

# Iteration

## Python Reference

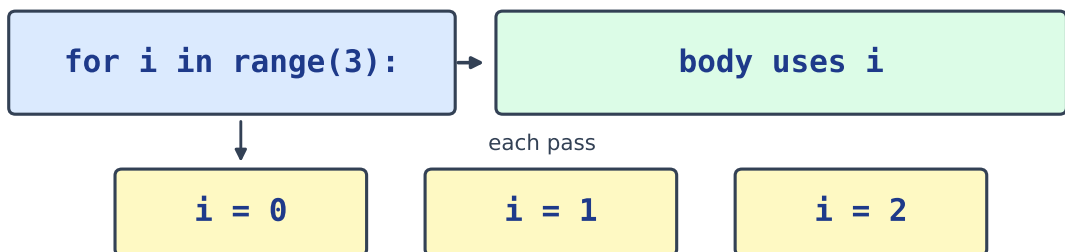
### for loops and range

A loop 循环 repeats code. A `for` loop repeats once for each item in a sequence 序列. `range(n)` gives the numbers 0 up to  $n - 1$ .

```
for i in range(5):
    print(i)
# 0, then 1, 2, 3, 4 (each on its own line)
```

- `range(a, b)` goes from `a` up to (but not including) `b`.
- `range(a, b, step)` adds a step 步长 each time.

```
for n in range(2, 11, 2):
    print(n)          # 2 4 6 8 10
```



Exam tip: `range(n)` is 0 ...  $n-1$ ; the loop variable takes one value per pass

*for  $i$  in  $range(n)$ : body runs with  $i = 0 \dots n-1$*

### The accumulator pattern

To build a result across a loop, start a variable **before** the loop, then update 更新 it each turn. This is the accumulator 累加器 pattern.

```
total = 0
for n in range(1, 6):
    total = total + n
```

```
print(total)          # 15
```

- The same idea counts how many items match a test.

```
count = 0
for letter in "banana":
    if letter == "a":
        count = count + 1
print(count)          # 3
```

## while loops

A **while** loop repeats **as long as** a condition stays true. Change something inside, or it never stops — an infinite loop 无限循环.

```
n = 1
while n <= 3:
    print(n)
    n = n + 1
# 1 2 3
```

- **break** leaves the loop straight away.

```
total = 0
while True:
    total = total + 10
    if total >= 30:
        break
print(total)          # 30
```

## Nested loops

A loop inside another loop is a nested loop 嵌套循环. The inner loop 内层循环 runs fully for **each** turn of the outer loop 外层循环.

```
for row in range(3):
    line = ""
    for col in range(3):
        line = line + "*"
    print(line)
# ***
# ***
```

```
# ***
```

## Common mistakes

- `range(n)` goes from 0 to `n - 1`, not 1 to `n` — the classic off-by-one error.
- Changing a list while looping over it skips items; loop over a copy if you must remove things.
- Forgetting to change the loop variable in a `while` makes it run forever.
- Indentation decides what is inside the loop; a wrongly-indented line runs only once, after the loop.