Memoization Decorator

Amjith Ramanujam

Utah Python User Group

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Memoization

Definition

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.

- Optimization technique.
- Store the results.
- Return stored results when called with same args.

Decorator

Definition

A decorator is any callable Python object that is used to modify a function, method or class definition.

- Decorator is a wrapper around exsiting callables.
- Syntactic sugar for decorators is @decorator. Eg:

```
@profile
def fibonacci(num):
    if num in (0,1):
        return num
    return fibonacci(num-1) + fibonacci(num-2)
```

Examples

```
def power_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

>>> timeit('math_funcs.power_of(10,30,30)',
           'import math_funcs')
32.03165197372436
```

Memoized Version

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

Examples

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

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

Memoized Version

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

>>> timeit('math_funcs.mpower_of(10,30,30)',
           'import math_funcs')
0.70642209053039551
```

Memoization Decorator

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

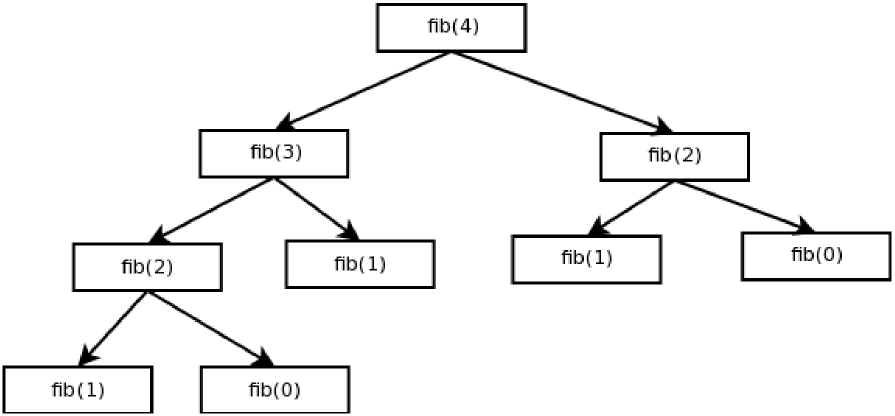
```
class memoized(object):
    def __init__(self, func):
        self.func = func
        self.cache = {}
    def __call__(self, * args):
        try:
            return self.cache[args]
        except KeyError:
            value = self.func(* args)
            self.cache[args] = value
            return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

Fibonacci - Example

Fibonacci

```
def fibonacci(num):
    print 'fibonacci(%d)'%num
    if num in (0,1):
        return num
    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 r
```

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/