

Creating Magic Functions in IPython - Part 1

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IPython magic functions

One of the cool features of IPython are [magic functions](#) - helper functions built into IPython. They can help you easily [start an interactive debugger](#), [create a macro](#), [run a statement through a code profiler](#) or [measure its' execution time](#) and do many more common things.



Don't mistake **IPython** magic functions with **Python** magic functions (functions with leading and trailing double underscore, for example `__init__` or `__eq__`) - those are completely different things! In this and next parts of the article, whenever you see a **magic function** - it's an IPython magic function.

Moreover, you can create your own magic functions. There are 2 different types of magic functions.

The first type - called **line magics** - are prefixed with `%` and work like a command typed in your terminal. You start with the name of the function and then pass some arguments, for example:

```
In [1]: %timeit range(1000)
255 ns ± 10.3 ns per loop (mean ± std. dev. of 7 runs, 1000 loops each)
```

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My favorite one is the `%debug` function. Imagine you run some code and it throws an exception. But given you weren't prepared for the exception, you didn't run it through a debugger. Now, to be able to debug it, you would usually have to go back, put some breakpoints and rerun the same code. Fortunately, if you are using IPython there is a better way! You can run `%debug` right after the exception happened and IPython will start an interactive debugger for that exception. It's called *post-mortem debugging* and I absolutely love it!

The second type of magic functions are **cell magics** and they work on a block of code, not on a single line. They are prefixed with `%%`. To close a block of code, when you are inside a cell magic function, hit `Enter` twice. Here is an example of `timeit` function working on a block of code:

```
In [2]: %%timeit elements = range(1000)
...: x = min(elements)
...: y = max(elements)
...:
...:
52.8 µs ± 4.37 µs per loop (mean ± std. dev. of 7 runs, 1000 loops each)
```

PYTHON

Both the line magic and the cell magic can be created by simply decorating a Python function. Another way is to write a class that inherits from the `IPython.core.magic.Magics`. I will cover this second method in a different article.

Creating line magic function

That's all the theory. Now, let's write our first magic function. We will start with a `line magic` and in the second part of this tutorial, we will make a `cell magic`.

What kind of magic function are we going to create? Well, let's make something useful. I'm from Poland and in Poland we are used to [Polish notation](#) for writing down mathematical operations. So instead of writing $2 + 3$, we write $+ 2 3$. And instead of writing $(5 - 6) * 7$ we write $* - 5 6 7$.

Let's write a simple Polish notation interpreter. It will take an expression in Polish notation as input, and output the correct answer. To keep this example short, I will limit it to only the basic arithmetic operations: $+$, $-$, $*$, and $/$.

Here is the code that interprets the Polish notation:

```
PYTHON
def interpret(tokens):
    token = tokens.popleft()
    if token == "+":
        return interpret(tokens) + interpret(tokens)
    elif token == "-":
        return interpret(tokens) - interpret(tokens)
    elif token == "*":
        return interpret(tokens) * interpret(tokens)
    elif token == "/":
        return interpret(tokens) / interpret(tokens)
    else:
        return int(token)
```

Next, we will create a `%pn` magic function that will use the above code to interpret Polish notation.

```
PYTHON
from collections import deque

from IPython.core.magic import register_line_magic

@register_line_magic
def pn(line):
    """Polish Notation interpreter

    Usage:
    >>> %pn + 2 2
    4
    """
    return interpret(deque(line.split()))
```

And that's it. The `@register_line_magic` decorator turns our `pn` function into a `%pn` magic function. The `line` parameter contains whatever is passed to the magic function. If we call it in the following way: `%pn + 2 2`, `line` will contain `+ 2 2`.

To make sure that IPython loads our magic function on startup, copy all the code that we just wrote (you can find the whole file [on GitHub](#)) to a file inside IPython startup directory. You can read more about this directory in the [IPython startup files post](#). In my case, I'm saving it in a file called:

```
SHELL
~/ipython/profile_default/startup/magic_functions.py
```

(name of the file doesn't matter, but the directory where you put it is important).

Ok, it's time to test it. Start IPython and let's do some *Polish* math:

```
In [1]: %pn + 2 2
Out[1]: 4

In [2]: %pn * - 5 6 7
Out[2]: -7

In [3]: %pn * + 5 6 + 7 8
Out[3]: 165
```

PYTHON

Perfect, it works! Of course, it's quite rudimentary - it only supports 4 operators, it doesn't handle exceptions very well, and given that it's using recursion, it might fail for very long expressions. Also, the `queue` module and the `interpret` function will now be available in your IPython sessions, since whatever code you put in the `magic_function.py` file will be run on IPython startup.

But, you just wrote your first magic function! And it wasn't so difficult!

At this point, you are probably wondering - *Why didn't we just write a standard Python function?* That's a good question - in this case, we could simply run the following code:

```
In [1]: pn('+ 2 2')
Out[1]: 4
```

PYTHON

or even:

```
In [1]: interpret(deque('+ 2 2'.split()))
Out[1]: 4
```

PYTHON

As I said in the beginning, magic functions are usually helper functions. Their main advantage is that when someone sees functions with the `%` prefix, it's clear that it's a magic function from IPython, not a function defined somewhere in the code or a built-in. Also, there is no risk that their names collide with functions from Python modules.

Conclusion

I hope you enjoyed this short tutorial and if you have questions or if you have a cool magic function that you would like to share - drop me [an email](#) or ping me on [Twitter](#)!

Stay tuned for the next parts. We still need to cover the **cell magic** functions, **line AND cell magic** functions and **Magic** classes.

Image from: [Pexels](#)

1. It's a joke. We don't use *Polish notation* in Poland 😊🇵🇱

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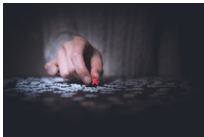
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