Memoization Decorator

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Memoization

Memoization is an optimization technique used primarily to speed up computer programs by having function calls avoid repeating the calculation of results for previously processed inputs. -Wikipedia.

Decorator

A decorator is any callable Python object that is used to modify a function, method or class definition.
Syntactic sugar for decorators is @decorator. Eg:

```
@profile
def fibonacci(num):
    if num == 1:
        return 1
    return fibonacci(num-1) + fibonacci(num-2)
```

Memoization Decorator

http://wiki.python.org/moin/PythonDecoratorLibrary#Memoize

```
class memoized(object):
def __init__(self, func):
    self.func = func
    self.cache = {}
def __call__(self, * args):
    try:
        return self.cache[args]
    except KeyError:
        value = self.func(* args)
        self.cache[args] = value
        return value
    except TypeError:
        # uncachable -- for instance, passing a list as an
        # Better to not cache than to blow up entirely.
        return self.func(* args)
```

Examples

```
def power_of(x,y,z):
    return (x**y)**z

@memoized
def mpower_of(x,y,z):
    return (x**y)**z
```

Examples

```
def power_of(x,y,z):
    return (x**y)**z

@memoized
def mpower_of(x,y,z):
    return (x**y)**z
```

```
>>> timeit('math_funcs.power_of(10,30,30)',
           'import math_funcs')
32.031651973724365
```

Examples

```
def power_of(x,y,z):
    return (x**y)**z

@memoized
def mpower_of(x,y,z):
    return (x**y)**z
```

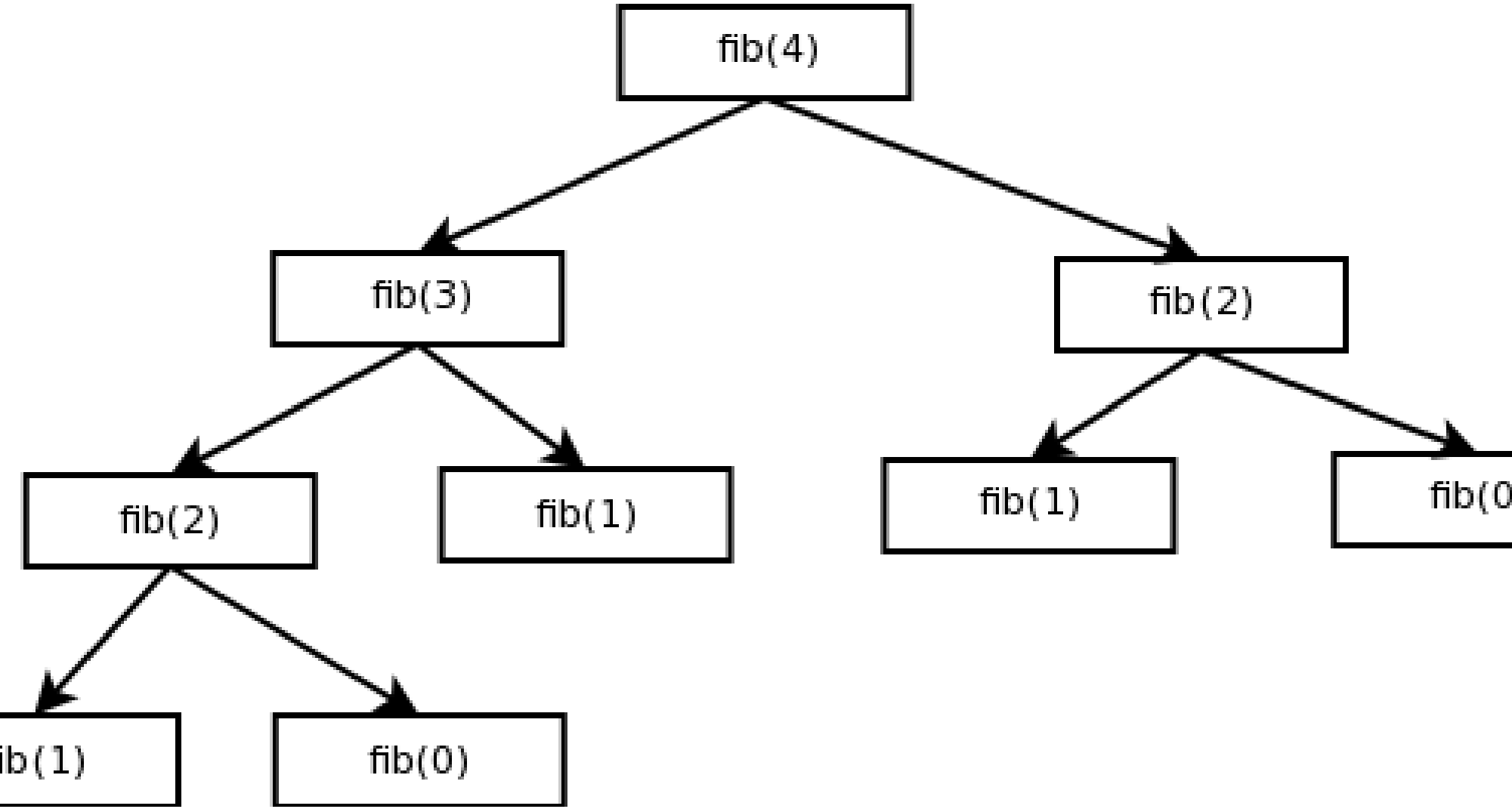
```
>>> timeit('math_funcs.power_of(10,30,30)',
           'import math_funcs')
32.031651973724365

>>> timeit('math_funcs.mpower_of(10,30,30)',
           'import math_funcs')
0.7064220905303955
```

Fibonacci - Example

```
def fibonacci(num):
    if num == 0:
        return 0
    elif num ==1:
        return 1
    return fibonacci(num-1) + fibonacci(num-2)
```

Fibonacci - Call Graph



Fibonacci - Without Memoization

```
>>> math_funcs.fibonacci(4)    # 9 function calls
fibonacci(4)
fibonacci(3)
fibonacci(2)
fibonacci(1)
fibonacci(0)
fibonacci(1)
fibonacci(2)
fibonacci(1)
fibonacci(0)
3
```

Fibonacci - With Memoization

```
>>> math_funcs.mfibonacci(4)  # 5 function calls
fibonacci(4)
fibonacci(3)
fibonacci(2)
fibonacci(1)
fibonacci(0)
3
```

Fibonacci - With Memoization

```
>>> math_funcs.mfibonacci(4)  # 5 function calls
fibonacci(4)
fibonacci(3)
fibonacci(2)
fibonacci(1)
fibonacci(0)
3

>>> math_funcs.mfibonacci(4)  # No function calls
3                             # cache already has results
```

References

- http://wiki.python.org/moin/PythonDecoratorLibrary#Memoize
- Guide to: Learning Python Decorators by Matt Harrison http://www.amazon.com/Guide-Learning-Python-Decorators-ebook/dp/B006ZHJSIM/