargs(**kwargs):
    print(kwargs)
```

```
func_with_var_kwargs(arg1=1, arg2=2, arg3=3)
```

```
{arg1: 1, arg2: 2, arg3: 3}
```

```
func_with_var_kwargs(1, arg2=2, arg3=3)
```

```
TypeError
```

# Redefining multiply()

```
def multiply_kwargs(**kwargs):
    result = 1
    for (key, value) in kwargs.items():
        print(key + ' = ' + str(value))
        result = result * value
    return result
```

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

# Calling multiply_kwargs()

```
multiply_kwargs(num1=1, num2=2, num3=3, num4=4)
```

```
num1 = 1
num2 = 2
num3 = 3
num4 = 4
24
```

# Another use of double asterisk **

```
def multiply(num1=1, num2=2, num3=3):
    print('num1 = ' + str(num1))
    print('num2 = ' + str(num2))
    print('num3 = ' + str(num3))
    return num1 * num2 * num3
```

```
multiply()
```

```
num1 = 1
num2 = 2
num3 = 3
6
```

# Another use of double asterisk **

```
def multiply(num1=1, num2=2, num3=3):
    print('num1 = ' + str(num1))
    print('num2 = ' + str(num2))
    print('num3 = ' + str(num3))
    return num1 * num2 * num3
```

```
nums = {'num1': 10, 'num2': 20, 'num3': 30
```

```
multiply(**nums)
```

```
num1 = 10
num2 = 20
num3 = 30
6000
```

# Another use of double asterisk **

```
def multiply(num1=1, num2=2, num3=3):
    print('num1 = ' + str(num1))
    print('num2 = ' + str(num2))
    print('num3 = ' + str(num3))
    return num1 * num2 * num3
```

```
nums = {'num1': 10, 'num3': 30}
```

```
multiply(**nums)
```

```
num1 = 10
num2 = 2
num3 = 30
600
```

# Another use of double asterisk **

```
def multiply(num1=1, num2=2, num3=3):
    print('num1 = ' + str(num1))
    print('num2 = ' + str(num2))
    print('num3 = ' + str(num3))
    return num1 * num2 * num3
```

```
nums = {'NUM10': 1, 'num2': 2, 'num3': 3}
```

```
multiply(**nums)
```

```
TypeError
```

# Another use of double asterisk **

```
def multiply_kwargs(**kwargs):
    result = 1
    for (key, value) in kwargs.items():
        print(key + ' = ' + str(value))
        result = result * value
    return result
```

```
nums = {
    'num1': 2, 'num2': 3,
    'num3': 4, 'num4': 5
}
```

```
multiply_kwargs(**nums)
```

```
num1 = 2
num2 = 3
num3 = 4
num4 = 5
120
```

# Argument order

```
def func(                                                    ):
```

# Argument order

```
def func(arg1, arg2,                                    ):
```

- `arg1` , `arg2` - positional arguments

# Argument order

```
def func(arg1, arg2, *args,                                    ):
```

- `arg1` , `arg2` - positional arguments
- `*args` - positional arguments of variable size

# Argument order

```
def func(arg1, arg2, *args, kwarg1, kwarg2,          ):
```

- `arg1` , `arg2` - positional arguments
- `*args` - positional arguments of variable size
- `kwarg1` , `kwarg2` - keyword arguments

# Argument order

```
def func(arg1, arg2, *args, kwarg1, kwarg2, **kwargs):
```

- `arg1` , `arg2` - positional arguments
- `*args` - positional arguments of variable size
- `kwarg1` , `kwarg2` - keyword arguments
- `**kwargs` - keyword arguments of variable size

```
def func(arg1, arg2, *args):
def func(arg1, arg2, **kwargs):
def func(*args, **kwargs):
```

# Let's practice!

PREPARING FOR CODING INTERVIEW QUESTIONS IN PYTHON

# What is a lambda expression?

PREPARING FOR CODING INTERVIEW QUESTIONS IN PYTHON

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# Definition

**lambda expression/function** - is a short function having the following syntax:

```
lambda arg1, arg2, ...: expression(arg1, arg2, ...)
```

# Definition

**lambda expression/function -** is a short function having the following syntax:

```
lambda
```

# Definition

**lambda expression/function** - is a short function having the following syntax:

```
lambda arg1, arg2, ...:
```

# Definition

**lambda expression/function** - is a short function having the following syntax:

```
lambda arg1, arg2, ...: expression(arg1, arg2, ...)
```

```
lambda x: x**2
```

```
squared = lambda x: x**2

squared(4)
```

```
16
```

`4` → `x` → `x**2` → `16`

# Definition

**lambda expression/function -** is a short function having the following syntax:

```
lambda arg1, arg2, ...: expression(arg1, arg2, ...)
```

```
power = lambda x, y: x**y

power(2, 3)
```

```
8
```

`2, 3` → `x, y` → `x**y` → `8`

# Missing argument

```
power = lambda x, y: x**y
```

```
power(2)
```

```
TypeError
```

# Comparison to normal function definition

```
squared_lambda = lambda x: x**2
```

```
def squared_normal(x):
    return x**2
```

# Comparison to normal function definition

```
                    lambda
```

```
def
```

# Comparison to normal function definition

```
squared_lambda = lambda
```

```
def squared_normal
```

# Comparison to normal function definition

```
squared_lambda = lambda x:
```

```
def squared_normal(x):
```

# Comparison to normal function definition

```
squared_lambda = lambda x: x**2
```

```
def squared_normal(x):
    return x**2
```

```
squared_lambda(3)
```

```
9
```

```
squared_normal(3)
```

```
9
```

# Passing lambda function as an argument

```
def function_with_callback(num, callback_function):
    return callback(num)
```

`callback_function(arg)` - a function with one argument

```
def squared_normal(x):
    return x**2
```

```
function_with_callback(2, squared_normal)
```

```
4
```

# Passing lambda function as an argument

```
def function_with_callback(num, callback_function):
    return callback(num)
```

`callback_function(arg)` - a function with one argument

```
--> def squared_normal(x): <--
-->     return x**2          <--
```

```
--> function_with_callback(2, squared_normal) <--
```

```
4
```

# Passing lambda function as an argument

```
def function_with_callback(num, callback_function):
    return callback(num)
```

`callback_function(arg)` - a function with one argument

```
function_with_callback(2, lambda x: x**2)
```

```
4
```

# Definition

**lambda expression/function** - is a short function having the following syntax:

```
lambda arg1, arg2, ...: expression(arg1, arg2, ...)
```

# Definition

**lambda expression/function** - is a short (anonymous) function having the following syntax:

```
lambda arg1, arg2, ...: expression(arg1, arg2, ...)
```

```
squared = lambda x: x**2
squared(3)
```

```
9
```

# Definition

**lambda expression/function -** is a short (anonymous) function having the following syntax:

```
lambda arg1, arg2, ...: expression(arg1, arg2, ...)
```

```
(lambda x: x**2)(3)
```

```
9
```

# Ternary operator

```
def odd_or_even(num):
    if num % 2 == 0:
        return 'even'
    else:
        return 'odd'
```

```
odd_or_even(3)
```

```
'odd'
```

```
odd_or_even(6)
```

```
'even'
```

# Ternary operator

```
def odd_or_even(num):
    return 'even' if num % 2 == 0 else 'odd'
```

```
odd_or_even(3)
```

```
'odd'
```

```
odd_or_even(6)
```

```
'even'
```

# Ternary operator

```
odd_or_even = lambda num: 'even' if num % 2 == 0 else 'odd'
```

```
odd_or_even(3)
```

```
'odd'
```

```
odd_or_even(6)
```

```
'even'
```

# Practical use

Use lambda expressions when it is really necessary!

- within function bodies to perform a small task
- as callbacks

# Let's practice!

PREPARING FOR CODING INTERVIEW QUESTIONS IN PYTHON

# What are the functions map(), filter(), reduce()?

PREPARING FOR CODING INTERVIEW QUESTIONS IN PYTHON

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# map()

```
map(                                                    )
```

# map()

```
map(                        Iterable1, Iterable2, ...)
```

Iterables: `[1, 2, 3, 4, 5]` , `[10, 20, 30, 40, 50]` , ...

# map()

```
map(function(x1, x2, ...), Iterable1, Iterable2, ...)
```

Iterables: `[1, 2, 3, 4, 5]` , `[10, 20, 30, 40, 50]` , ...

`1` , `10` , ... → `function(1, 10, ...)` → new object

`2` , `20` , ... → `function(2, 20, ...)` → new object

`3` , `30` , ... → `function(3, 30, ...)` → new object

`4` , `40` , ... → `function(4, 40, ...)` → new object

`5` , `50` , ... → `function(5, 50, ...)` → new object

# map() with single Iterable

```
nums = [1, 2, 3, 4, 5]
```

The task is to get `[1, 4, 9, 16, 25]`

```
def squared(x):
    return x**2
```

```
squares = map(squared, nums)
```

```
print(squares)
```

```
<map object at 0x7fdbe4ab3da0>
```

`squares` is iterable

```
for square in squares:
    print(square)
```

```
1
4
9
16
25
```

# map() with single Iterable

```
nums = [1, 2, 3, 4, 5]
```

The task is to get `[1, 4, 9, 16, 25]`

```
def squared(x):
    return x**2
```

```
squares = map(squared, nums)
```

```
print(squares)
```

```
<map object at 0x7fdbe4ab3da0>
```

`squares` is Iterable

```
list(squares)
```

```
[1, 4, 9, 16, 25]
```

# map() with single Iterable

```
nums = [1, 2, 3, 4, 5]
```

The task is to get `[1, 4, 9, 16, 25]`

```
def squared(x):
    return x**2
```

```
squares = map(squared, nums)
```

```
print(squares)
```

```
<map object at 0x7fdbe4ab3da0>
```

`squares` is Iterator

```
next(squares)
```

```
1
```

```
next(squares)
```

```
4
```

# map() with lambda expressions

```
nums = [1, 2, 3, 4, 5]
```

The task is to get `[1, 4, 9, 16, 25]`

```
def squared(x):
    return x**2
```

```
squares = map(squared, nums)
list(squares)
```

```
[1, 4, 9, 16, 25]
```


```
nums = [1, 2, 3, 4, 5]
```

The task is to get `[1, 4, 9, 16, 25]`


```
squares = map(lambda x: x**2, nums)
list(squares)
```


```
[1, 4, 9, 16, 25]
```

# map() with multiple Iterables

```
nums1 = [1, 2, 3, 4, 5]
nums2 = [10, 20, 30, 40, 50]
```

The task is to get: `[1*10, 2*20, 3*30, 4*40, 5*50] = [10, 40, 90, 160, 250]`

```
mult = map(lambda x, y: x*y, nums1, nums2)
```

```
list(mult)
```

```
[10, 40, 90, 160, 250]
```

# filter()

```
filter(                    )
```

# filter()

```
filter(              Iterable)
```

Iterable: `[1, 2, 3, 4, 5]`

# filter()

```
filter(function(x), Iterable)
```

Iterable: `[1, 2, 3, 4, 5]`

`1` → `function(1)` → `True` → `1` is kept

`2` → `function(2)` → `False` → `2` is rejected

`3` → `function(3)` → `True` → `3` is kept

`4` → `function(4)` → `False` → `4` is rejected

`5` → `function(5)` → `True` → `5` is kept

# filter() example

```
nums = [-3, -2, -1, 0, 1, 2, 3]
```

The task is to get: `[1, 2, 3]`

```
def positive(x):
    return x > 0
```

```
fobj = filter(positive, nums)
```

```
print(fobj)
```

```
<filter object at 0x7f196d378d68>
```

`fobj` is Iterable

```
for item in fobj:
    print(item)
```

```
1
2
3
```

# filter() example

```
nums = [-3, -2, -1, 0, 1, 2, 3]
```

The task is to get: `[1, 2, 3]`

```
def positive(x):
    return x > 0
```

```
fobj = filter(positive, nums)
```

```
print(fobj)
```

```
<filter object at 0x7f196d378d68>
```

`fobj` is Iterable

```
list(fobj)
```

```
[1, 2, 3]
```

# filter() example

```
nums = [-3, -2, -1, 0, 1, 2, 3]
```

The task is to get: `[1, 2, 3]`

```
def positive(x):
    return x > 0
```

```
fobj = filter(positive, nums)
```

```
print(fobj)
```

```
<filter object at 0x7f196d378d68>
```

`fobj` is Iterator

```
next(fobj)
```

```
1
```

```
next(fobj)
```

```
4
```

# filter() with lambda expressions

```
nums = [-3, -2, -1, 0, 1, 2, 3]
```

The task is to get: `[1, 2, 3]`

```
def positive(x):
    return x > 0
```

```
fobj = filter(positive, nums)
list(fobj)
```

```
[1, 2, 3]
```


```
nums = [-3, -2, -1, 0, 1, 2, 3]
```

The task is to get: `[1, 2, 3]`


```
fobj = filter(lambda x: x > 0, nums)
list(fobj)
```

```
[1, 2, 3]
```

# reduce()

```
from functools import reduce

reduce(function(x, y), Iterable)
```

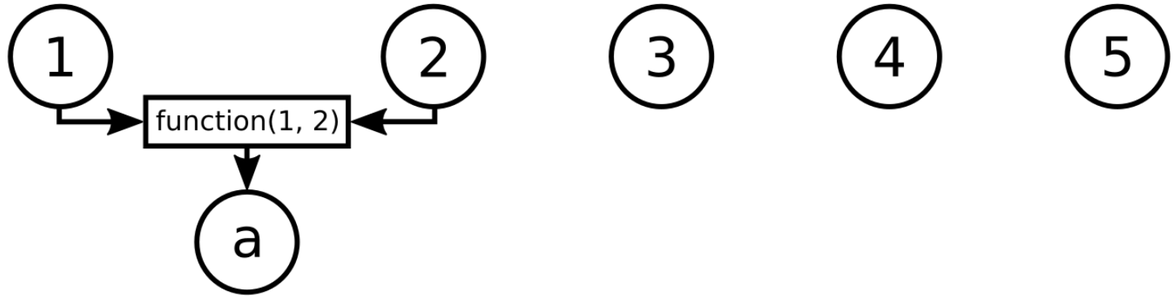

Iterable: `[1, 2, 3, 4, 5]`

`[1, 2, 3, 4, 5]` $\rightarrow$ new object of the same type as the content

# reduce()

```
from functools import reduce

reduce(function(x, y), Iterable)
```



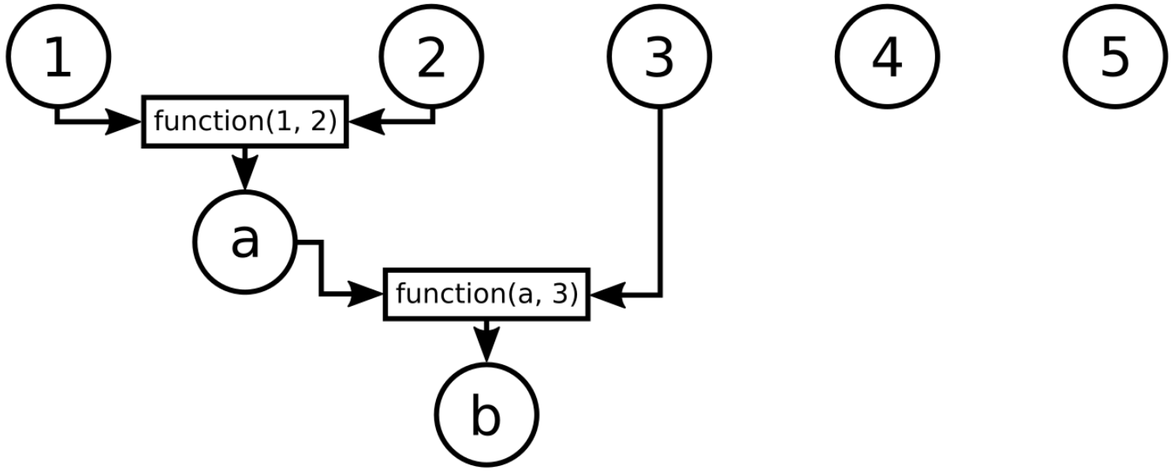

Iterable: `[1, 2, 3, 4, 5]`

`[1, 2, 3, 4, 5]` $\rightarrow$ new object of the same type as the content

# reduce()

```
from functools import reduce

reduce(function(x, y), Iterable)
```




Iterable: `[1, 2, 3, 4, 5]`

`[1, 2, 3, 4, 5]` $\rightarrow$ new object of the same type as the content

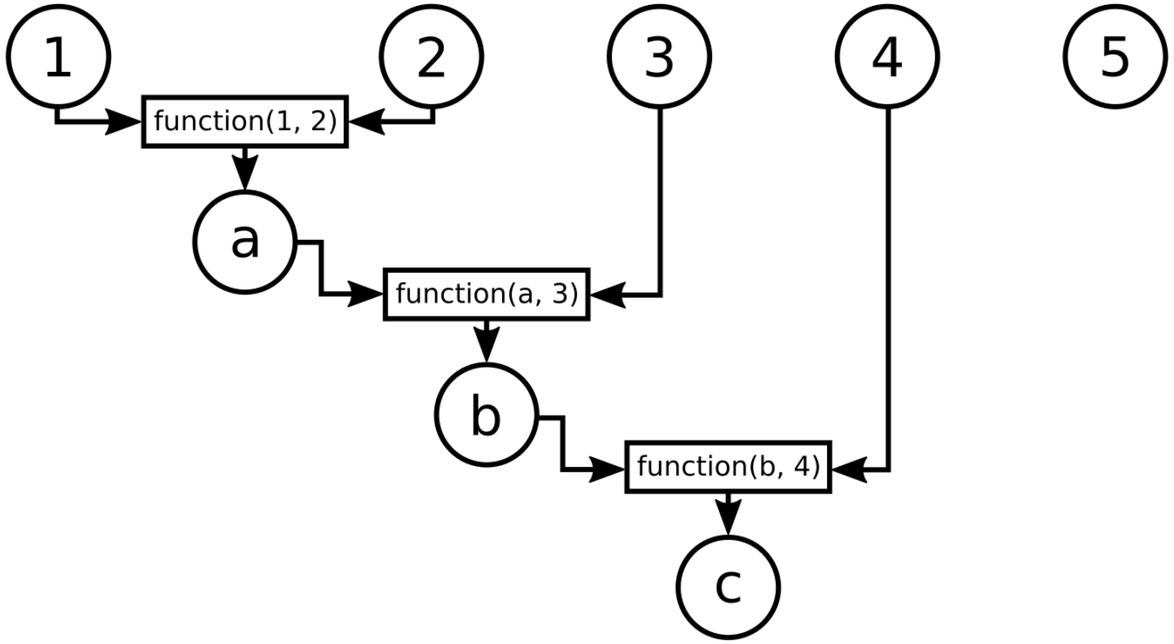
# reduce()

```
from functools import reduce

reduce(function(x, y), Iterable)
```

Iterable: `[1, 2, 3, 4, 5]`

`[1, 2, 3, 4, 5]` → new object of the same type as the content



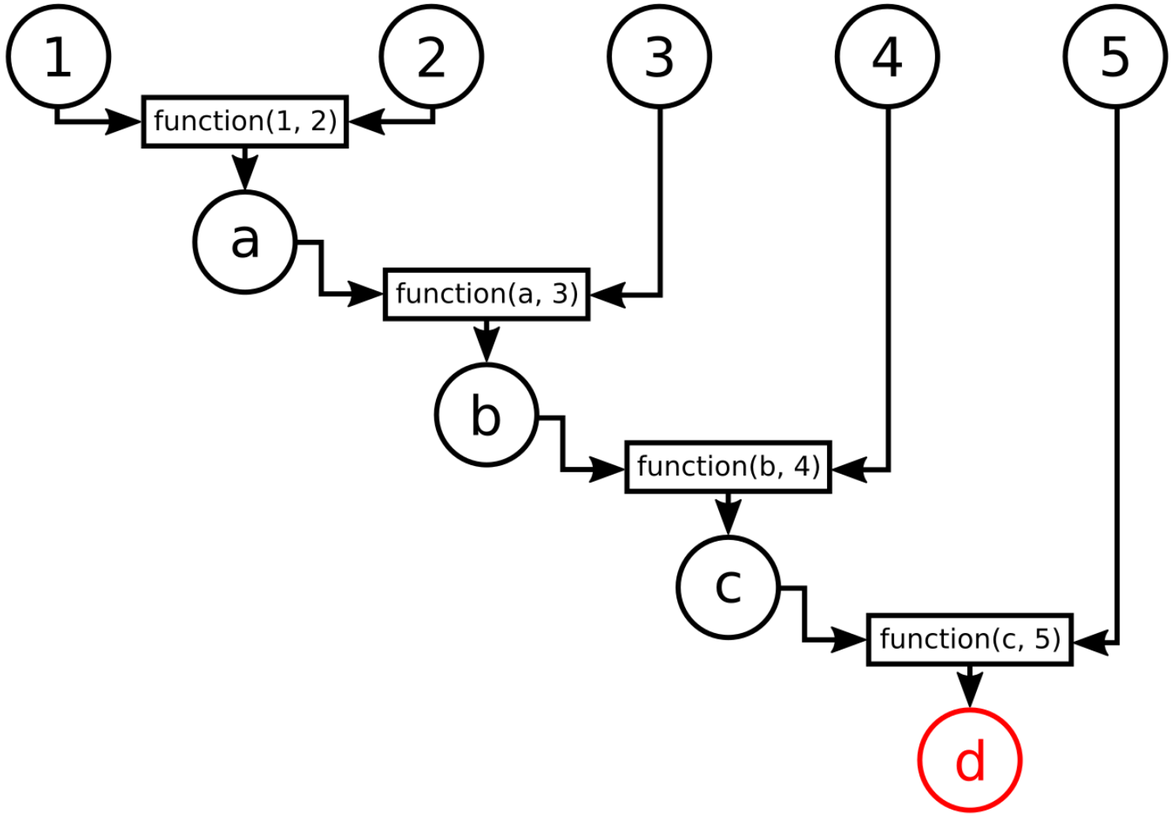
# reduce()

```
from functools import reduce

reduce(function(x, y), Iterable)
```

Iterable: `[1, 2, 3, 4, 5]`

`[1, 2, 3, 4, 5]` → new object of the same type as the content



# reduce() example

```
nums = [8, 4, 5, 1, 9]
```

The task is to get: `1` - minimum

```
def smallest(x, y):
    if x < y:
        return x
    else:
        return y
```

```
reduce(smallest, nums)
```

```
1
```

`smallest(8, 4)` → `4`

`smallest(4, 5)` → `4`

`smallest(4, 1)` → `1`

`smallest(1, 9)` → `1` - final result

# reduce() with lambda expressions

```
nums = [8, 1, 4, 2, 9]
```

The task is to get: `1` - minimum

```
def smallest(x, y):
    if x < y:
        return x
    else:
        return y
```

```
reduce(smallest, nums)
```

```
1
```

```
nums = [8, 1, 4, 2, 9]
```

The task is to get: `1` - minimum

```
reduce(lambda x, y: x if x < y else y, nums)
```

```
1
```

# Let's practice!

PREPARING FOR CODING INTERVIEW QUESTIONS IN PYTHON

# What is recursion?

PREPARING FOR CODING INTERVIEW QUESTIONS IN PYTHON

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# Definition

- Recursion is the process of defining a problem in terms of itself
- Recursion is a process in which a function calls itself as a subroutine

# Example: Factorial $n!$

$n! = n \cdot (n-1) \cdot (n-2) \cdot ... \cdot 1$

$n = 4$:

$4! = 4 \cdot 3 \cdot 2 \cdot 1$

**4! = 24**

# Factorial - Iterative Approach

$n! = n \cdot (n-1) \cdot (n-2) \cdot ... \cdot 1 =$

$= 1 \cdot 2 \cdot 3 \cdot ... \cdot n$

Iterative solution:

```
# iterative factorial
def fact_iter(n):
    result = 1
    # looping over numbers from 1 to n
    for num in range(1, n+1)
        result = num * result

    return result
```

$n = 4$ :

`result` = 1

1. `result` = 1 * `result` (1) = 1
2. `result` = 2 * `result` (1) = 2
3. `result` = 3 * `result` (2) = 6
4. `result` = 4 * `result` (4) = 24

$4! = 1 \cdot 2 \cdot 3 \cdot 4 = 24$

# Factorial - Recursive Approach

$n! = n \cdot (n-1)!$

```
def fact_rec(n):
    return n * fact_rec(n-1)
```

**What's wrong with that code?**

```
fact_rec(4)
```

```
RecursionError
```

We must define a base case!

$n! = n \cdot (n-1) \cdot (n-2) \cdot ... \cdot 1$

A stopping criterion / base case: $1! = 1$

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

```
fact_rec(4)
```

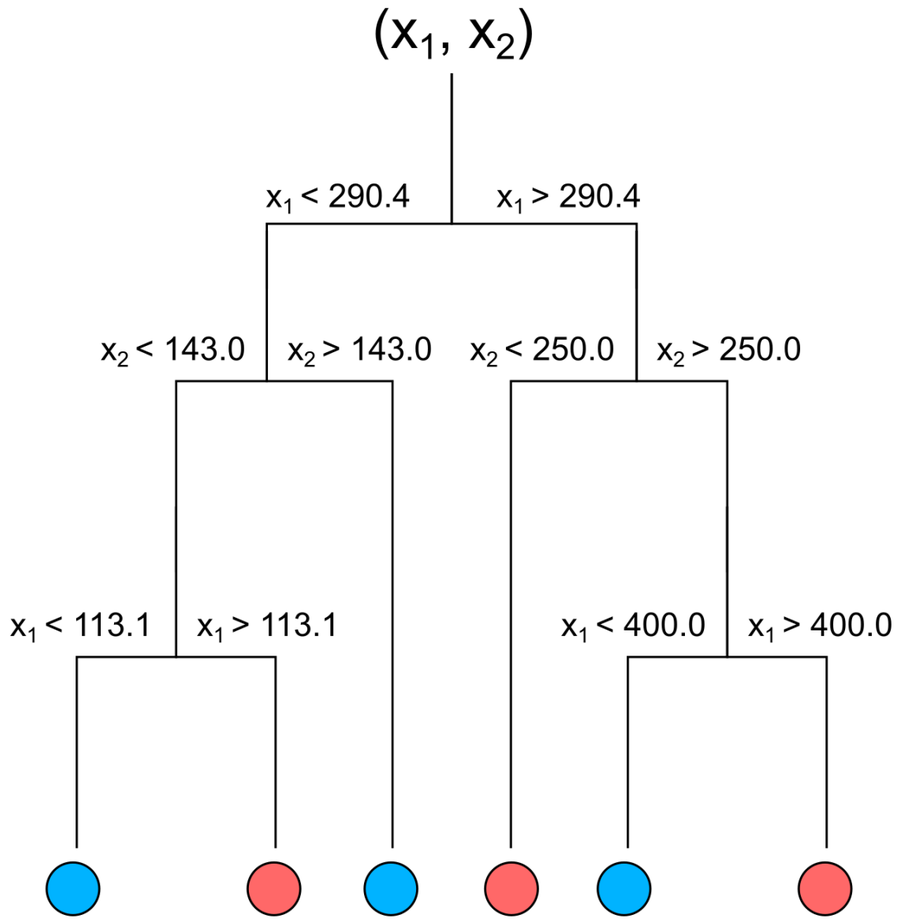
```
24
```

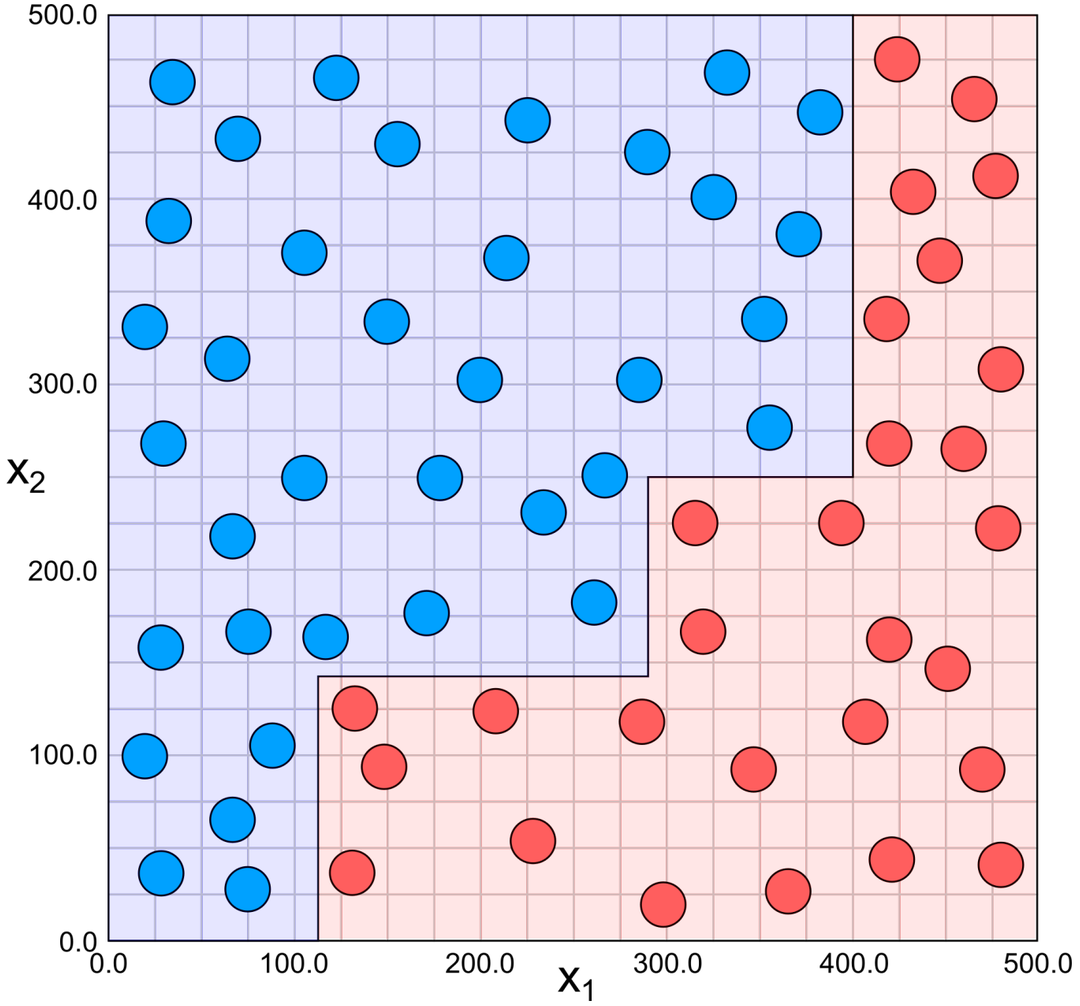
# Wrapping Up

Recursive functions have two main components:

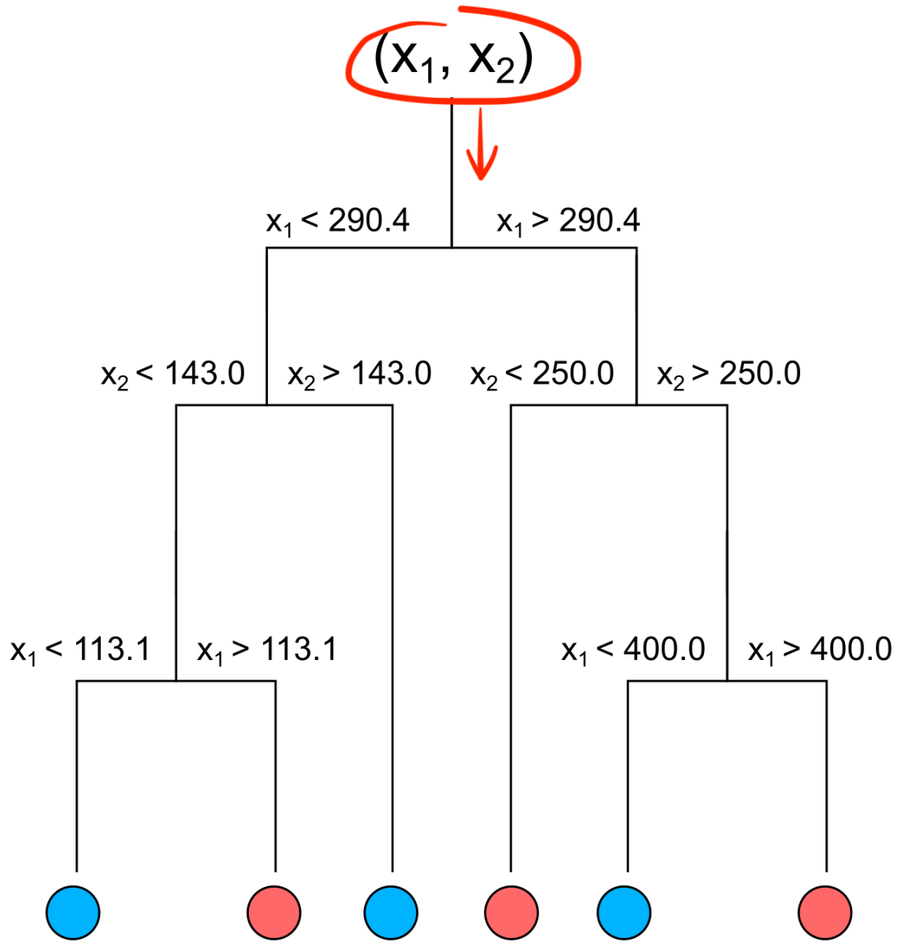
- a recursive call to a smaller problem of itself
- a base case that prevents an infinite calling

# Example - Decision Trees



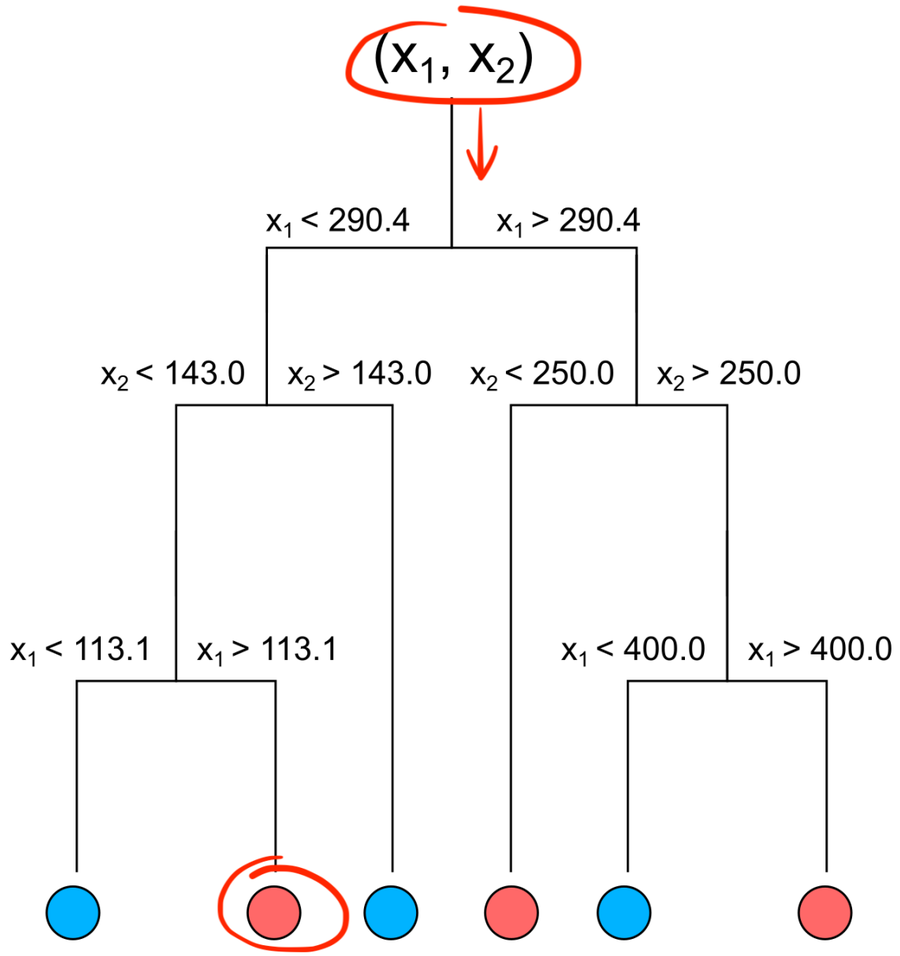
# Traversing a Decision Tree




**x** - a new sample $(x_1, x_2)$

```
# Pseudo algorithm for finding out the category:
category = pred(node, x):
  # Check if there is a split
  if node.hasSplitting:
    # Check which child node to take
    if node.goToLeftChild(x):
      return pred(node.leftChild, x)
    if node.goToRightChild(x):
      return pred(node.rightChild, x)
```

# Traversing a Decision Tree

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    if node.goToRightChild(x):
      return pred(node.rightChild, x)
  # Returning the category
  return node.category
```

# Let's practice!

PREPARING FOR CODING INTERVIEW QUESTIONS IN PYTHON