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Context Managers:
You Can Write Your Own!

Daniel Porteous

Production Engineer

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Me!

Me!!! Daniel Porteous!

Tweeter:

@banool1000

Github:

github.com/banool

Website:

dport.me

Agenda

TODO

- What is a context manager?
- Why use context managers?
- Core Python examples.
- Making our own context managers the hard way.
- The easy way!
- Best practices, gotchas, and more.

What are context managers?

You've seen them, you just don't know it!

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```
1 with
```

What are context managers?

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```
1 with                              as
```

What are context managers?

You've seen them, you just don't know it!

```
1 with open("myfile.txt") as f:
2     content = f.read()
3     print(content)
```

Why use context managers?

They're pretty and safe is why!

- You can't forget to close resources.
- They can make code much prettier.
- They can make complex logic simpler.
- More!

Why use context managers?

They're pretty and safe is why!

>>> import this

The Zen of Python, by Tim Peters

Beautiful is better than ugly.

Simple is better than complex.

Readability counts.

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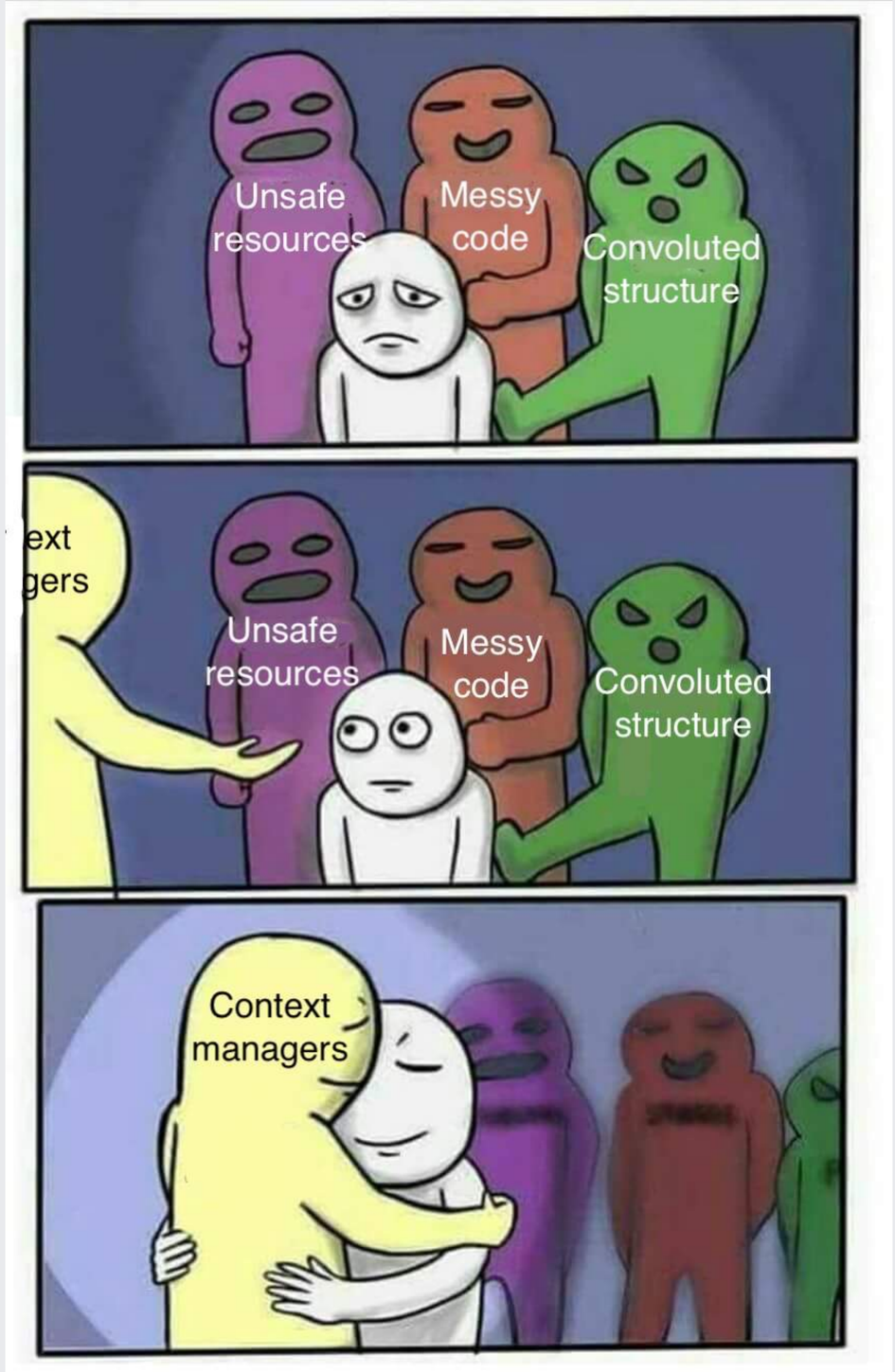

Context managers in core Python

contextlib.suppress

```
1 def kill_process(pid):
2     try:
3         os.kill(pid, signal.SIGKILL)
4     except ProcessLookupError:
5         pass
```

Context managers in core Python

contextlib.suppress

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1 from contextlib import suppress
```

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3 def kill_process(pid):
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3 def kill_process(pid):
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```

Context managers in core Python

ThreadPoolExecutor - Bad version!

```
1 # Bad!!!
2 pool = ThreadPoolExecutor()
3 for k, v in data.items():
4     pool.submit(myfunc, k, v)
5 # Wait on the results and do something with them.
6 pool.shutdown()
```

Context managers in core Python

ThreadPoolExecutor - Good version!

```
1 # Bad!!!
2 pool = ThreadPoolExecutor()
3 for k, v in data.items():
4     pool.submit(myfunc, k, v)
5 # Wait on the results and do something with them.
6 pool.shutdown()
```

```
1 # Good, safe, context managed!
2 with ThreadPoolExecutor() as pool:
3     for k, v in data.items():
4         pool.submit(myfunc, k, v)
```

Write your own context managers!

First, the hard way

But not necessarily the wrong way

write a context manager for something we've seen before. hmm open is a builtin and threadpoolexecutor is too complex. suppress would necessitate explanation of exception handling

Our very own context manager!

Simple!

```
 1 class MyContextManager:
 2     def __enter__(self):
 3         print("Enter!")
 4
 5     def __exit__(self, *exc):
 6         print("Exit!")
 7
 8
 9 with MyContextManager():
10     print("Inside the block!")
```

Our very own context manager!

Super simple!

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 1 class MyContextManager:
 2     def __enter__(self):
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 5     def __exit__(self, *exc):
 6         print("Exit!")
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 8
 9 with MyContextManager():
10     print("Inside the block!")
```

```
Enter!
Inside the block!
Exit!
```

As neat as it gets!

```
 1 class FoodContextManager:
 2     def __init__(self):
 3         self.data = {}
 4
 5     def __enter__(self):
 6         print(f"Enter: {self.data}")
 7         return self.data
 8
 9     def __exit__(self, *exc):
10         print(f"Exit: {self.data}")
11
12 with FoodContextManager() as data:
13     data["fruit"] = "delicious"
```

As neat as it gets!

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 1 class FoodContextManager:
 2     def __init__(self):
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```

A fully fledged context manager!

```
 1 class FoodContextManager:
 2     def __init__(self, data):
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 7         return self.data
 8
 9     def __exit__(self, *exc):
10         print(f"Exit: {self.data}")
11
12 with FoodContextManager({"dairy":"yuck"}) as data:
13     data["fruit"] = "delicious"
```

A fully fledged context manager!

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 1 class FoodContextManager:
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12 with FoodContextManager({"dairy": "yuck"}) as data:
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```

"Boy, that sure was a lot of work"

— Me when I first wrote a context manager this way

There is an easier way!

`contextlib.contextmanager`

`@contextlib.contextmanager`

> This function is a decorator that can be used to define a factory function for with statement context managers, without needing to create a class or separate `__enter__()` and `__exit__()` methods.

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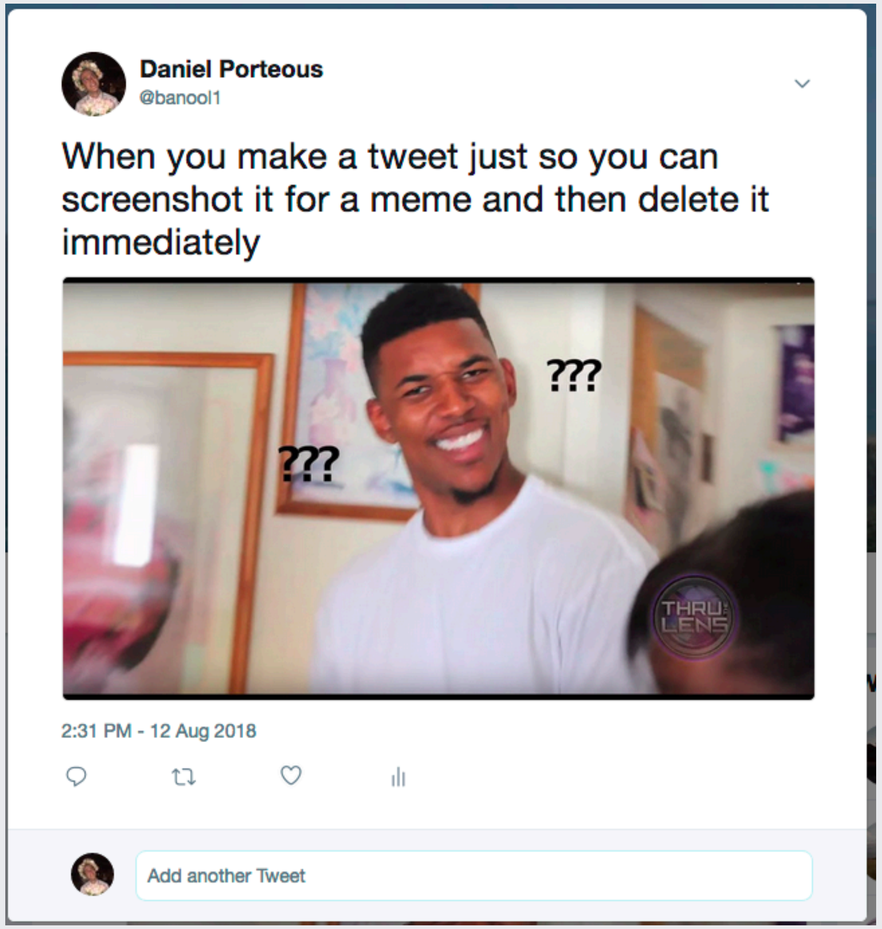

Generators

Generating nothing but good times 🎉

```
1 def first_n(n):
2     for i in range(n):
3         yield i
```

Generators

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```
1 def first_n(n):
2     for i in range(n):
3         yield i
4
5 gen = first_n(5)
6 print(next(gen))
7 print(next(gen))
```

Generators

Generating nothing but good times 🎉

```
1 def first_n(n):
2     for i in range(n):
3         yield i
4
5 gen = first_n(5)
6 print(next(gen))  # 0
7 print(next(gen))
```

Generators

Generating nothing but good times 🎉

```
1 def first_n(n):
2     for i in range(n):
3         yield i
4
5 gen = first_n(5)
6 print(next(gen))  # 0
7 print(next(gen))  # 1
```

Generators

Generating nothing but good times 🎉

```
1 def first_n(n):
2     for i in range(n):
3         yield i
4
5 for i in first_n(5):
6     print(i)
```

Generators

Generating nothing but good times 🎉

```
1 def first_n(n):
2     for i in range(n):
3         yield i
```

```
1 def first_n(n):
2     nums = []
3     for i in range(n):
4         nums.append(i)
5     return nums
```

```
print(sum(first_n(10)))
```

Decorators

TODO

- code snippet of decorator
- show how it just wraps a function.
- syntactic sugar

There is an easier way!

contextlib.contextmanager

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class MyContextManager:
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@contextmanager
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    print("Exit!")


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    print("Enter!")
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    print("Inside the block!")
```

```
class FoodContextManager:
    def __init__(self, data):
        self.data = data

    def __enter__(self):
        print(f"Enter: {self.data}")
        return self.data

    def __exit__(self, *exc):
        print(f"Exit: {self.data}")


with FoodContextManager({"dairy": "yuck"}) as data:
    data["fruit"] = "delicious"
```

There is an easier way!

contextlib.contextmanager

```
from contextlib import contextmanager

@contextmanager
def food_context_manager(data):
    print(f"Enter: {data}")
    yield data
    print(f"Exit: {data}")

with food_context_manager({"dairy": "yuck"}) as data:
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from contextlib import contextmanager

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with food_context_manager({"dairy": "yuck"}) as data:
    data["fruit"] = "delicious"
```

Typical usage:

```
@contextmanager
def some_generator(<arguments>):
    <setup>
    try:
        yield <value>
    finally:
        <cleanup>
```

equivalent to this:

```
<setup>
try:
    <variable> = <value>
    <body>
finally:
    <cleanup>
```

This makes this:

```
with some_generator(<arguments>) as <variable>:
    <body>
```

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Phew, that was a lot

Let's take a moment

Phew, that was a lot

Let's take a moment

- Context managers have:
  - `__enter__()`
  - `__exit__()`

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Phew, that was a lot

Let's take a moment

- Context managers have:
  - `__enter__()`
  - `__exit__()`
- Generators and decorators are a thing that exist.
- `@contextmanager` decorator is neat!

All the rest

Some things you should really know

- Scope
- Exceptions in __exit__
- try / finally in generator context managers

Scope with Context Managers

Variables defined inside it still exist!

```
with open("myfile.txt", "r") as f:
    content = f.read()
print(content)
```

Scope with Context Managers

The thing yielded does too, but it'll be closed.

```
with open("myfile.txt", "r") as f:
    pass
content = f.read()
print(content)
```

All the rest

Some things you should really know

- Scope
- **Exceptions in __exit__**
- try / finally in generator context managers

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Exceptions in __exit__

Making context managers even more powerful 💪

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Making context managers even more powerful 💪

```
class MyContextManager:
    def __enter__(self):
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    def __exit__(self, *exc):
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with MyContextManager():
    print("Inside the block!")
```

Exceptions in __exit__

Making context managers even more powerful 💪

```
class MyContextManager:
    def __enter__(self):
        print("Enter!")

    def __exit__(self, *exc):
        print("Exit!")


with MyContextManager():
    print("Inside the block!")
```

```
def __exit__(
    self,
    exc_type,
    exc,
    exc_tb,
):
    print("Exit!")
```

All the rest

Some things you should really know

- Scope
- Exceptions in __exit__
- **try / finally in generator context managers**

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try / finally

TODO

Best practices

TODO

- Do not explicitly re-raise exceptions in __exit__ methods, return False.
- Know the roles of __init__ and __enter__
  - No side effects in __init__
  - Don’t make __init__ too expensive.

Other possible uses!

So many!

- Enclose an event and log based on what happens.
- More!

Key take aways

Context managers are amazing!

- Use context managers

Questions?

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Why use context managers?

ThreadPoolExecutor - Good version!

```
data = {
    "Fruit": "spectacular",
    "Dairy": "yucky",
    "Meat": "not cool",
}

def make_a_sentence(noun, adjective):
    return f"{noun} is {adjective}!"
```

```
# Spinach is delicious!
# Fruit is spectacular!
# Dairy is yucky!
# Meat is not cool!
```

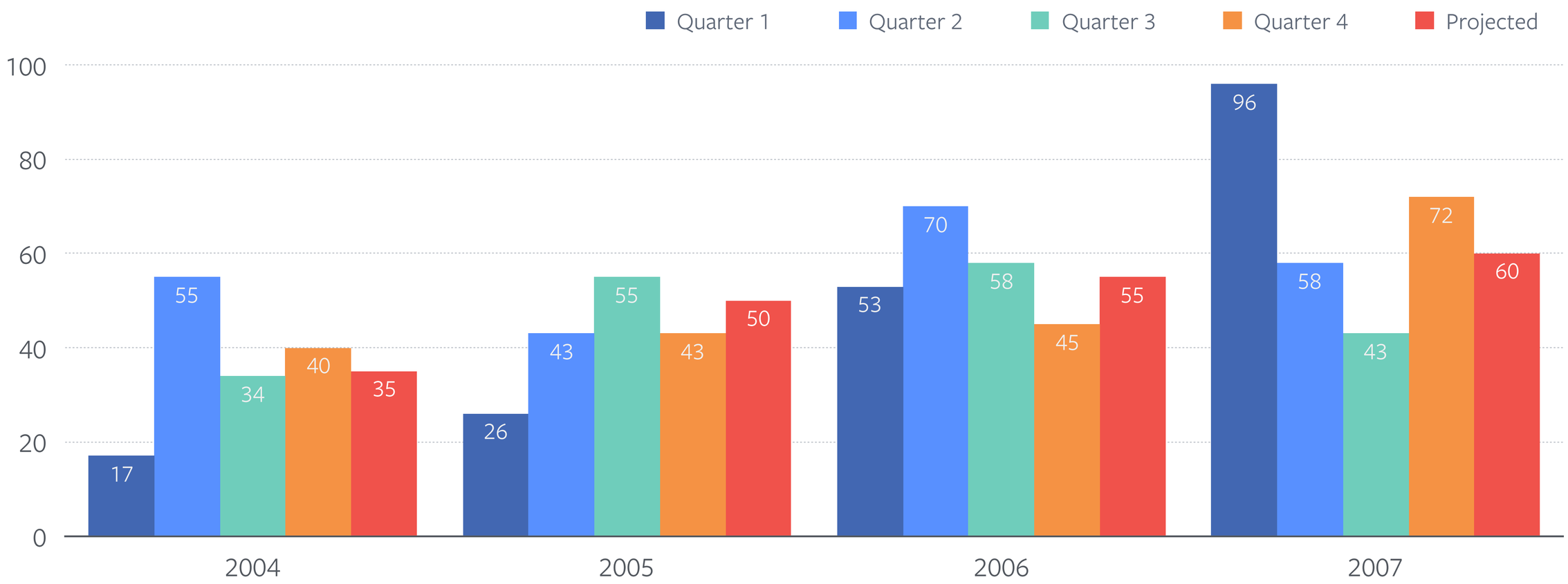
Slide Title

Slide Subtitle

```
with open(myfile, "r") as f:
    f.read()
```

Slide Title

Slide Subtitle



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