

Generators and Generator Functions

```
>>> def plus_minus(x):
...    yield x
...    yield -x
>>> t = plus_minus(3)
>>> next(t)
3
>>> next(t)
-3
>>> t
<generator object plus_minus ...>
```

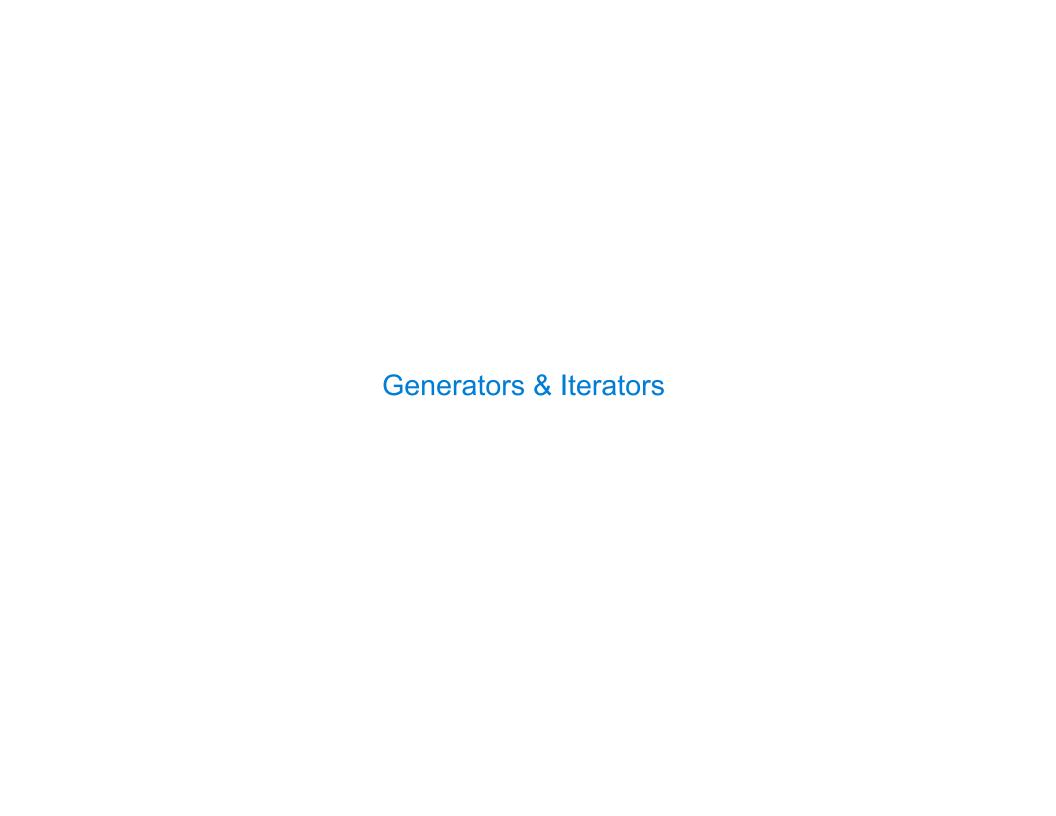
A generator function is a function that yields values instead of returning them

A normal function returns once; a generator function can yield multiple times

A generator is an iterator created automatically by calling a generator function

When a generator function is called, it returns a generator that iterates over its yields

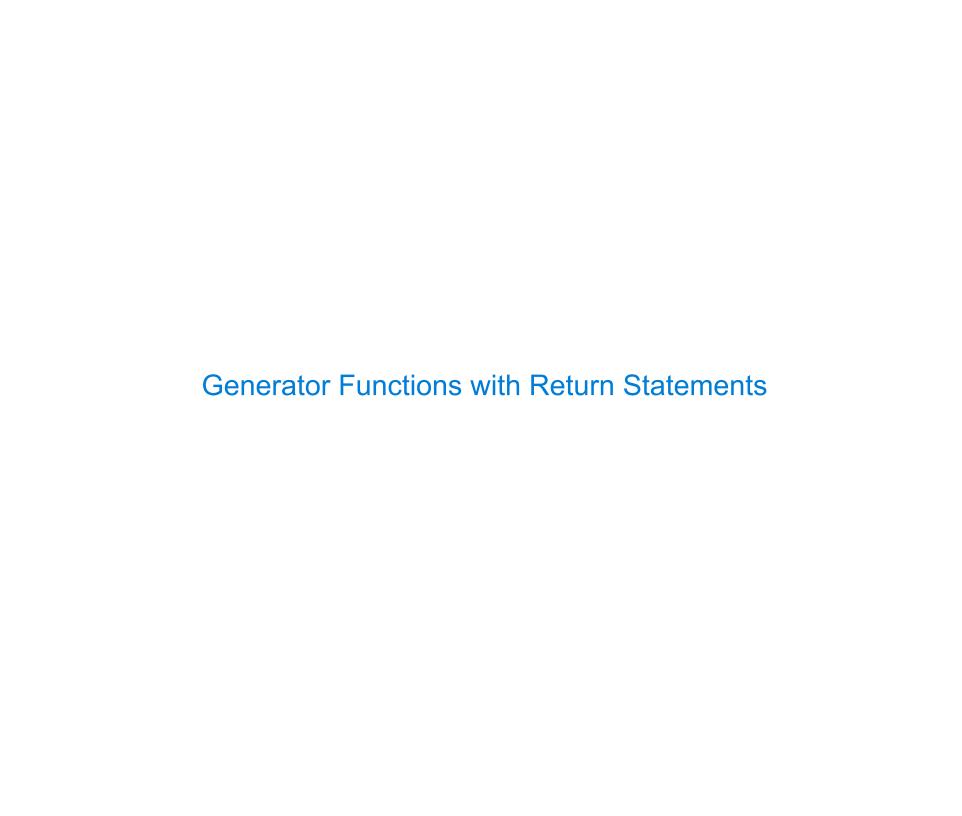
(Demo)



Generator Functions can Yield from Iterators

```
A yield from statement yields all values from an iterator or iterable (Python 3.3)
                                     >>> list(a_then_b([3, 4], [5, 6]))
                                     [3, 4, 5, 6]
                                def a_then_b(a, b):
                                                              def a_then_b(a, b):
                                  for x in a:
                                                                yield from a
                                     yield x
                                                                yield from b
                                  for x in b:
                                     yield x
                                           >>> list(countdown(5))
                                            [5, 4, 3, 2, 1]
                                      def countdown(k):
                                        if k > 0:
                                           yield k
                                          yield from countdown(k-1)
```

(Demo)



A Return Statement Within a Generator Function

Upon executing a return statement, a generator function exits and cannot yield more values.

```
def f(x):
    yield x
    yield x + 1
    return
    yield x + 3
>>> list(f(2))
```

Providing a value to be returned is allowed, but this value is not yielded.

```
def g(x):
    yield x
    yield x + 1
    return x + 2
    yield x + 3
>>> list(g(2))
[2, 3]
```

It is possible to access the returned value (but you don't need to know how).

```
def h(x):
    y = yield from g(x)
    yield y
>>> list(h(2))
[2, 3, 4]
```

Example: Partitions

Yielding Partitions

A partition of a positive integer n, using parts up to size m, is a way in which n can be expressed as the sum of positive integer parts up to m in increasing order.

partitions(6, 4)

```
2 + 4 = 6
                                 def count_partitions(n, m):
                                     if n == 0:
1 + 1 + 4 = 6
                                         return 1
3 + 3 = 6
                                     elif n < 0:
                                         return 0
1 + 2 + 3 = 6
                                     elif m == 0:
1 + 1 + 1 + 3 = 6
                                         return 0
                                     else:
2 + 2 + 2 = 6
                                          with m = count partitions(n-m, m)
1 + 1 + 2 + 2 = 6
                                          without m = count partitions(n, m-1)
1 + 1 + 1 + 1 + 2 = 6
                                          return with m + without m
1 + 1 + 1 + 1 + 1 + 1 = 6
                                (Demo)
```