

# Real-world examples

WRITING FUNCTIONS IN PYTHON



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# Time a function

```
import time

def timer(func):
    """A decorator that prints how long a function took to run.

    Args:
        func (callable): The function being decorated.

    Returns:
        callable: The decorated function.
    """
```

```
import time

def timer(func):
    """A decorator that prints how long a function took to run."""
    # Define the wrapper function to return.
    def wrapper(*args, **kwargs):
        # When wrapper() is called, get the current time.
        t_start = time.time()
        # Call the decorated function and store the result.
        result = func(*args, **kwargs)
        # Get the total time it took to run, and print it.
        t_total = time.time() - t_start
        print('{} took {}s'.format(func.__name__, t_total))
        return result
    return wrapper
```

# Using timer()

```
@timer  
def sleep_n_seconds(n):  
    time.sleep(n)
```

```
sleep_n_seconds(5)
```

```
sleep_n_seconds took 5.0050950050354s
```

```
sleep_n_seconds(10)
```

```
sleep_n_seconds took 10.010067701339722s
```

```
def memoize(func):  
    """Store the results of the decorated function for fast lookup  
    """  
  
    # Store results in a dict that maps arguments to results  
    cache = {}  
  
    # Define the wrapper function to return.  
    def wrapper(*args, **kwargs):  
        # If these arguments haven't been seen before,  
        if (args, kwargs) not in cache:  
            # Call func() and store the result.  
            cache[(args, kwargs)] = func(*args, **kwargs)  
        return cache[(args, kwargs)]  
    return wrapper
```

```
@memoize
def slow_function(a, b):
    print('Sleeping...')
    time.sleep(5)
    return a + b
```

```
slow_function(3, 4)
```

```
Sleeping...
```

```
7
```

```
slow_function(3, 4)
```

```
7
```

# When to use decorators

- Add common behavior to multiple functions

```
@timer
def foo():
    # do some computation

@timer
def bar():
    # do some other computation

@timer
def baz():
    # do something else
```

**Let's practice!**  
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# Decorators and metadata

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```
def sleep_n_seconds(n=10):  
    """Pause processing for n seconds.  
  
    Args:  
        n (int): The number of seconds to pause for.  
    """  
    time.sleep(n)  
print(sleep_n_seconds.__doc__)
```

Pause processing for n seconds.

Args:

n (int): The number of seconds to pause for.

```
def sleep_n_seconds(n=10):  
    """Pause processing for n seconds.  
  
    Args:  
        n (int): The number of seconds to pause for.  
    """  
    time.sleep(n)  
print(sleep_n_seconds.__name__)
```

```
sleep_n_seconds
```

```
print(sleep_n_seconds.__defaults__)
```

```
(10,)
```

```
@timer
def sleep_n_seconds(n=10):
    """Pause processing for n seconds.

    Args:
        n (int): The number of seconds to pause for.
    """
    time.sleep(n)
print(sleep_n_seconds.__doc__)
```

```
print(sleep_n_seconds.__name__)
```

```
wrapper
```

# The timer decorator

```
def timer(func):  
    """A decorator that prints how long a function took to run."""  
  
    def wrapper(*args, **kwargs):  
        t_start = time.time()  
  
        result = func(*args, **kwargs)  
  
        t_total = time.time() - t_start  
        print('{} took {}s'.format(func.__name__, t_total))  
  
        return result  
  
    return wrapper
```

```
from functools import wraps
def timer(func):
    """A decorator that prints how long a function took to run."""

    @wraps(func)
    def wrapper(*args, **kwargs):
        t_start = time.time()

        result = func(*args, **kwargs)

        t_total = time.time() - t_start
        print('{} took {}s'.format(func.__name__, t_total))

    return result
return wrapper
```

```
@timer
def sleep_n_seconds(n=10):
    """Pause processing for n seconds.

    Args:
        n (int): The number of seconds to pause for.
    """
    time.sleep(n)
print(sleep_n_seconds.__doc__)
```

Pause processing for n seconds.

Args:

n (int): The number of seconds to pause for.

```
@timer
def sleep_n_seconds(n=10):
    """Pause processing for n seconds.

    Args:
        n (int): The number of seconds to pause for.
    """
    time.sleep(n)
print(sleep_n_seconds.__name__)
```

```
sleep_n_seconds
```

```
print(sleep_n_seconds.__defaults__)
```

```
(10,)
```



# Access to the original function

```
@timer
def sleep_n_seconds(n=10):
    """Pause processing for n seconds.

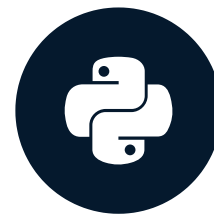
    Args:
        n (int): The number of seconds to pause for.
    """
    time.sleep(n)
    sleep_n_seconds.__wrapped__
```

```
<function sleep_n_seconds at 0x7f52cab44ae8>
```

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# Decorators that take arguments

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```
def run_three_times(func):  
    def wrapper(*args, **kwargs):  
        for i in range(3):  
            func(*args, **kwargs)  
    return wrapper  
@run_three_times  
def print_sum(a, b):  
    print(a + b)  
print_sum(3, 5)
```

8

8

8

# run\_n\_times()

```
def run_n_times(func):  
    def wrapper(*args, **kwargs):  
        # How do we pass "n" into this function?  
        for i in range(???):  
            func(*args, **kwargs)  
    return wrapper  
  
@run_n_times(3)  
def print_sum(a, b):  
    print(a + b)  
  
@run_n_times(5)  
def print_hello():  
    print('Hello!')
```

# A decorator factory

```
def run_n_times(n):  
    """Define and return a decorator"""  
    def decorator(func):  
        def wrapper(*args, **kwargs):  
            for i in range(n):  
                func(*args, **kwargs)  
        return wrapper  
    return decorator  
  
@run_n_times(3)  
def print_sum(a, b):  
    print(a + b)
```

```
def run_n_times(n):  
    """Define and return a decorator"""  
    def decorator(func):  
        def wrapper(*args, **kwargs):  
            for i in range(n):  
                func(*args, **kwargs)  
        return wrapper  
    return decorator  
  
run_three_times = run_n_times(3)  
  
@run_three_times  
def print_sum(a, b):  
    print(a + b)  
  
@run_n_times(3)  
def print_sum(a, b):  
    print(a + b)
```

# Using run\_n\_times()

```
@run_n_times(3)
def print_sum(a, b):
    print(a + b)
print_sum(3, 5)
```

```
8
8
8
```

```
@run_n_times(5)
def print_hello():
    print('Hello!')
print_hello()
```

```
Hello!
Hello!
Hello!
Hello!
Hello!
```



# Let's practice!

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# Timeout(): a real world example

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# Timeout

```
def function1():  
    # This function sometimes  
    # runs for a loooong time  
    ...  
  
def function2():  
    # This function sometimes  
    # hangs and doesn't return  
    ...
```

# Timeout

```
@timeout
def function1():
    # This function sometimes
    # runs for a loooong time
    ...

@timeout
def function2():
    # This function sometimes
    # hangs and doesn't return
    ...
```



# Timeout - background info

```
import signal
def raise_timeout(*args, **kwargs):
    raise TimeoutError()
# When an "alarm" signal goes off, call raise_timeout()
signal.signal(signalnum=signal.SIGALRM, handler=raise_timeout)
# Set off an alarm in 5 seconds
signal.alarm(5)
# Cancel the alarm
signal.alarm(0)
```

```
def timeout_in_5s(func):  
    @wraps(func)  
    def wrapper(*args, **kwargs):  
        # Set an alarm for 5 seconds  
        signal.alarm(5)  
        try:  
            # Call the decorated func  
            return func(*args, **kwargs)  
        finally:  
            # Cancel alarm  
            signal.alarm(0)  
    return wrapper
```

```
@timeout_in_5s  
def foo():  
    time.sleep(10)  
    print('foo!')
```

```
foo()
```

TimeoutError

```
def timeout(n_seconds):
    def decorator(func):
        @wraps(func)
        def wrapper(*args, **kwargs):
            # Set an alarm for n seconds
            signal.alarm(n_seconds)
            try:
                # Call the decorated func
                return func(*args, **kwargs)
            finally:
                # Cancel alarm
                signal.alarm(0)
        return wrapper
    return decorator
```

```
@timeout(5)
def foo():
    time.sleep(10)
    print('foo!')
@timeout(20)
def bar():
    time.sleep(10)
    print('bar!')
foo()
```

TimeoutError

bar()

bar!

# Let's practice!

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# Great job!

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# Chapter 1 - Best Practices

- Docstrings
- DRY and Do One Thing
- Pass by assignment (mutable vs immutable)

# Chapter 2 - Context Managers

```
with my_context_manager() as value:  
    # do something
```

```
@contextlib.contextmanager  
def my_function():  
    # this function can be used in a "with" statement now
```

# Chapter 3 - Decorators

```
@my_decorator  
def my_decorated_function():  
    # do something
```

```
def my_decorator(func):  
    def wrapper(*args, **kwargs):  
        return func(*args, **kwargs)  
    return wrapper
```

# Chapter 4 - More on Decorators

```
def my_decorator(func):  
    @functools.wraps(func)  
    def wrapper(*args, **kwargs):  
        return func(*args, **kwargs)  
    return wrapper
```

# Chapter 4 - More on Decorators

```
def decorator_that_takes_args(a, b, c):  
    def decorator(func):  
        @functools.wraps(func)  
        def wrapper(*args, **kwargs):  
            return func(*args, **kwargs)  
        return wrapper  
    return decorator
```

# Thank you!

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