Extracted from:

Python Testing with pytest, Second Edition

Simple, Rapid, Effective, and Scalable

The Pragmatic Bookshelf

Raleigh, North Carolina

The Pragmatic Programmers

Python Testing with pytest

Second Edition

Simple, Rapid, Effective, and Scalable

Brian Okken

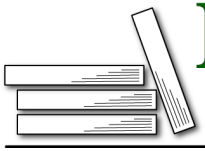
edited by Katharine Dvorak

Python Testing with pytest, Second Edition

Simple, Rapid, Effective, and Scalable

Brian Okken

The Pragmatic Bookshelf
Raleigh, North Carolina



Pragmatic Bookshelf

For our complete catalog of hands-on, practical, and Pragmatic content for software developers, please visit *https://pragprog.com*.

The team that produced this book includes:

CEO: Dave Rankin
COO: Janet Furlow
Managing Editor: Tammy Coron
Development Editor: Katharine Dvorak
Copy Editor: Karen Galle
Indexing: Potomac Indexing, LLC
Layout: Gilson Graphics
Founders: Andy Hunt and Dave Thomas

For sales, volume licensing, and support, please contact *support@pragprog.com*.

For international rights, please contact *rights@pragprog.com*.

ISBN-13: 978-1-68050-860-4
Encoded using the finest acid-free high-entropy binary digits.
Book version: P1.0—February 2022

CHAPTER 10

Mocking

In the last chapter, we tested the Cards project through the API. In this chapter, we're going to test the CLI. When we wrote the test strategy for the Cards project in Writing a Test Strategy, on page ?, we included the following statement:

- Test the CLI enough to verify the API is getting properly called for all features.

We're going to use the mock package to help us with that. Shipped as part of the Python standard library as unittest.mock as of Python 3.3,[1] the mock package is used to swap out pieces of the system to isolate bits of our application code from the rest of the system. *Mock objects* are sometimes called *test doubles*, *spies*, *fakes*, or *stubs*. Between pytest's own monkeypatch fixture (covered in Using monkeypatch, on page ?) and mock, you should have all the test double functionality you need.

In this chapter, we'll take a look at using mock to help us test the Cards CLI. We'll also look at using the CliRunner provided by Typer to assist in testing.

Isolating the Command-Line Interface

The Cards CLI uses the Typer library[2] to handle all of the command-line parts, and then it passes the real logic off to the Cards API. In testing the Cards CLI, the idea is that we'd like to test the code within cli.py and cut off access to the rest of the system. To do that, we have to look at cli.py to see how it's accessing the rest of Cards.

The cli.py module accesses the rest of the Cards system through an import of cards:

1. https://docs.python.org/3/library/unittest.mock.html
2. https://pypi.org/project/typer

cards_proj/src/cards/cli.py
```
import cards
```

Through this cards namespace, cli.py accesses:

- cards.__version__ (a string)
- cards.CardDB (a class representing the main API methods)
- cards.InvalidCardID (an exception)
- cards.Card (the primary data type for use between the CLI and API)

Most of the API access is through a context manager that creates a cards.CardsDB object:

cards_proj/src/cards/cli.py
```
@contextmanager
def cards_db():
    db_path = get_path()
    db = cards.CardsDB(db_path)
    yield db
    db.close()
```

Most of the functions work through that object. For example, the start command accesses db.start() through db, a CardsDB instance:

cards_proj/src/cards/cli.py
```
@app.command()
def start(card_id: int):
    """Set a card state to 'in prog'."""
    with cards_db() as db:
        try:
            db.start(card_id)
        except cards.InvalidCardId:
            print(f"Error: Invalid card id {card_id}")
```

Both add and update also use the cards.Card data structure we've played with before:

cards_proj/src/cards/cli.py
```
db.add_card(cards.Card(summary, owner, state="todo"))
```

And the version command looks up cards.__version__:

cards_proj/src/cards/cli.py
```
@app.command()
def version():
    """Return version of cards application"""
    print(cards.__version__)
```

For the sake of what to mock for testing the CLI, let's mock both __version__ and CardsDB.

The version command looks pretty simple. It just accesses cards.__version__ and prints that. We'll start there. But first, let's look at how Typer helps us with testing.

Testing with Typer

A great feature of Typer is that it provides a testing interface. With it, we can call our application without having to resort to using subprocess.run, which is good, because we can't mock stuff running in a separate process. (We looked at a short example of using subprocess.run with test_version_v1 in Using capsys, on page ?.) We just need to give the runner's invoke function our app—cards.app—and a list of strings that represents the command.

Here's an example of invoking the version function:

ch10/test_typer_testing.py

```
from typer.testing import CliRunner
from cards.cli import app

runner = CliRunner()

def test_typer_runner():
    result = runner.invoke(app, ["version"])
    print()
    print(f"version: {result.stdout}")

    result = runner.invoke(app, ["list", "-o", "brian"])
    print(f"list:\n{result.stdout}")
```

In the example test:

- To run cards version, we run runner.invoke(app, ["version"]).
- To run cards list -o brian, we run runner.invoke(app, ["list", "-o", "brian"]).

We don't have to include "cards" in the list to send to the app, and the rest of the string is split into a list of strings.

Let's run this code and see what happens:

```
$ cd /path/to/code/ch10
$ pytest -v -s test_typer_testing.py::test_typer_runner
========================== test session starts ==========================
collected 1 item

test_typer_testing.py::test_typer_runner
version: 1.0.0

list:
  ID   state   owner   summary
```

```
  3    todo    brian   Finish second edition
PASSED
========================== 1 passed in 0.05s ==========================
```

Looks like it works, and is running against the live database.

However, before we move on, let's write a helper function called cards_cli. We know we're going to invoke the app plenty of times during testing the CLI, so let's simplify it a bit:

ch10/test_typer_testing.py

```
import shlex

def cards_cli(command_string):
    command_list = shlex.split(command_string)
    result = runner.invoke(app, command_list)
    output = result.stdout.rstrip()
    return output

def test_cards_cli():
    result = cards_cli("version")
    print()
    print(f"version: {result}")

    result = cards_cli("list -o brian")
    print(f"list:\n{result}")
```

This allows us to let shlex.split() turn "list -o brian" into ["list", "-o", "brian"] for us, as well as grab the output and return it.

Now we're ready to get back to mocking.

Mocking an Attribute

Most of the Cards API is accessed through a CardsDB object, but one entry point is just an attribute, cards.__version__. Let's look at how we can use mocking to make sure the value from cards.__version__ is correctly reported through the CLI.

There are several patch methods within the mock package. We'll be using patch.object. We'll use it primarily in its context manager form. Here's what it looks like to mock __version__:

ch10/test_mock.py

```
from unittest import mock

import cards
import pytest
from cards.cli import app
from typer.testing import CliRunner
```

```
runner = CliRunner()

def test_mock_version():
    with mock.patch.object(cards, "__version__", "1.2.3"):
        result = runner.invoke(app, ["version"])
        assert result.stdout.rstrip() == "1.2.3"
```

In our test code, we import cards. The resulting cards object is what we're going to be patching. The call to mock.patch.object() used as a context manager within a with block returns a mock object that is cleaned up after the with block.

In this case, the __version__ attribute of cards is replaced with "1.2.3" for the duration of the with block. We then use invoke to call our application with the "version" command. The print statement within the version() method will add a newline, which we are stripping with result.stdout.rstrip() to make the comparison easier.

When the version() method is called from the CLI code, the __version__ attribute isn't the original string, it's the string we replaced with patch.object().

Mock is replacing part of our system with something else, namely mock objects. With mock objects, we can do lots of stuff, like setting attribute values, return values for callables, and even look at how callables are called.

If that last bit was confusing, you're not alone. This weirdness is one of the reasons many people avoid mocking altogether. Once you get your head around that, the rest kinda sorta makes sense.

In the upcoming sections, we'll look at mocking classes and methods of classes.