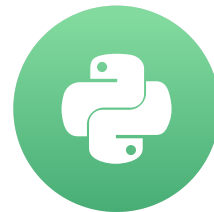


How to pass a variable number of arguments to a function?

PRACTICING CODING INTERVIEW QUESTIONS IN PYTHON

Kirill Smirnov

Data Science Consultant, Altran



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):
```

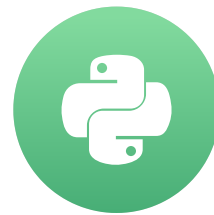
```
def func(*args, **kwargs):
```

Let's practice!

PRACTICING CODING INTERVIEW QUESTIONS IN PYTHON

What is a lambda expression?

PRACTICING CODING INTERVIEW QUESTIONS IN PYTHON



Kirill Smirnov

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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) <--
```

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)
```


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!

PRACTICING CODING INTERVIEW QUESTIONS IN PYTHON

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

PRACTICING CODING INTERVIEW QUESTIONS IN PYTHON



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Data Science Consultant, Altran

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] → new object of the same
type as the content

①

②

③

④

⑤

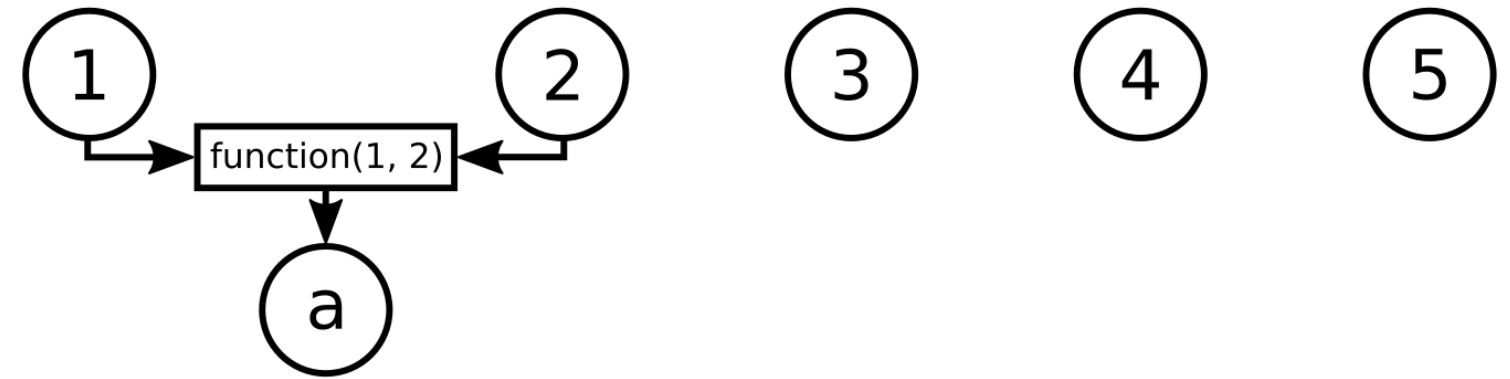
reduce()

```
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



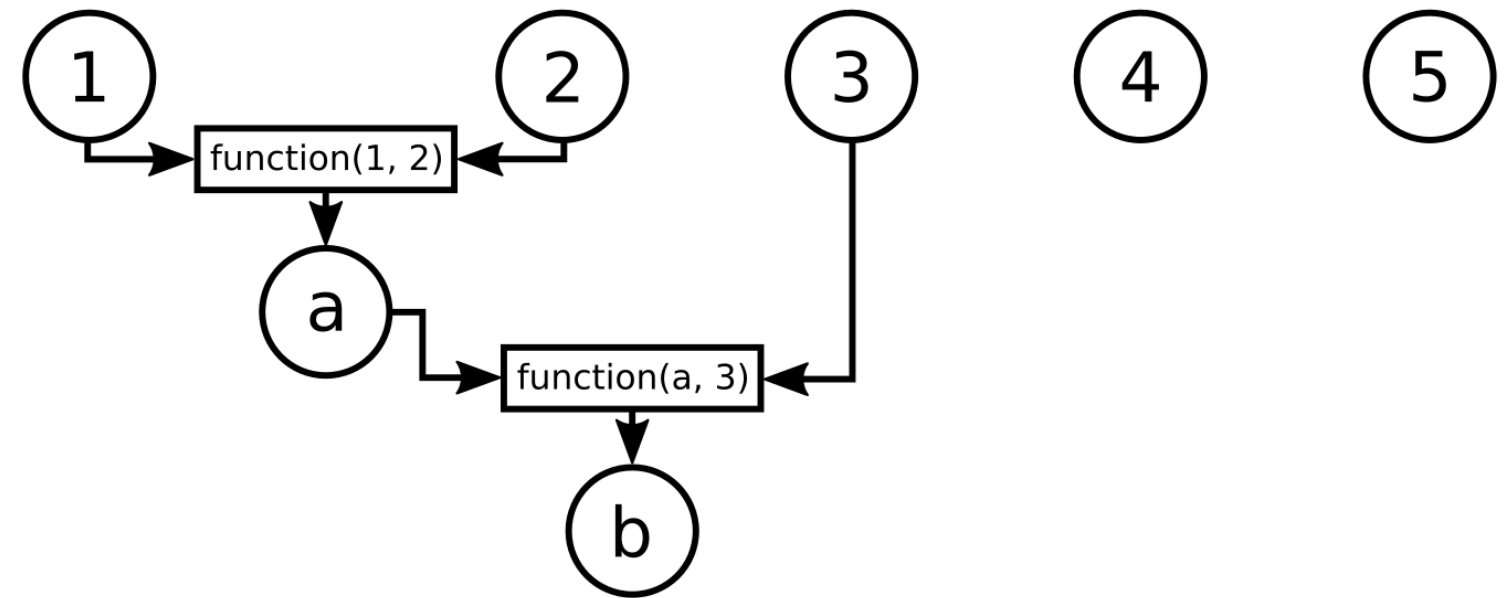
reduce()

```
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



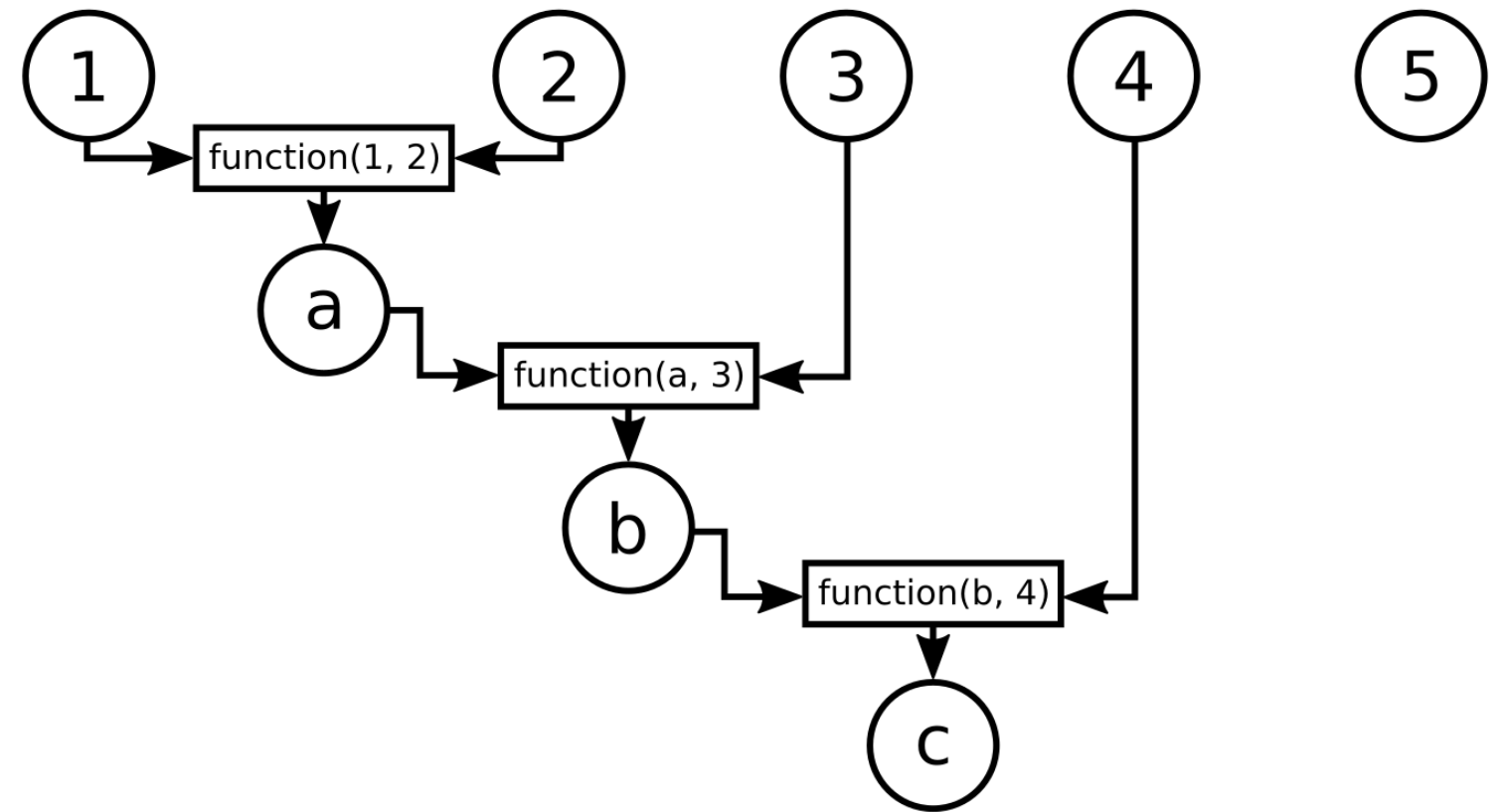
reduce()

```
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



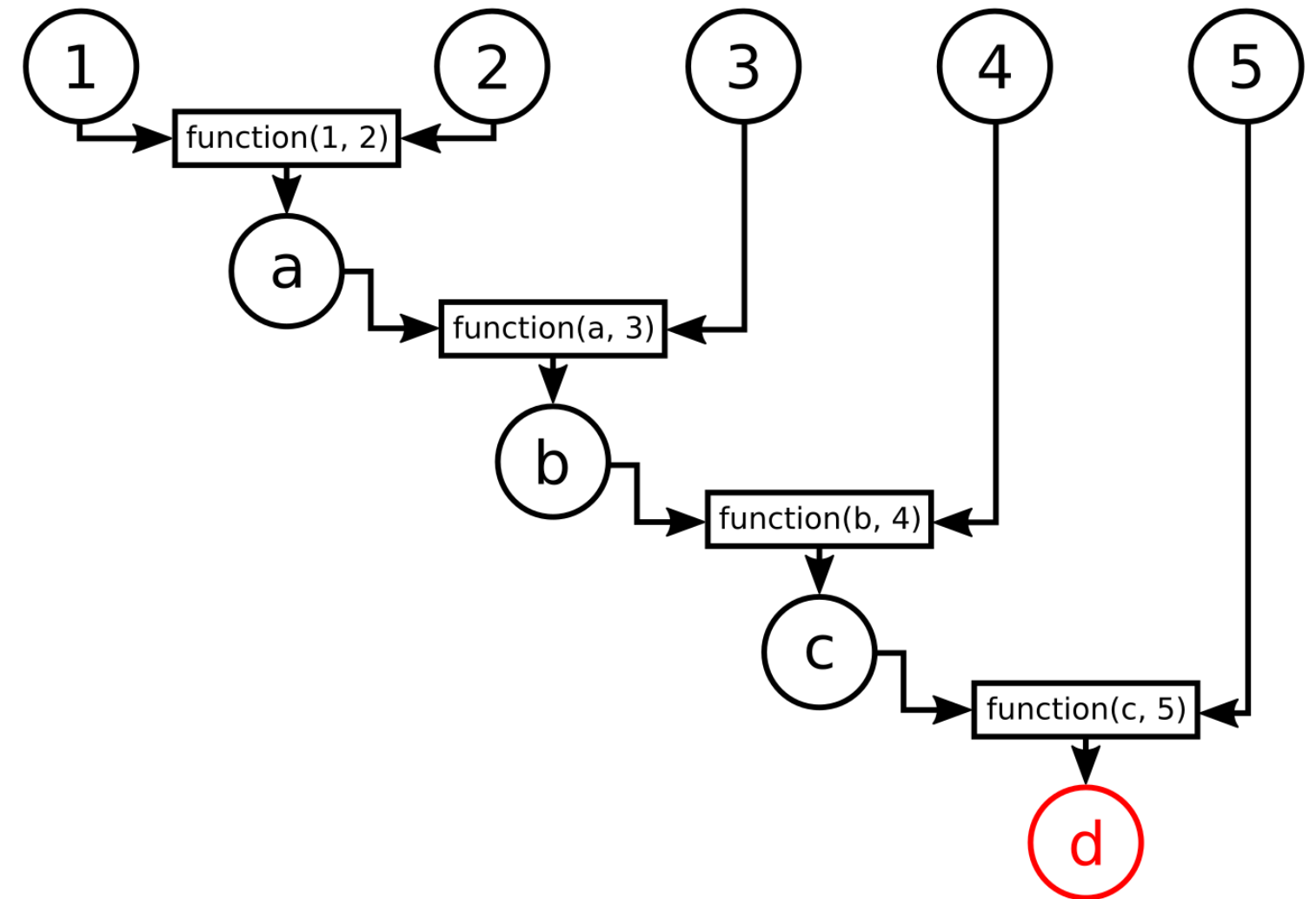
reduce()

```
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!

PRACTICING CODING INTERVIEW QUESTIONS IN PYTHON

What is recursion?

PRACTICING CODING INTERVIEW QUESTIONS IN PYTHON



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Data Science Consultant, Altran

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 $n!$

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

$$n = 4:$$

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

$$4! = 24$$

Factorial - Iterative Approach

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

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

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
```

$$n = 4 :$$

$$\text{result} = 1$$

$$1. \text{ result} = 1 * \text{result} \quad (1) = 1$$

$$2. \text{ result} = 2 * \text{result} \quad (1) = 2$$

$$3. \text{ result} = 3 * \text{result} \quad (2) = 6$$

$$4. \text{ result} = 4 * \text{result} \quad (4) = 24$$

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

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!

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

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)
```

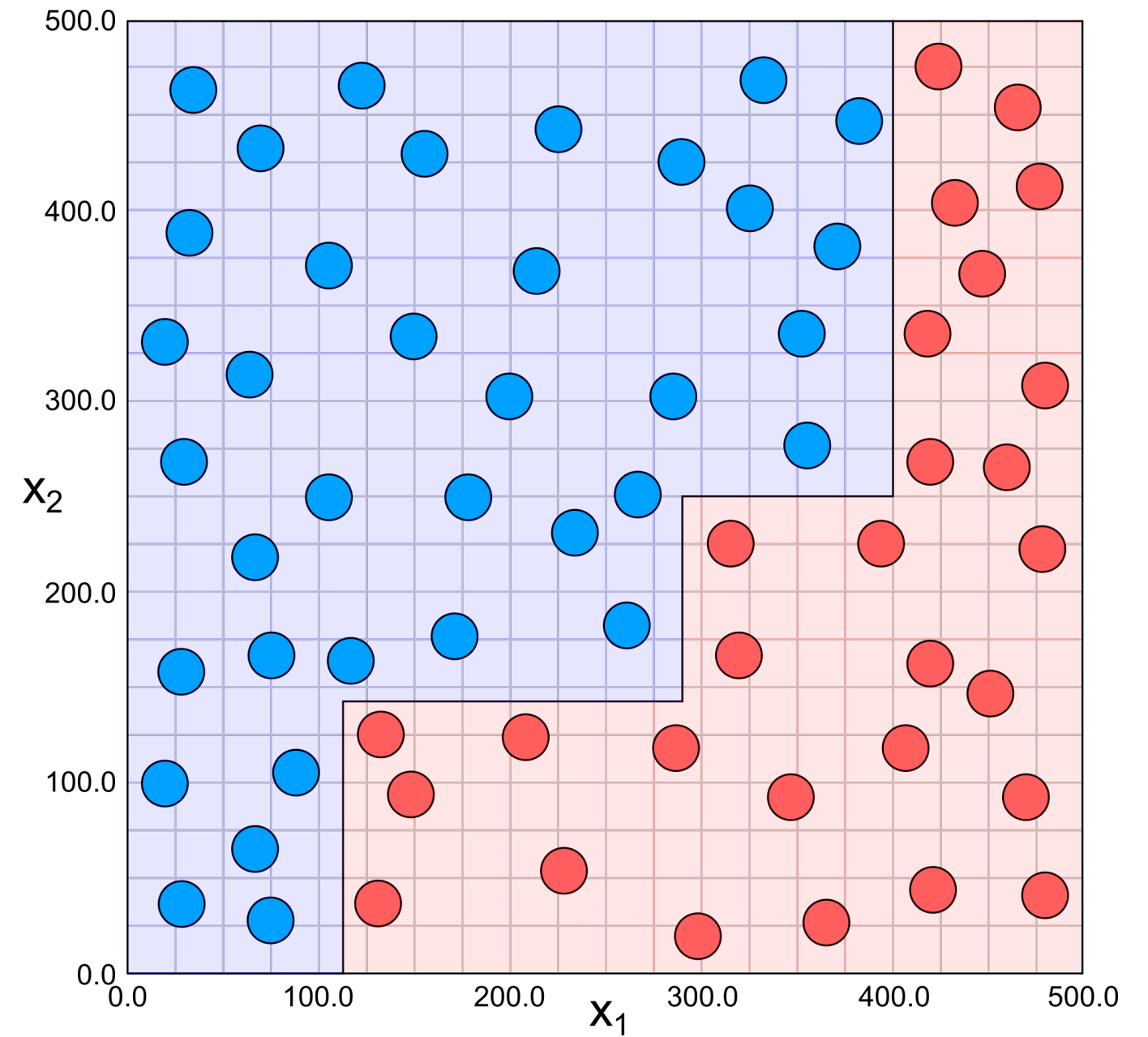
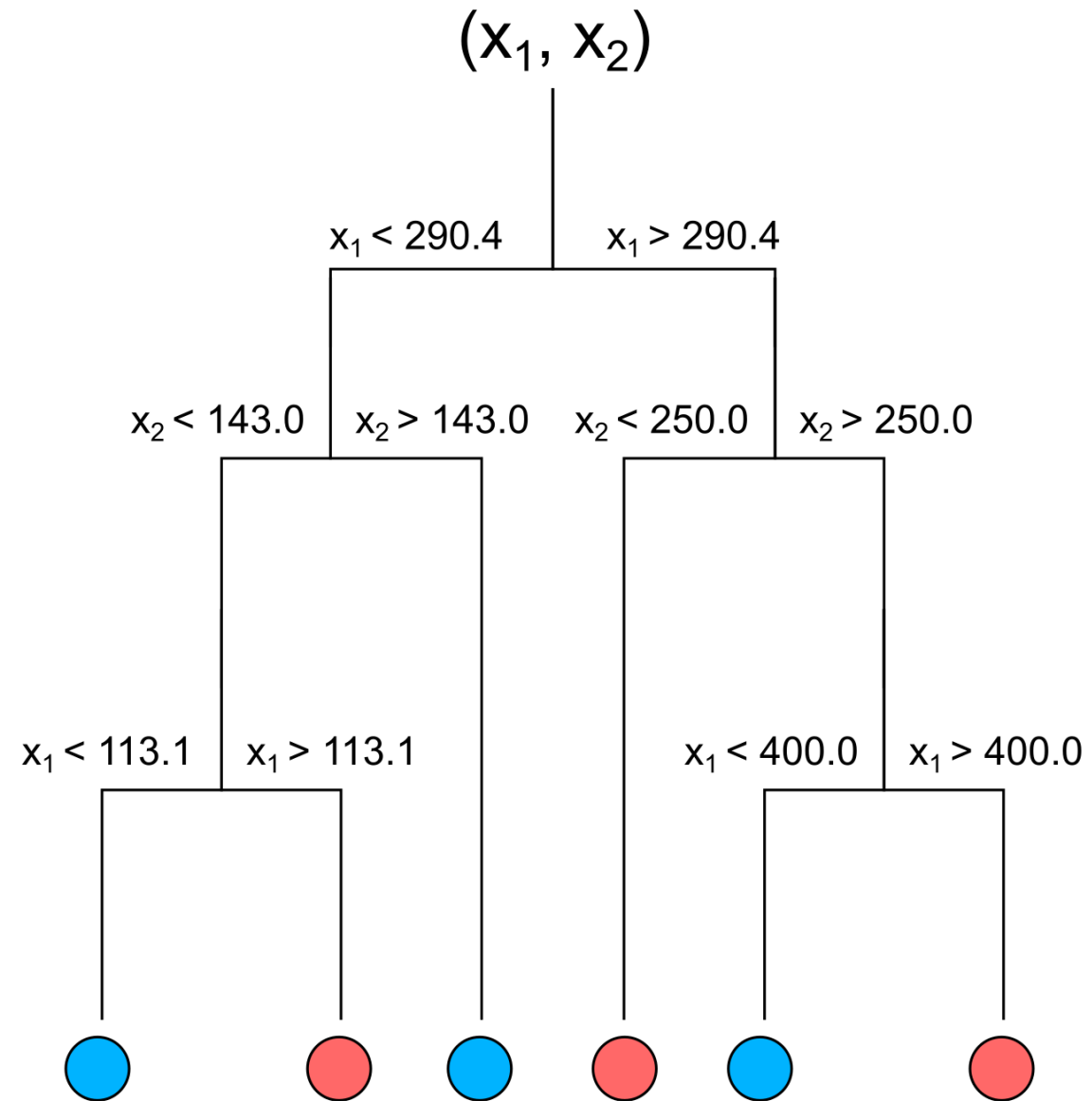
```
24
```

Wrapping Up

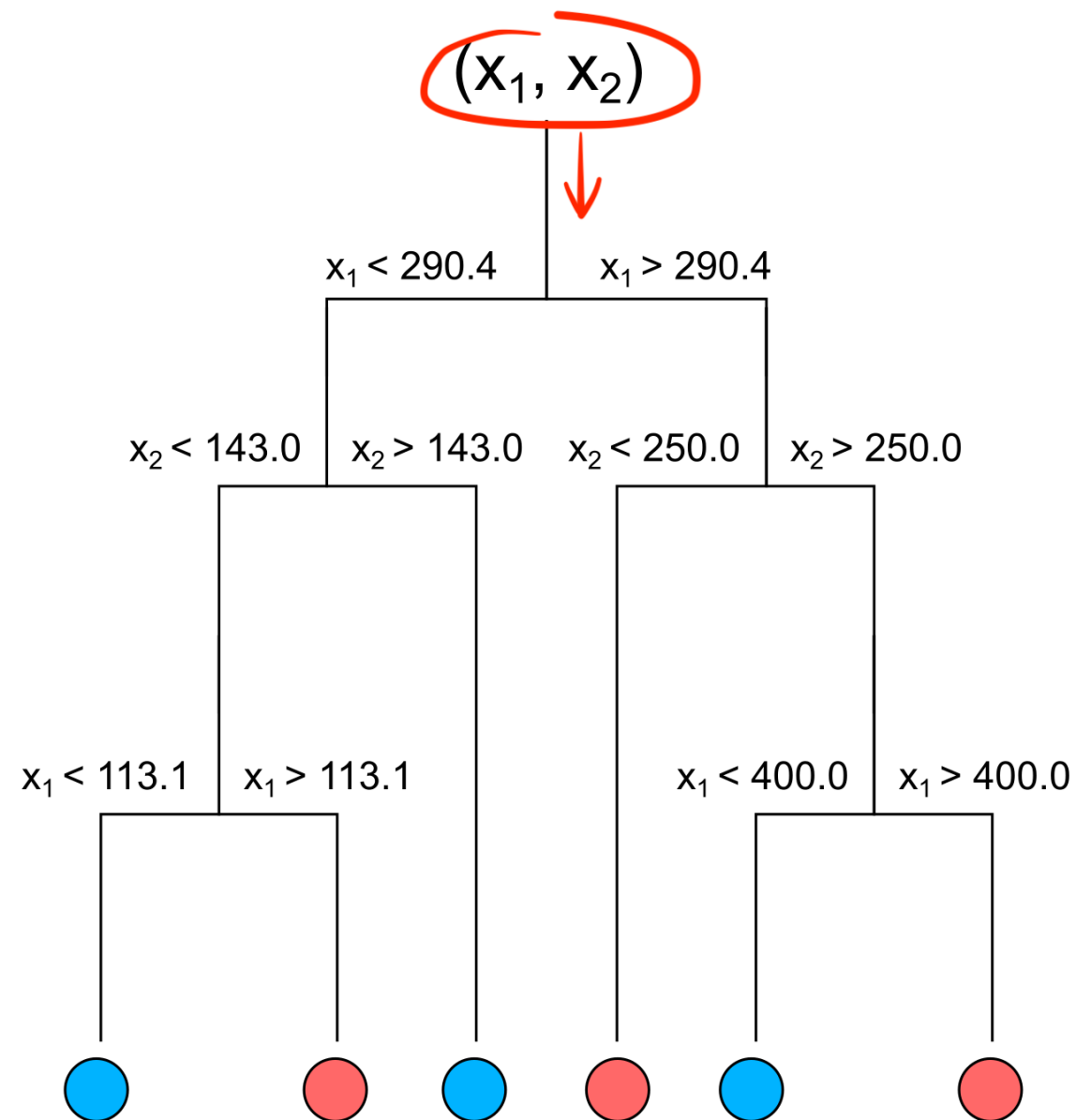
Recursive functions have two main components:

- 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
```

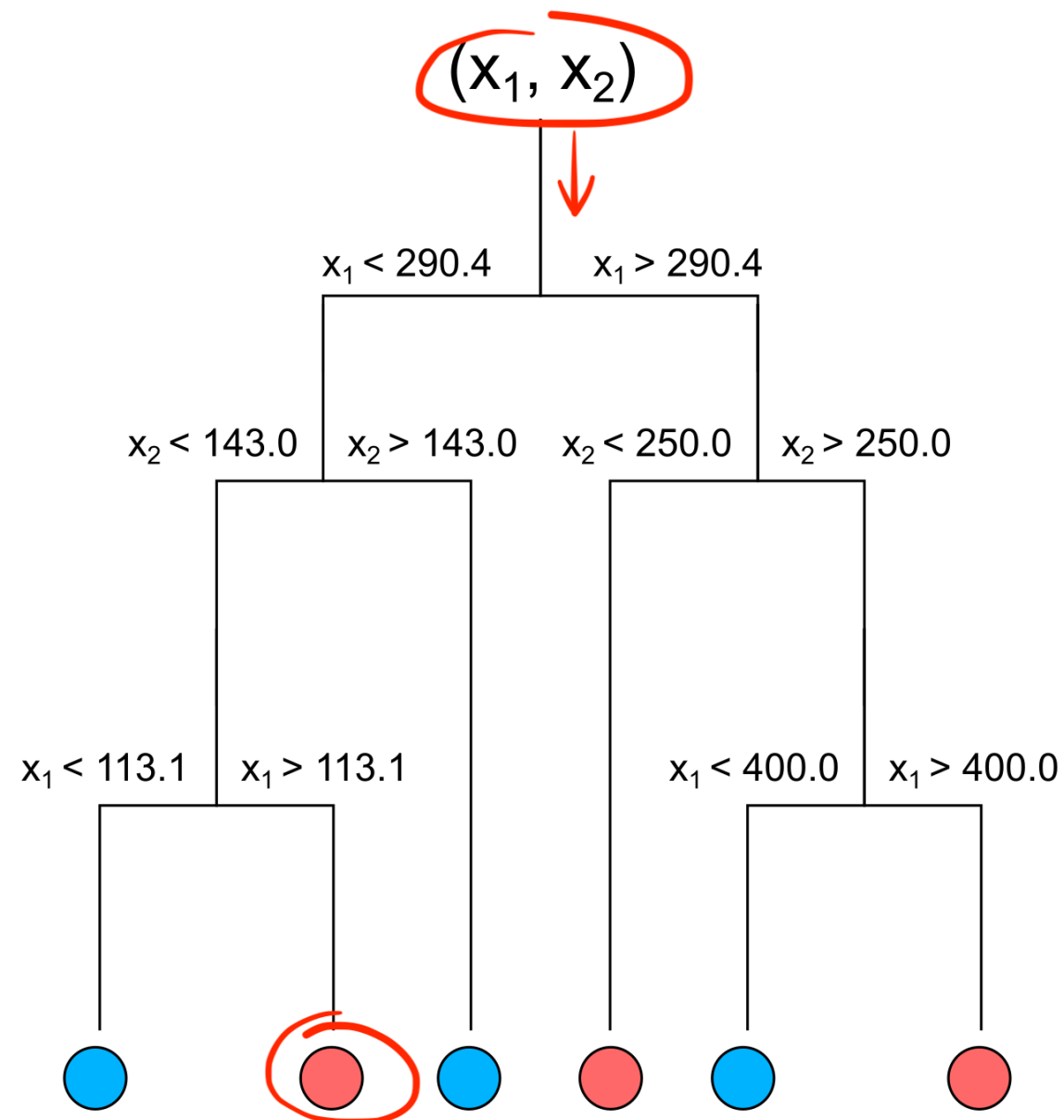
```
if node.goToLeftChild(x):
```

```
    return pred(node.leftChild, x)
```

```
if node.goToRightChild(x):
```

```
    return pred(node.rightChild, x)
```

Traversing a Decision Tree



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)
    # Returning the category
    return node.category
```

Let's practice!

PRACTICING CODING INTERVIEW QUESTIONS IN PYTHON