Multi-dimensional View of Python

Python面面观

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用Python玩转数据

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条件

if 语句

语 法

if expression :

    expr_true_suite

expression

条件表达式:

- 比较运算符
- 成员运算符
- 逻辑运算符

expr_true_suite

- expression 条 件 为 True时执行的代码块
- 代码块必须缩进（通常为4个空格）

File

```
# Filename: ifpro.py
sd1 = 3
sd2 = 3
if sd1 == sd2:
    print("the square's area is", sd1*sd2)
```

else 语句

语 法

```
if  expression :
    expr_true_suite
else:
    expr_false_suite
```

expr_false_suite

- expression 条 件 为 False时执行的代码块
- 代码块必须缩进
- else语句不缩进

File

```
# Filename: elsepro.py
sd1 = int(input('the first side: '))
sd2 = int(input('the second side: '))
if sd1 == sd2:
    print("the square's area is", sd1*sd2)
else:
    print("the rectangle's area is", sd1*sd2)
```

Input and Output

```
the first side: 4
the second side: 4
the square's area is 16
```

elif 语句

语 法

```
if  expression :
     expr_true_suite
elif expression2:
     expr2_true_suite
              :
              :
elif expressionN :
    exprN_true_suite
else:
   none_of_the_above_suite
```

expr2_true_suite

- expression2为True时执行的代码块

exprN_true_suite

- expressionN 为 True时执行的代码块

else

- none_of_the_above_suite是以上所有条件都不满足时执行的代码块

elif 语句

File

```
# Filename: elifpro.py
k = input('input the index of shape: ')
if k == '1':
    print('circle')
elif k == '2':
    print('oval')
elif k == '3':
    print('rectangle')
elif k == '4':
    print('triangle')
else:
    print('you input the invalid number')
```

Input and Output

```
input the index of shape: 3
rectangle
```

Input and Output

```
input the index of shape: 8
you input the invalid number
```

条件嵌套

- 同等缩进为同一条件结构

Input and Output

```
input the index of shape: 3
the first side: 3
the second side: 4
the rectangle's area is 12
```

Input and Output

```
input the index of shape: 2
oval
```

File

```
# Filename: ifnestpro.py
k = input('input the index of shape: ')
if k == '1':
    print('circle')
elif k == '2':
    print('oval')
elif k == '3':
    sd1 = int(input('the first side: '))
    sd2 = int(input('the second side : '))
    if sd1 == sd2:
        print("the square's area is", sd1*sd2)
    else:
        print("the rectangle's area is", sd1*sd2)
elif k == '4':
    print('triangle')
else:
    print('you input the invalid number')
```

猜数字游戏

- 程序随机产生一个0~300间的整数，玩家竞猜，系统给出“猜中”、“太大了”或“太小了”的提示。

File

```
# Filename: guessnum1.py
from random import randint

x = randint(0, 300)
digit = int(input('Please input a number between 0~300: '))
if digit  == x :
   print('Bingo!')
elif digit > x:
   print('Too large, please try again.')
else:
   print('Too small, please try again.')
```

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RANGE函数

range()

语 法

range (start, end, step=1)

range (start, end)

range (end)

- 产生一系列整数，返回一个range对象

Source

```
>>> list(range(3,11,2))
[3, 5, 7, 9]
>>> list(range(3,11))
[3, 4, 5, 6, 7, 8, 9, 10]
>>> list(range(11))
[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
```

start

- 起始值（包含）

end

- 终值（不包含）

step

- 步长（不能为0）

range (start, end, step=1)

- 不包含end的值

range (start, end)

- 缺省step值为1

range (end)

- 缺省了start值为0，step为1

range()

异同	range()	xrange()
语法	基本一致	
返回	列表	生成器（类似）
生成	真实列表	用多少生成多少

Python 2.x

异同	range()
语法	与Python 2.x中类似
返回	生成器（类似）
生成	用多少生成多少

Python 3.x

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3

循环

while 循环

语法

```
while  expression:
    suite_to_repeat
```

expression

- 条件表达式
- 当expression值为True时执行suite_to_repeat代码块

Source

```
>>> sumA = 0
>>> j = 1
>>> while j < 10:
        sumA += j
        j += 1
>>> sumA
45
>>> j
10
```

for 循环（一）

语 法

```
for iter_var in iterable_object:
    suite_to_repeat
```

可以明确循环的次数

- 遍历一个数据集内的成员
- 在列表解析中使用
- 生成器表达式中使用

iterable_object

- String
- List
- Tuple
- Dictionary
- File

for 循环（二）

- 字符串就是一个*iterable_object*
- range()返回的也是*iterable_object*

Source

```
>>> s = 'python'
>>> for c in s:
        print(c)
p
y
t
h
o
n
>>> for i in range(3,11,2):
        print(i, end = ' ')
3 5 7 9
```

猜数字游戏

- 程序随机产生一个0~300间的整数，玩家竞猜，允许猜多次，系统给出“猜中”、“太大了”或太 小了”的提示。

File

```
# Filename: guessnum2.py
from random import randint

x = randint(0, 300)
for count in range(5):
    digit = int(input('Please input a number between 0~300: '))
    if digit  == x :
        print('Bingo!')
    elif digit > x:
        print('Too large, please try again.')
    else:
        print('Too small, please try again.')
```

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循环中的

BREAK,CONTINUE和ELSE

break 语句

- break语句终止当前循环，转而执行循环之后的语句

File

```
# Filename: breakpro.py
sumA = 0
i = 1
while True:
    sumA += i
    i += 1
    if sumA > 10:
        break
print('i={},sum={}'.format(i, sumA))
```

Output:
i=6, sum=15

while 循环和break

- 输出2-100之间的素数

Output:
2 3 5 7 11 13 17 19
23 29 31 37 41 43
47 53 59 61 67 71
73 79 83 89 97

File

```
# Filename: prime.py
from math import sqrt
j = 2
while j <=100:
    i = 2
    k= sqrt(j)
    while i <= k:
        if j%i == 0: break
        i = i+1
    if i > k:
        print(j, end = ' '))
    j += 1
```

for 循环和break

- 输出2-100之间的素数

Output:
2 3 5 7 11 13 17 19
23 29 31 37 41 43
47 53 59 61 67 71
73 79 83 89 97

File

```
# Filename: prime.py
from math import sqrt
for i in range(2,101):
    k = int(sqrt(i))
    for j in range(2,k+1):
        if i%j == 0:
            flag = 0
            break
    if(  flag  ):
        print(i, end = ' ')
```

flag = 1

continue 语句

- 在while和for循环中，continue语句的作用：
  - 停止当前循环，重新进入循环
  - while循环则判断循环条件是否满足
  - for循环则判断迭代是否已经结束

continue语句

- 循环中的break：

File

```
# Filename: breakpro.py
sumA = 0
i = 1
while i <= 5:
    sumA += i
    if i  ==  3:
        break
    print('i={},sum={}'.format(i,sumA))
    i += 1
```

- 循环中的continue：

File

```
# Filename: continuepro.py
sumA = 0
i = 1
while i <= 5:
    sumA += i
    i += 1
    if i == 3:
        continue
    print('i={},sum={}'.format(i,sumA))
```

猜数字游戏（想停就停，非固定次数）

- 程序随机产生一个0~300间的整数，玩家竞猜，允许玩家自己控制游戏次数，如果猜中系统给出提示并退出程序，如果猜错给出“太大了”或“太小了”的提示，如果不想继续玩可以退出并说再见。

File

```
# Filename: guessnum3.py
from random import randint
x = randint(0, 300)
go = 'y'
while (go == 'y'):
    digit = int(input('Please input a number between 0~300: '))
    if digit  == x :
        print('Bingo!')
        break
    elif digit > x:
        print('Too large, please try again.')
    else:
        print('Too small, please try again.')
    print('Input y if you want to continue.')
    go = input()
else:
    print('Goodbye!')
```

循环中的else语句

- 循环中的else：
  - 如果循环代码从break处终止，跳出循环
  - 正常结束循环，则执行else中代码

File

```
# Filename: prime.py
from math import sqrt
num = int(input('Please enter a number: '))
j = 2
while j <= int(sqrt(num)):
    if num % j == 0:
        print('{:d} is not a prime.'.format(num))
        break
    j += 1
else:
    print('{:d} is a prime.'.format(num))
```

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自定义函数

函数

内置函数

函数调用之前必须先定义

自定义函数

自定义函数的创建

语 法

```
def  function_name([arguments]):
"optional documentation string"
function_suite
```

Source

```
>>> def addMe2Me(x):
        'apply operation +  to argument'
        return (x+x)
```

自定义函数的调用

- 函数名加上函数运算符， 一对小括号
  - 括号之间是所有可选的参数
  - 即使没有参数， 小括号也不能省略

Source

```
>>> addMe2Me()

Traceback (most recent call last):
  File "<pyshell#6>", line 1, in <module>
    addMe2Me()
TypeError: addMe2Me() takes exactly 1 argument (0 given)
```

Source

```
>>> addMe2Me(3.7)
7.4
>>> addMe2Me(5)
10
>>> addMe2Me('Python')
'PythonPython'
```

自定义函数

- 输出1-100之间的素数

Output:
2 3 5 7 11 13 17 19
23 29 31 37 41 43
47 53 59 61 67 71
73 79 83 89 97

File

```
# Filename: prime.py
from math import sqrt
def isprime(x):
    if x == 1:
        return False
    k = int(sqrt(x))
    for j in range(2,k+1):
        if x%j == 0:
            return False
    return True
for i in range(2,101):
    if isprime(i):
        print( i,  end = ' ')
```

默认参数（一）

- 函数的参数可以有一个默认值， 如果提供有默认值，在函数定义中，默认参数以赋值语句的形式提供

Source

```
>>> def f(x = True):
        '''whether x is a correct word or not'''
        if x:
            print('x is a correct word')
        print('OK')
>>> f()
x is a correct word
OK
>>> f(False)
OK
```

默认参数（二）

- 默认参数的值可以改变

Source

```
>>> def f(x ,  y = True):
        '''x and y both correct words or not '''
        if y:
            print(x, 'and y both correct')
        print(x, 'is OK')
>>> f (68)
68 and y both correct
68 is OK
>>> f(68, False)
68 is OK
```

默认参数（三）

- 默认参数一般需要放置在参数列表的最后


```
def f(y = True, x):
    '''x and y both correct words or not '''
    if y:
        print(x, 'and y both correct ')
    print(x, 'is OK')
```

SyntaxError: non-default argument follows default argument

关键字参数

- 关键字参数是让调用者通过使用参数名区分参数。允许改变参数列表中的参数顺序

Source

```
>>> def f(x , y):
        '''x and y both correct words or not '''
        if y:
            print(x, 'and y both correct ')
        print(x, 'is OK')
>>> f(68, False)
68 is OK
>>> f(y = False, x = 68)
68 is OK
>>> f(y = False, 68)
SyntaxError: non-keyword arg after keyword arg
>>> f(x = 68, False)
SyntaxError: non-keyword arg after keyword arg
```

传递函数

- 函数可以像参数一样传递给另外一个函数

Source

```
>>> def addMe2Me(x):
        return x+x
>>> def self(f, y):
        print(f(y))
>>> self(addMe2Me, 2.2)
4.4
```

lambda函数

- 匿名函数

Source

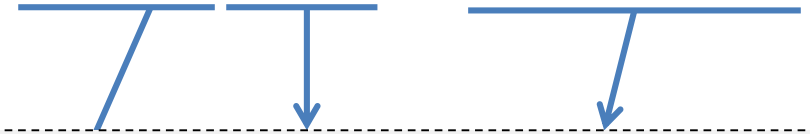
```
>>> def addMe2Me(x):
        'apply operation +  to argument'
        return (x + x)
>>> addMe2Me(5)
10
```

Source

```
>>> r = lambda x : x + x
>>> r(5)
10
```

lambda函数


```
def my_add(x, y) : return x + y
```



```
lambda     x, y  :  x + y
```

```
my_add = lambda x, y :  x + y
```

```
>>> my_add(3, 5)
8
```

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递归

递归

循环 生成斐波那契数列的方法 递归

递归是最能表现计算思维的算法之一

循环和递归

- 递归必须要有边界条件，即停止递归的条件
  - n == 0 or n == 1
- 递归的代码更简洁，更符合自然逻辑，更容易理解

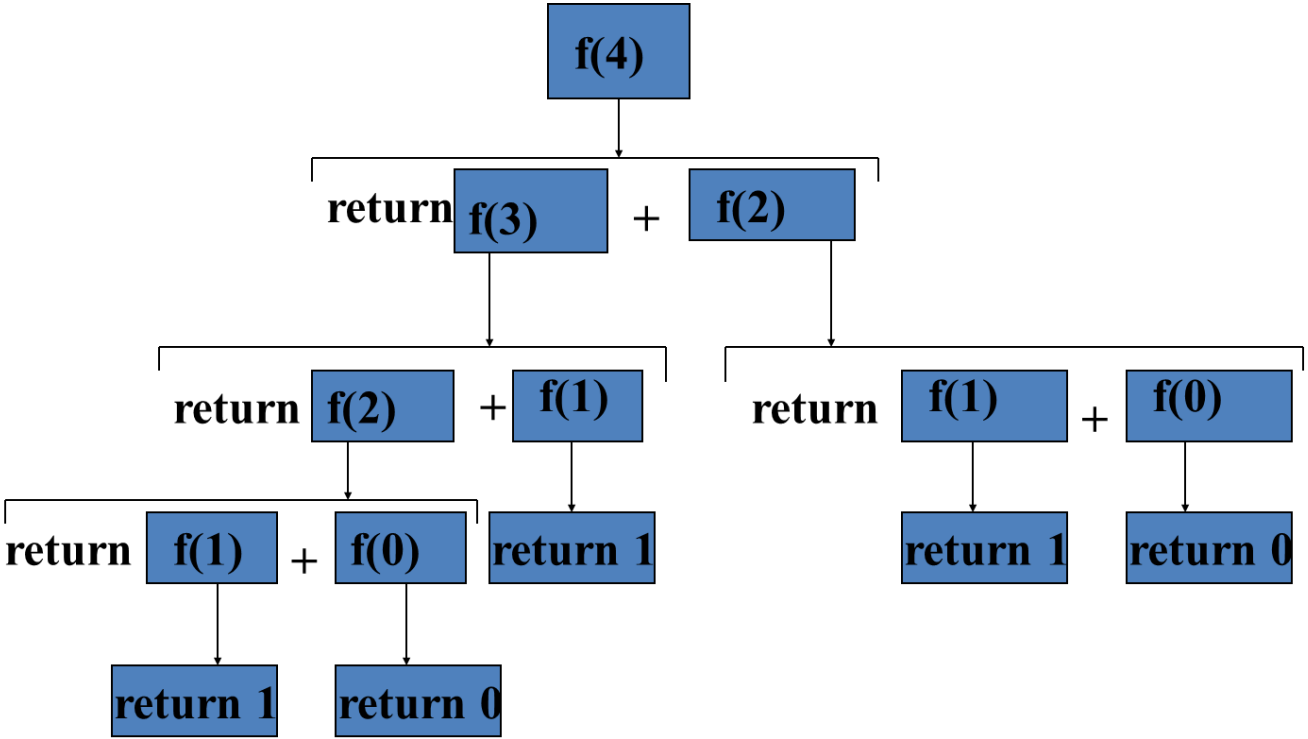
Source

```
# the nth Fibonacci number
def fib(n):
    a, b = 0, 1
    count = 1
    while count  < n:
        a, b = b, a+b
        count = count + 1
    print(a)
```

Source

```
# the nth Fibonacci number
def fib(n):
    if n == 0 or n == 1:
        return n
    else:
        return fib(n – 1)  +  fib(n – 2)
```

递归


f(4)
return
f(3)
+
f(2)
return
f(2)
+
f(1)
return
f(1)
+
f(0)
return
f(1)
+
f(0)
return 1
return 1
return 0
return 1
return 0

递归

- 递归的执行

汉诺塔

- 汉诺塔游戏

三个塔座A、B、C上各有一根针，通过C把64个盘子从A针移动到B针上，移动时必须遵循下列规则：

（1）圆盘可以插入在A、B或C塔座的针上

（2）每次只能移动一个圆盘

（3）任何时刻都不能将一个较大的圆盘压在较小的圆盘之上

File

```
# Filename: Hanoi.py
def hanoi(a,b,c,n):
    if n==1:
        print(a,'->',c)
    else:
        hanoi(a,c,b,n-1)
        print(a,'->', c)
        hanoi(b,a,c,n-1)

hanoi('a','b','c',4)
```

Output:

```
a -> b
a -> c
b -> c
a -> b
c -> a
c -> b
a -> b
a -> c
b -> c
b -> a
c -> a
b -> c
a -> b
a -> c
b -> c
```

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变量作用域

变量作用域

- 全局变量
- 局部变量

File

```
# Filename: global.py
global_str = 'hello'
def foo():
    local_str = 'world'
    return global_str + local_str
```

Source

```
>>> foo()
'helloworld'
```

同名变量

- 全局变量和局部变量用同一个名字


```
# Filename: samename.py
a = 3
def f( ):
    a = 5
    print(a ** 2)
```

改变全局变量的值

- 方法是否可行?


```
# Filename: scopeofvar.py
def f(x):
    print(a)
    a = 5
    print(a + x)

a = 3
f(8)
```

UnboundLocalError: local variable 'a' referenced before assignment

global语句

- global语句强调全局变量


```
# Filename: scopeofvar.py
def f(x):
    global a
    print(a)
    a = 5
    print(a + x)

a = 3
f(8)
print(a)
```

Output:
3
13
5