flexmock Documentation

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flexmock is a testing library for Python.

Its API is inspired by a Ruby library of the same name. However, it is not a goal of Python flexmock to be a clone of the Ruby version. Instead, the focus is on providing full support for testing Python programs and making the creation of fake objects as unobtrusive as possible.

As a result, Python flexmock removes a number of redundancies in the Ruby flexmock API, alters some defaults, and introduces a number of Python-only features.

flexmock’s design focuses on simplicity and intuitiveness. This means that the API is as lean as possible, though a few convenient short-hand methods are provided to aid brevity and readability.

flexmock declarations are structured to read more like English sentences than API calls, and it is possible to chain them together in any order to achieve high degree of expressiveness in a single line of code.
$ sudo easy_install flexmock

Or download the tarball, unpack it and run:

$ sudo python setup.py install
CHAPTER 2

Compatibility

Tested to work with:

- python 2.7
- python 3.4
- python 3.5
- python 3.6
- python 3.7
- pypy
- pypy3

Automatically integrates with all major test runners, including:

- unittest
- unittest2
- nose
- py.test
- django
- twisted / trial
- doctest
- zope.testrunner
- subunit
- testtools
3.1 Start Here

So what does flexmock actually help you do?

### 3.1.1 Creating fake objects

Making a new object in Python requires defining a new class with all the fake methods and attributes you’re interested in emulating and then instantiating it. For example, to create a FakePlane object to use in a test in place of a real Plane object we would need to do something like:

```python
class FakePlane(object):
    operational = True
    model = "MIG-21"
    def fly(self): pass

plane = FakePlane()  # this is tedious!
```

In other words, we must first create a class, make sure it contains all required attributes and methods, and finally instantiate it to create the object.

flexmock provides an easier way to generate a fake object on the fly using the flexmock() function:

```python
plane = flexmock(
    operational=True,
    model="MIG-21")
```

It is also possible to add methods to this object using the same notation and Python’s handy lambda keyword to turn an attribute into a method:

```python
plane = flexmock(
    operational=True,
    fly=lambda self: None)
```
3.1.2 Replacing parts of existing objects and classes (stubs)

While creating fake objects from scratch is often sufficient, many times it is easier to take an existing object and simply stub out certain methods or replace them with fake ones. flexmock makes this easy as well:

```python
flexmock(
    Train,  # this can be an instance, a class, or a module
    get_destination="Tokyo",
    get_speed=200)
```

By passing a real object (or class or module) into the flexmock() function as the first argument it is possible to modify that object in place and provide default return values for any of its existing methods.

In addition to simply stubbing out return values, it can be useful to be able to call an entirely different method and substitute return values based on test-specific conditions:

```python
(flexmock(Train)
    .should_receive("get_route")
    .replace_with(lambda x: custom_get_route()))
```

3.1.3 Creating and checking expectations

flexmock features smooth integration with pretty much every popular test runner, so no special setup is necessary. Simply importing flexmock into your test module is sufficient to get started with any of the following examples.

**Mocks**

Expectations take many flavors, and flexmock has many different facilities and modes to generate them. The first and simplest is ensuring that a certain method is called:

```python
flexmock(Train).should_receive("get_destination").once()
```

The .once() modifier ensures that Train.get_destination() is called at some point during the test and will raise an exception if this does not happen.

Of course, it is also possible to provide a default return value:

```python
flexmock(Train).should_receive("get_destination").once().and_return("Tokyo")
```

Or check that a method is called with specific arguments:

```python
flexmock(Train).should_receive("set_destination").with_args("Tokyo").at_least().∧times(1)
```

In this example we used .times(1) instead of .once() and added the .at_least() modifier to demonstrate that it is easy to match any number of calls, including 0 calls or a variable amount of calls. As you’ve probably guessed there is also an at_most() modifier.
Spies

While replacing method calls with canned return values or checking that they are called with specific arguments is quite useful, there are also times when you want to execute the actual method and simply find out how many times it was called. flexmock uses should_call() to generate this sort of expectations instead of should_receive:

```ruby
flexmock(Train).should_call("get_destination").once()
```

In the above case the real get_destination() method will be executed, but flexmock will raise an exception unless it is executed exactly once. All the modifiers allowed with should_receive() can also be used with should_call() so it is possible to tweak the allowed arguments, return values and call times.

```ruby
(flexmock(Train)
  .should_call("set_destination")
  .once()
  .with_args(object, str, int)
  .and_raise(Exception, re.compile("^No such dest.*")))
```

The above example introduces a handful of new capabilities – raising exceptions, matching argument types (object naturally matches any argument type) and regex matching on string return values and arguments.

3.1.4 Summary

flexmock has many other features and capabilities, but hopefully the above overview has given you enough of the flavor for the kind of things that it makes possible. For more details see the User Guide.
4.1 Usage Documentation

4.1.1 Definitions

In order to discuss flexmock usage it’s important to define the following terms.

- **Stub**: fake object that returns a canned value
- **Mock**: fake object that returns a canned value and has an expectation, i.e. it includes a built-in assertion
- **Spy**: watches method calls and records/verifies if the method is called with required parameters and/or returns expected values/exceptions

4.1.2 Overview

flexmock declarations follow a consistent style of the following 3 forms:

```
flexmock ( OBJECT ).COMMAND( ATTRIBUTE ).MODIFIER[.MODIFIER, ...]
```

- or -

```
flexmock ( OBJECT [, ATTRIBUTE=VALUE, ...] )
```

- or -

```
flexmock ( ATTRIBUTE=VALUE [, ATTRIBUTE=VALUE,...] )
```

**OBJECT:**

Either a module, a class, or an instance of a class
COMMAND:

One of should_receive, should_call, or new_instances. These create the initial expectation object.

ATTRIBUTE:

String name of an attribute

MODIFIER:

One of several Expectation modifiers, such as as with_args, and_return, should_raise, times, etc.

VALUE:

Anything

4.2 Example Usage

4.2.1 Setup

```python
from flexmock import flexmock
```

This will include flexmock in your test and make the necessary runner modifications so no further setup or cleanup is necessary.

Since version 0.10.0, it’s also possible to call flexmock module directly, so you can just do:

```python
import flexmock
```

4.2.2 Fake objects

```python
fake = flexmock()  # creates an object with no attributes
```

Specify attribute/return value pairs

```python
fake_plane = flexmock(
    model="MIG-16",
    condition="used"
)
```

Specify methods/return value pairs

```python
fake_plane = flexmock(
    fly=lambda: "vooosh!",
    land=lambda: "landed!"
)
```

You can mix method and non-method attributes by making the return value a lambda for callable attributes.
flexmock Documentation, Release 0.10.5

4.2.3 Partial mocks

flexmock provides three syntactic ways to hook into an existing object and override its methods.

Mark the object as partially mocked, allowing it to be used to create new expectations

```plaintext
defmock(plane)
plane.should_receive('fly').and_return('vooosh!').once()
plane.should_receive('land').and_return('landed!').once()
```

Equivalent syntax assigns the partially mocked object to a variable

```plaintext
plane = defmock(plane)
plane.should_receive('fly').and_return('vooosh!').once()
plane.should_receive('land').and_return('landed!').once()
```

Or you can combine everything into one line if there is only one method to override

```plaintext
defmock(plane).should_receive('fly').and_return('vooosh!').once()
```

You can also return the mock object after setting the expectations

```plaintext
plane = defmock(plane).should_receive('fly').and_return('vooosh!').mock()
```

Note the “mock” modifier above – the expectation chain returns an expectation otherwise

```plaintext
plane.should_receive('land').with_args().and_return('foo', 'bar')
```

**NOTE** If you do not provide a with_args() modifier then any set of arguments, including none, will be matched. However, if you specify with_args() the expectation will only match exactly zero arguments.

**NOTE** If you do not provide a return value then None is returned by default. Thus, and_return() is equivalent to and_return( None ) is equivalent to simply leaving off and_return.

4.2.4 Attributes and properties

Just as you’re able to stub return values for functions and methods, flexmock also allows to stub out non-callable attributes and even (getter) properties. Syntax for this is exactly the same as for methods and functions.

4.2.5 Shorthand

Instead of writing out the lengthy should_receive/and_return statements, you can also use the handy shorthand approach of passing them in as key=value pairs to the defmock() function. For example, we can stub out two methods of the plane object in the same call:

```plaintext
defmock(plane) = flexmock(fly=lambda: "vooosh!")
defmock(plane).should_receive("land").and_return("landed!")
```
This approach is handy and quick but only limited to stubs, i.e. it is not possible to further modify these kind of calls with any of the usual modifiers described below.

### 4.2.6 Class level mocks

If the object you partially mock is a class, flexmock effectively replaces the method for all instances of that class.

```python
>>> class User:
...     def get_name(self):
...         return 'George Bush'
...>
... flexmock(User)
>>> User.should_receive('get_name').and_return('Bill Clinton')
>>> bubba = User()
>>> bubba.get_name()
'Bill Clinton'
```

### 4.2.7 Automatically checked expectations

Using the times(N) modifier, or its aliases – once, twice, never – allows you to create expectations that will be automatically checked by the test runner.

Ensure `fly('forward')` gets called exactly three times

```python
(flexmock(plane)
    .should_receive('fly')
    .with_args('forward')
    .times(3))
```

Ensure `turn('east')` gets called at least twice

```python
(flexmock(plane)
    .should_receive('turn')
    .with_args('east')
    .at_least().twice())
```

Ensure `land('airfield')` gets called at most once

```python
(flexmock(plane)
    .should_receive('land')
    .with_args('airfield')
    .at_most().once())
```

Ensure that `crash('boom!')` is never called

```python
(flexmock(plane)
    .should_receive('crash')
    .with_args('boom!')
    .never())
```
4.2.8 Exceptions

You can make the mocked method raise an exception instead of returning a value.

```ruby
(flexmock(plane)
  .should_receive('fly')
  .and_raise(BadWeatherException))
```

Or you can add a message to the exception being raised

```ruby
(flexmock(plane)
  .should_receive('fly')
  .and_raise(BadWeatherException, 'Oh noes, rain!'))
```

4.2.9 Spies (proxies)

In addition to stubbing out a given method and returning fake values, flexmock also allows you to call the original method and make expectations based on its return values/exceptions and the number of times the method is called with the given arguments.

Matching specific arguments

```ruby
(flexmock(plane)
  .should_call('repair')
  .with_args(wing, cockpit)
  .once())
```

Matching any arguments

```ruby
(flexmock(plane)
  .should_call('turn')
  .twice())
```

Matching specific return values

```ruby
(flexmock(plane)
  .should_call('land')
  .and_return('landed!'))
```

Matching a regular expression

```ruby
(flexmock(plane)
  .should_call('land')
  .and_return(re.compile('^la')))  
```

Match return values by class/type

```ruby
(flexmock(plane)
  .should_call('fly')
  .and_return(str, object, None))
```

Ensure that an appropriate exception is raised

```ruby
(flexmock(plane)
  .should_call('fly')
  .and_raise(BadWeatherException))
Check that the exception message matches your expectations

```python
(flexmock(plane)
    .should_call('fly')
    .and_raise(BadWeatherException, 'Oh noes, rain!'))
```

Check that the exception message matches a regular expression

```python
(flexmock(plane)
    .should_call('fly')
    .and_raise(BadWeatherException, re.compile('rain')))
```

If either and_return() or and_raise() is provided, flexmock will verify that the return value matches the expected return value or exception.

**NOTE** should_call() changes the behavior of and_return() and and_raise() to specify expectations rather than generate given values or exceptions.

### 4.2.10 Multiple return values

It’s possible for the mocked method to return different values on successive calls.

```python
>>> flexmock(group).should_receive('get_member').and_return('user1').and_return('user2').and_return('user3')
>>> group.get_member()
'user1'
>>> group.get_member()
'user2'
>>> group.get_member()
'user3'
```

Or use the short-hand form

```python
(flexmock(group)
    .should_receive('get_member')
    .and_return('user1', 'user2', 'user3')
    .one_by_one())
```

You can also mix return values with exception raises

```python
(flexmock(group)
    .should_receive('get_member')
    .and_return('user1')
    .and_raise(Exception)
    .and_return('user2'))
```

### 4.2.11 Fake new instances

Occasionally you will want a class to create fake objects when it’s being instantiated. flexmock makes it easy and painless.

Your first option is to simply replace the class with a function.

```python
(flexmock(some_module)
    .should_receive('NameOfClass')
    (continues on next page)
The upside of this approach is that it works for both new-style and old-style classes. The downside is that you may run into subtle issues since the class has now been replaced by a function.

If you’re dealing with new-style classes, flexmock offers another alternative using the `new_instances()` method.

```python
>>> class Group(object): pass
>>> fake_group = flexmock(name='fake')
>>> flexmock(Group).new_instances(fake_group)
>>> Group().name == 'fake'
True
```

It is also possible to return different fake objects in a sequence.

```python
>>> class Group(object): pass
>>> fake_group1 = flexmock(name='fake')
>>> fake_group2 = flexmock(name='real')
>>> flexmock(Group).new_instances(fake_group1, fake_group2)
>>> Group().name == 'fake'  # True
>>> Group().name == 'real'  # True
```

Another approach, if you’re familiar with how instance instantiation is done in Python, is to stub the `__new__` method directly.

```python
>>> flexmock(Group).should_receive('__new__').and_return(fake_group)
>>> # or, if you want to be even slicker
>>> flexmock(Group, __new__=fake_group)
```

In fact, the new_instances command is simply shorthand for `should_receive('__new__').and_return()` under the hood.

Note, that Python issue 25731 causes a problem with restoring the original `__new__` method. It has been already fixed upstream, but all versions of Python 3 lower than 3.5.2 are affected and will probably never receive a bug fix for this. If you’re using some of the affected versions and are getting `TypeError: object() takes no parameters`, you’re hitting this issue (original bug report is at flexmock issue 13.

### 4.2.12 Generators

In addition to returning values and raising exceptions, flexmock can also turn the mocked method into a generator that yields successive values.

```python
>>> flexmock(plane).should_receive('flight_log').and_yield('take off', 'flight', 'landing')
>>> for i in plane.flight_log():
...    print i
'take off'
'flight'
'landing'
```

You can also use Python’s builtin `iter()` function to generate an iterable return value.

```python
flexmock(plane, flight_log=iter(['take off', 'flight', 'landing']))
```
In fact, the \texttt{and\_yield()} modifier is just shorthand for \texttt{should\_receive().and\_return(iter)} under the hood.

### 4.2.13 Private methods

One of the small pains of writing unit tests is that it can be difficult to get at the private methods since Python “conveniently” renames them when you try to access them from outside the object. With \texttt{flexmock} there is nothing special you need to do to – mocking private methods is exactly the same as any other methods.

### 4.2.14 Call order

\texttt{flexmock} does not enforce call order by default, but it’s easy to do if you need to.

```python
(flexmock(plane)
   .should_receive('fly')
   .with_args('forward')
   .and_return('ok')
   .ordered())
(flexmock(plane)
   .should_receive('fly')
   .with_args('up')
   .and_return('ok')
   .ordered())
```

The order of the \texttt{flexmock} calls is the order in which these methods will need to be called by the code under test.

If method \texttt{fly()} above is called with the right arguments in the declared order things will be fine and both will return ‘ok’. But trying to call \texttt{fly(‘up’)} before \texttt{fly(‘forward’)} will result in an exception.

### 4.2.15 State Support

\texttt{flexmock} supports conditional method execution based on external state. Consider the rather contrived \texttt{Radio} class with the following methods:

```python
>>> class Radio:
...     is_on = False
...     def switch_on(self): self.is_on = True
...     def switch_off(self): self.is_on = False
...     def select_channel(self): return None
...     def adjust_volume(self, num): self.volume = num

>>> radio = Radio()
```

Now we can define some method call expectations dependent on the state of the radio:

```python
>>> flexmock(radio)
>>> radio.should_receive('select_channel').once().when(lambda: radio.is_on)
>>> radio.should_call('adjust_volume').once().with_args(5).when(lambda: radio.is_on)
```

Calling these while the radio is off will result in an error:

```python
>>> radio.select_channel()
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
  File "flexmock.py", line 674, in mock_method
    (method, expectation._get_runnable()))
```
```python
>>> radio.adjust_volume(5)
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
  File "flexmock.py", line 674, in mock_method
    (method, expectation._get_runnable()))
flexmock.StateError: adjust_volume expected to be called when condition is True
Traceback (most recent call last):

Turning the radio on will make things work as expected:

```python
>>> radio.is_on = True
>>> radio.select_channel()
>>> radio.adjust_volume(5)
```

### 4.2.16 Chained methods

Let’s say you have some code that looks something like the following:

```python
http = HTTP()
results = (http.get_url('http://www.google.com')
  .parse_html()
  .display_results())
```

You could use flexmock to mock each of these method calls individually:

```python
mock = flexmock(get_url=lambda: flexmock(parse_html=lambda: flexmock(display_results='ok')))
flexmock(HTTP).new_instances(mock)
```

But that looks really error prone and quite difficult to parse when reading. Here’s a better way:

```python
mock = flexmock()
flexmock(HTTP).new_instances(mock)
mock.should_receive('get_url.parse_html.display_results').and_return('ok')
```

When using this short-hand, flexmock will create intermediate objects and expectations, returning the final one in the chain. As a result, any further modifications, such as with_args() or times() modifiers, will only be applied to the final method in the chain. If you need finer grained control, such as specifying specific arguments to an intermediate method, you can always fall back to the above long version.

Word of caution: because flexmock generates temporary intermediate mock objects for each step along the chain, trying to mock two method call chains with the same prefix will not work. That is, doing the following will fail to set up the stub for display_results() because the one for save_results() overrides it:

```python
flexmock(HTTP).should_receive('get_url.parse_html.display_results').and_return('ok')
flexmock(HTTP).should_receive('get_url.parse_html.save_results').and_return('ok')
```

In this situation, you should identify the point where the chain starts to diverge and return a flexmock() object that handles all the “tail” methods using the same object:

```python
(flexmock(HTTP)
    .should_receive('get_url.parse_html')
    .and_return(flexmock(display_results='ok', save_results='ok')))```
4.2.17 Replacing methods

There are times when it is useful to replace a method with a custom lambda or function, rather than simply stubbing it out, in order to return custom values based on provided arguments or a global value that changes between method calls.

```python
(flexmock(plane)
  .should_receive('set_speed')
  .replace_with(lambda x: x == 5))
```

There is also shorthand for this, similar to the shorthand for should_receive/and_return:

```python
flexmock(plane, set_speed=lambda x: x == 5)
```

**NOTE** Whenever the return value provided to the key=value shorthand is a callable (such as lambda), flexmock expands it to should_receive().replace_with() rather than should_receive().and_return().

4.2.18 Builtin functions

Mocking or stubbing out builtin functions, such as open(), can be slightly tricky. The “builtins” module is accessed differently in interactive Python sessions versus running applications and named differently in Python 3.0 and above.

It is also not always obvious when the builtin function you are trying to mock might be internally called by the test runner and cause unexpected behavior in the test. As a result, the recommended way to mock out builtin functions is to always specify a fall-through with should_call() first and use with_args() to limit the scope of your mock or stub to just the specific invocation you are trying to replace:

```python
# python 2.4+
mock = flexmock(sys.modules['__builtin__'])
mock.should_call('open')  # set the fall-through
(mock.should_receive('open')
  .with_args('/your/file')
  .and_return( flexmock(read=lambda: 'file contents') ))

# python 3.0+
mock = flexmock(sys.modules['builtins'])
mock.should_call('open')  # set the fall-through
(mock.should_receive('open')
  .with_args('/your/file')
  .and_return( flexmock(read=lambda: 'file contents') ))
```

4.3 Expectation Matching

Creating an expectation with no arguments will by default match all arguments, including no arguments.

```python
>>> flexmock(plane).should_receive('fly').and_return('ok')
```

Will be matched by any of the following:

```python
>>> plane.fly()
'ok'
>>> plane.fly('up')
'ok'
```
>>> plane.fly('up', 'down')
'ok'

You can also match exactly no arguments

```python
(flexmock(plane)
    .should_receive('fly')
    .with_args())
```

Or match any single argument

```python
(flexmock(plane)
    .should_receive('fly')
    .with_args(object))
```

**NOTE** In addition to exact values, you can match against the type or class of the argument.

Match any single string argument

```python
(flexmock(plane)
    .should_receive('fly')
    .with_args(str))
```

Match the empty string using a compiled regular expression

```python
regex = re.compile('^(up|down)$')
(flexmock(plane)
    .should_receive('fly')
    .with_args(regex))
```

Match any set of three arguments where the first one is an integer, second one is anything, and third is string 'notes' (matching against user defined classes is also supported in the same fashion)

```python
(flexmock(plane)
    .should_receive('repair')
    .with_args(int, object, 'notes'))
```

And if the default argument matching based on types is not flexible enough, flexmock will respect matcher objects that provide a custom `__eq__` method.

For example, when trying to match against contents of numpy arrays, equality is undefined by the library so comparing two of them directly is meaningless unless you use all() or any() on the return value of the comparison.

What you can do in this case is create a custom matcher object and flexmock will use its `__eq__` method when comparing the arguments at runtime.

```python
class NumpyArrayMatcher(object):
    def __init__(self, array): self.array = array
    def __eq__(self, other): return all(other == self.array)

(flexmock(obj)
    .should_receive('function')
    .with_args(NumpyArrayMatcher(array1)))
```

The above approach will work for any objects that choose not to return proper boolean comparison values, or if you simply find the default equality and type-based matching not sufficiently specific.

It is, of course, also possible to create multiple expectations for the same method differentiated by arguments.
Try to execute `plane.fly()` with any, or no, arguments as defined by the first `flexmock` call will return the first value.

```python
>>> plane.fly()
'ok'
>>> plane.fly('forward', 'down')
'ok'
```

But! If argument values match the more specific `flexmock` call the function will return the other return value.

```python
>>> plane.fly('up')
'bad'
```

The order of the expectations being defined is significant, with later expectations having higher precedence than previous ones. Which means that if you reversed the order of the example expectations above the more specific expectation would never be matched.

### 4.4 Style

While the order of modifiers is unimportant to `flexmock`, there is a preferred convention that will make your tests more readable.

If using `with_args()`, place it before `should_return()`, `and_raise()` and `and_yield()` modifiers:

```python
(flexmock(plane)
  .should_receive('fly')
  .with_args('up', 'down')
  .and_return('ok'))
```

If using the `times()` modifier (or its aliases: once, twice, never), place them at the end of the `flexmock` statement:

```python
(flexmock(plane)
  .should_receive('fly')
  .and_return('ok')
  .once())
```
5.1 flexmock API

`flexmock.flexmock(spec=None, **kwargs)`
Main entry point into the flexmock API.

This function is used to either generate a new fake object or take an existing object (or class or module) and use it as a basis for a partial mock. In case of a partial mock, the passed in object is modified to support basic Mock class functionality making it unnecessary to make successive flexmock() calls on the same objects to generate new expectations.

Examples:

```python
>>> flexmock(SomeClass)
>>> SomeClass.should_receive('some_method')
```

NOTE: it's safe to call flexmock() on the same object, it will detect when an object has already been partially mocked and return it each time.

Args:

- spec: object (or class or module) to mock
- kwargs: method/return_value pairs to attach to the object

Returns: Mock object if no spec is provided. Otherwise return the spec object.

class flexmock.Mock(**kwargs)`
Fake object class returned by the flexmock() function.

new_instances(*kargs)
Overrides __new__ method on the class to return custom objects.

Alias for should_receive(‘__new__’).and_return(kargs).one_by_one

Args:

- kargs: objects to return on each successive call to __new__
Returns:

- Expectation object

**should_call**(name)

Creates a spy.

This means that the original method will be called rather than the fake version. However, we can still keep track of how many times it’s called and with what arguments, and apply expectations accordingly.

should_call is meaningless/not allowed for non-callable attributes.

Args:

- name: string name of the method

Returns:

- Expectation object

**should_receive**(name)

Replaces the specified attribute with a fake.

Args:

- name: string name of the attribute to replace

Returns:

- Expectation object which can be used to modify the expectations on the fake attribute

### class flexmock.Expectation

(mock, name=None, return_value=None, original=None)

Holds expectations about methods.

The information contained in the Expectation object includes method name, its argument list, return values, and any exceptions that the method might raise.

**and_raise**(exception, *kargs, **kwargs)

Specifies the exception to be raised when this expectation is met.

Args:

- exception: class or instance of the exception
- kargs: optional keyword arguments to pass to the exception
- kwargs: optional named arguments to pass to the exception

Returns:

- self, i.e. can be chained with other Expectation methods

**and_return**(values)

Override the return value of this expectation’s method.

When and_return is given multiple times, each value provided is returned on successive invocations of the method. It is also possible to mix and_return with and_raise in the same manner to alternate between returning a value and raising an exception on different method invocations.

When combined with the one_by_one property, value is treated as a list of values to be returned in the order specified by successive calls to this method rather than a single list to be returned each time.

Args:

- values: optional list of return values, defaults to None if not given

Returns:
- self, i.e. can be chained with other Expectation methods

**and_yield**(*kargs*)

Specifies the list of items to be yielded on successive method calls.

In effect, the mocked object becomes a generator.

**Returns:**

- self, i.e. can be chained with other Expectation methods

**at_least**()

Modifies the associated times() expectation.

When given, an exception will only be raised if the method is called less than times() specified. Does nothing if times() is not given.

**Returns:**

- self, i.e. can be chained with other Expectation methods

**at_most**()

Modifies the associated “times” expectation.

When given, an exception will only be raised if the method is called more than times() specified. Does nothing if times() is not given.

**Returns:**

- self, i.e. can be chained with other Expectation methods

**mock**()

Return the mock associated with this expectation.

**one_by_one**()

Modifies the return value to be treated as a list of return values.

Each value in the list is returned on successive invocations of the method.

**Returns:**

- self, i.e. can be chained with other Expectation methods

**ordered**()

Makes the expectation respect the order of should_receive statements.

An exception will be raised if methods are called out of order, determined by order of should_receive calls in the test.

**Returns:**

- self, i.e. can be chained with other Expectation methods

**replace_with**(function)

Gives a function to run instead of the mocked out one.

**Args:**

- function: callable

**Returns:**

- self, i.e. can be chained with other Expectation methods

**times**(number)

Number of times this expectation’s method is expected to be called.

There are also 3 aliases for the times() method:
• once() -> times(1)
• twice() -> times(2)
• never() -> times(0)

Args:
• number: int

Returns:
• self, i.e. can be chained with other Expectation methods

when (func)
Sets an outside resource to be checked before executing the method.

Args:
• func: function to call to check if the method should be executed

Returns:
• self, i.e. can be chained with other Expectation methods

with_args (*kargs, **kwargs)
Override the arguments used to match this expectation’s method.

Args:
• kargs: optional keyword arguments
  • kwargs: optional named arguments

Returns:
• self, i.e. can be chained with other Expectation methods
6.1 Changelog

This project follows semantic versioning.

Types of changes:

- **Added**: New features.
- **Changed**: Changes in existing functionality.
- **Deprecated**: Soon-to-be removed features.
- **Removed**: Removed features.
- **Fixed**: Bug fixes.
- **Infrastructure**: Changes in build or deployment infrastructure.
- **Documentation**: Changes in documentation.

6.1.1 Release 0.10.5

**Added**

- Improve error message on unmatched method signature expectation.

**Fixed**

- Fix using `should_call` passes wrong `runtime_self`.
- Fix pytest `--durations` flag when flexmock is installed.
6.1.2 Release 0.10.4

- drop Python 2.6, 3.3 and Jython support
- add Python 3.6 and 3.7 support
- don’t hide exception when flexmock is used as context manager
- fix expectation reset for static methods on pypy 2
- ensure original exception isn’t suppressed in pytest hook

6.1.3 Release 0.10.3

- fix compatibility with py.test 4.1
- minor documentation fixes

6.1.4 Release 0.10.2

- fix recognizing whether mocked object is a method or not on Python 3

6.1.5 Release 0.10.1

- fix decode problem in setup.py on Python 3

6.1.6 Release 0.10.0

- new official upstream repository: https://github.com/bkabrda/flexmock/
- new official homepage: https://flexmock.readthedocs.org
- adopted the official BSD 2-clause license https://en.wikipedia.org/wiki/BSD_licenses#2-clause_license_.2822Simplified_BSD_License.22_or_.22FreeBSD_License.22.29
- add support for calling flexmock module directly
- add support for mocking keyword-only args
- add support for Python 3.4 and 3.5
- drop support for Python 2.4, 2.5, 3.1 and 3.2
- add __version__ attribute to flexmock module
- add various metadata to the package archive
- fix properly find out whether function is method or not and thanks to that don’t strip first args of functions
- fix should_call to work when function returns None or False
- fix various py.test issues
- fix CallOrderError with same subsequent mocking calls
- fix PyPy support issues
- various code style issues were fixed, 4-spaces indent is now used
6.1.7 Release 0.9.7

• small update to add support for TeamCity / PyCharm test runner.

6.1.8 Release 0.9.6

• fix staticmethod mocking on instances
• fix comparison of kwargs ordering issues
• fix `ReturnValue.__str__`

6.1.9 Release 0.9.5

• bugfix: stop enforcing argument signatures on flexmock objects

6.1.10 Release 0.9.4

• add support for stubbing return values on getter properties
• add custom matcher object support to `with_args`
• add support for striter function signature checks
• add support for non-callable attributes
• add support chained attributes (thanks Bryce Covert!)
• add iter support to `Mock` objects
• add PyPy support
• add Jython support
• fix `should_call` to work with class mocks
• fix `and_return` to return `None` by default
• fix MRO issues on builtin methods on 2.7+/3.2+
• improve defaults: partial mocks created using the `func=return_value` style now default to `replace_with` instead of `should_receive` for callables

6.1.11 Release 0.9.3

• add python 3.3 test target
• add proper handling of `ordered()` expectation across different methods
• add property support on fake objects
• fix compatibility with pytest 2.2 (thanks jpvanhal!)
• fix insidious bug with mocking subclasses of `str` class
• fix `tuple` handling when formatting arguments
• fix resetting subclass methods
6.1.12 Release 0.9.2

- fix mocking builtins by resetting expectation when raising exceptions
- fix mocking private methods on classes with leading underscores
- limit the damage of `from flexmock import *` by limiting to just `flexmock()`
- ensure `_pre_flexmock_success` is cleaned up after each test

6.1.13 Release 0.9.1

- adding support for more test runners:
  - unittest2
  - django
  - twisted/trial
  - zope.testrunner
  - subunit
  - testtools

6.1.14 Release 0.9.0

- adding state machine support using `when()`
- make expectation fail as soon as number of expected calls is exceeded
- `flexmock_teardown` no longer returns a function
- allow `should_call` on class and static methods
- disallow `should_call` on class mocks
- fixing `unicode` args handling
- fixing issues with `@property` methods misbehaving in the debugger
- fixing pytest integration and instance teardown
- fixing private method handling

6.1.15 Release 0.8.1

- fixing pytest and doctest integration to always call `flexmock_teardown`
- fixing `flexmock_teardown` to return a function as before so it can be used as a decorator

6.1.16 Release 0.8.0

- big changes in runner integration support (no more stack examination or sketchy teardown replacement)
- doctest integration
- fixing ordering verification when the method has a default stub
- fixing calling `with_args()` without arguments to match exactly no arguments (thanks jerico-dev!)
• 20% performance improvement
• make sure to return object itself when partial mocking instances unless the object already has some of the methods
• ensure consecutive calls return same mock object

6.1.17 Release 0.7.4.2

• adding regex support for arg matching and spy return values
• enabling replace_with for class mocks
• disabling expectation checking if an exception has already been raised
• massive refactoring of the way flexmock does monkey patching

6.1.18 Release 0.7.4.1

• Fixing replace_with to work properly like and_execute
• (and_execute will be deprecated in next release!)

6.1.19 Release 0.7.4

• Fixed exception type check when no message specified
• Make properties work optionally with parentheses
• Make sure should_receive does not replace flexmock methods
• Removed new_instances= param in favor of new_instances() method
• Refactoring to move all state to FlexmockContainer class

6.1.20 Release 0.7.3

• Added new_instances method (new_instances param will be deprecated in next release!)
• Added replace_with to enable returning results of custom functions
• Added with support for FlexMock objects
• Moved tests to their own directory
• Lots of documentation cleanup and updates

6.1.21 Release 0.7.2

• Added support for chained methods
• Moved flexmock_teardown to module level to expose it for other test runners
• Added py.test support (thanks to derdon)
• Lots of test refactoring and improvements for multiple test runner support
• Fix loop in teardown
• Fix should_call for same method with different args

6.1.22 Release 0.7.1

• Fix bug with “never” not working when the expectation is not met
• Fix bug in duplicate calls to original method in pass_thru mode (thanks sagara-!)
• Fix bug in handling unicode characters in ReturnValue

6.1.23 Release 0.7.0

• Better error handling for trying to mock builtins
• Added simple test harness for running on multiple versions / test runners
• Fixed unicode arg formatting (thanks to sagara-!)
• Made it impossible to mock non-existent methods
• Ensure flexmock teardown takes varargs (for better runner integration)

6.1.24 Release 0.6.9

• Initial nose integration (still no support for generated tests)
• Fixing private class methods
• Some test refactoring to support different test runners

6.1.25 Release 0.6.8

• Add should_call() alias for should_receive().and_execute
• Ensure new_instances can’t be used with expectation modifiers
• Make and_execute match return value by class in addition to value
• Support for mocking out static methods
• Bit of test fixage (thanks to derdon)

6.1.26 Release 0.6.7

• Fixing clobbering of original method by multiple flexmock calls
• Making and_raise work properly with exception classes and args
• Proper exception matching with and_execute
• Fix mocking same class twice
6.1.27 Release 0.6.6

- Removing extra args from `should_receive`
- Making `and_execute` check return/raise value of original method
- Refactoring FlexMock constructor into factory method
- Fixing `new_instances` to accept multiple args instead of just none
- Raising an exception when `and_execute` is set on class mock

6.1.28 Release 0.6.5

- Adding support for multiple `flexmock()` calls on same object
- Adding error detection on `and_execute` for missing or unbound methods
- Make sure empty args don’t include `None`

6.1.29 Release 0.6.4

- Fixing up teardown cleanup code after an exception is raised in tests
- Fixing `and_yield` to return proper generator
- Adding `and_yield` returning a predefined generator
- Replacing `and_passthru` with `and_execute`
- Make it easier to mock private methods

6.1.30 Release 0.6.3

- Adding keyword argument expectation matching

6.1.31 Release 0.6.2

- Changing `and_return(multiple=True)` to `one_by_one`
- Making it possible to supply multiple args to `and_return` instead of a tuple
- Changing default mock behavior to create attributes instead of methods
- FIX teardown for python3

6.1.32 Release 0.6.1

- Make it even easier to integrate with new test runners
- Adding support for mixing returns and raises in return values
6.1.33 Release 0.6

- Adding support for multiple arg type matches
- Pulling out the entry point code from constructor into its own method.

6.1.34 Release 0.5

- FIX: ensuring that mocks are cleaned up properly between tests
- BROKEN: part1 on ensuring mocking multiple objects works correctly
- Make sure pass_thru doesn’t try to call a non-existent method
- Fixing up copyright notice
- Adding some missing pydocs

6.1.35 Release 0.4

- Fixing tests and ensuring mock methods really get created properly
- Making sure shortcuts create methods rather than attributes
- Fixing doc strings
- Removing the new-style/old-style convert code, it’s stupid

6.1.36 Release 0.3

- Making Expectation.mock into a property so that it shows up in pydoc
- Adding proxying/spying and at_least/at_most expectation modifiers
CHAPTER 7

Comparison

7.1 Mock Library Comparison

7.1.1 (flexmock for Mox or Mock users.)

This document shows a side-by-side comparison of how to accomplish some basic tasks with flexmock as well as other popular Python mocking libraries.

Simple fake object (attributes only)

```python
# flexmock
mock = flexmock(some_attribute="value", some_other_attribute="value2")
assertEquals("value", mock.some_attribute)
assertEquals("value2", mock.some_other_attribute)

# Mox
mock = mox.MockAnything()
mock.some_attribute = "value"
mock.some_other_attribute = "value2"
assertEquals("value", mock.some_attribute)
assertEquals("value2", mock.some_other_attribute)

# Mock
my_mock = mock.Mock()
my_mock.some_attribute = "value"
my_mock.some_other_attribute = "value2"
assertEquals("value", my_mock.some_attribute)
assertEquals("value2", my_mock.some_other_attribute)
```
Simple fake object (with methods)

```python
# flexmock
mock = flexmock(some_method=lambda: "calculated value")
assertEquals("calculated value", mock.some_method())

# Mox
mock = mox.MockAnything()
mock.some_method().AndReturn("calculated value")
mox.Replay(mock)
assertEquals("calculated value", mock.some_method())

# Mock
my_mock = mock.Mock()
my_mock.some_method.return_value = "calculated value"
assertEquals("calculated value", my_mock.some_method())
```

Simple mock

```python
# flexmock
mock = flexmock()
mock.should_receive("some_method").and_return("value").once()
assertEquals("value", mock.some_method())

# Mox
mock = mox.MockAnything()
mock.some_method().AndReturn("value")
mox.Replay(mock)
assertEquals("value", mock.some_method())
mox.Verify(mock)

# Mock
my_mock = mock.Mock()
my_mock.some_method.return_value = "value"
my_mock.some_method.assert_called_once_with()
```

Creating partial mocks

```python
# flexmock
flexmock(SomeObject).should_receive("some_method").and_return('value')
assertEquals("value", mock.some_method())

# Mox
mock = mox.MockObject(SomeObject)
mock.some_method().AndReturn("value")
mox.Replay(mock)
assertEquals("value", mock.some_method())
mox.Verify(mock)

# Mock
with mock.patch("SomeObject") as my_mock:
    my_mock.some_method.return_value = "value"
    assertEquals("value", mock.some_method())
```
Ensure calls are made in specific order

```ruby
# flexmock
mock = flexmock(SomeObject)
mock.should_receive('method1').once().ordered().and_return('first thing')
mock.should_receive('method2').once().ordered().and_return('second thing')
# exercise the code

# Mox
mock = mox.MockObject(SomeObject)
mock.method1().AndReturn('first thing')
mock.method2().AndReturn('second thing')
# exercise the code
mox.Replay(mock)

# Mock
mock = mock.Mock(spec=SomeObject)
mock.method1.return_value = 'first thing'
mock.method2.return_value = 'second thing'
# exercise the code
assert mock.method_calls == [('method1',), ('method2',)]
```

Raising exceptions

```ruby
# flexmock
mock = flexmock()
mock.should_receive("some_method").and_raise(SomeException("message"))
assertRaises(SomeException, mock.some_method)

# Mox
mock = mox.MockAnything()
mock.some_method().AndRaise(SomeException("message"))
mox.Replay(mock)
assertRaises(SomeException, mock.some_method)
mox.Verify(mock)

# Mock
my_mock = mock.Mock()
my_mock.some_method.side_effect = SomeException("message")
assertRaises(SomeException, my_mock.some_method)
```

Override new instances of a class

```ruby
# flexmock
flexmock(some_module.SomeClass).new_instances(some_other_object)
assertEqual(some_other_object, some_module.SomeClass())

# Mox
# (you will probably have mox.Mox() available as self.mox in a real test)
mox.Mox().StubOutWithMock(some_module, 'SomeClass', use_mock_anything=True)
some_module.SomeClass().AndReturn(some_other_object)
mox.ReplayAll()
assertEqual(some_other_object, some_module.SomeClass())
```

7.1. Mock Library Comparison
# Mock

```python
with mock.patch('somemodule.Someclass') as MockClass:
    MockClass.return_value = some_other_object
    assert some_other_object == some_module.SomeClass()
```

Verify a method was called multiple times

```python
# flexmock (verifies that the method gets called at least twice)
flexmock(some_object).should_receive('some_method').at_least().twice()

# Mox
# (does not support variable number of calls, so you need to create a new entry for...
# each explicit call)
mock = mox.MockObject(some_object)
mock.some_method(mox.IgnoreArg(), mox.IgnoreArg())
mock.some_method(mox.IgnoreArg(), mox.IgnoreArg())
mox.Replay(mock)
# exercise the code
mox.Verify(mock)

# Mock
my_mock = mock.Mock(spec=SomeObject)
# exercise the code
assert my_mock.some_method.call_count >= 2
```

Mock chained methods

```python
# flexmock
# (intermediate method calls are automatically assigned to temporary fake objects
# and can be called with any arguments)
(flexmock(some_object)
    .should_receive('method1.method2.method3')
    .with_args(arg1, arg2)
    .and_return('some value'))
assertEqual('some_value', some_object.method1().method2().method3(arg1, arg2))

# Mox
mock = mox.MockObject(some_object)
mock2 = mox.MockAnything()
mock3 = mox.MockAnything()
mock.method1().AndReturn(mock1)
mock2.method2().AndReturn(mock2)
mock3.method3(arg1, arg2).AndReturn('some_value')
self.mox.ReplayAll()
assertEqual("some_value", some_object.method1().method2().method3(arg1, arg2))
self.mox.VerifyAll()

# Mock
my_mock = mock.Mock()
my_mock.method1.return_value.method2.return_value.method3.return_value = 'some value'
method3 = my_mock.method1.return_value.method2.return_value.method3
```
Mock context manager

```python
# flexmock
my_mock = flexmock()
with my_mock:
    pass

# Mock
my_mock = mock.MagicMock()
with my_mock:
    pass

# Mox
my_mock = mox.MockAnything()
with my_mock:
    pass
```

Mocking the builtin open used as a context manager

The following examples work in an interactive Python session but may not work quite the same way in a script, or with Python 3.0+. See examples in the *Builtin functions* section for more specific flexmock instructions on mocking builtins.

```python
# flexmock
(flexmock(__builtins__)  # <@
  .should_receive('open')  # <--
  .once()  # <--
  .with_args('file_name')  # <--
  .and_return(flexmock(read=lambda: 'some data')))  # <--
with open('file_name') as f:
    assertEqual('some data', f.read())

# Mox
self_mox = mox.Mox()
mock_file = mox.MockAnything()
mock_file.read().AndReturn('some data')
self_mox.StubOutWithMock(__builtins__, '__builtins__.open')  # <--
__builtins__.open('file_name').AndReturn(mock_file)  # <--
self_mox.ReplayAll()
with mock_file:
    assertEqual('some data', mock_file.read())
self_mox.VerifyAll()

# Mock
with mock.patch('__builtin__.open') as my_mock:
    my_mock.return_value.__enter__ = lambda s: s
    my_mock.return_value.__exit__ = mock.Mock()
    my_mock.return_value.read.return_value = 'some data'
with open('file_name') as h:
    assertEqual('some data', h.read())
```

(continues on next page)
assertEqual('some data', h.read())
my_mock.assert_called_once_with('foo')

A possibly more up-to-date version of this document, featuring more mocking libraries, is available at:
http://garybernhardt.github.com/python-mock-comparison/
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