TOOLS FOR WRITING

CONSISTENT AND RELIABLE

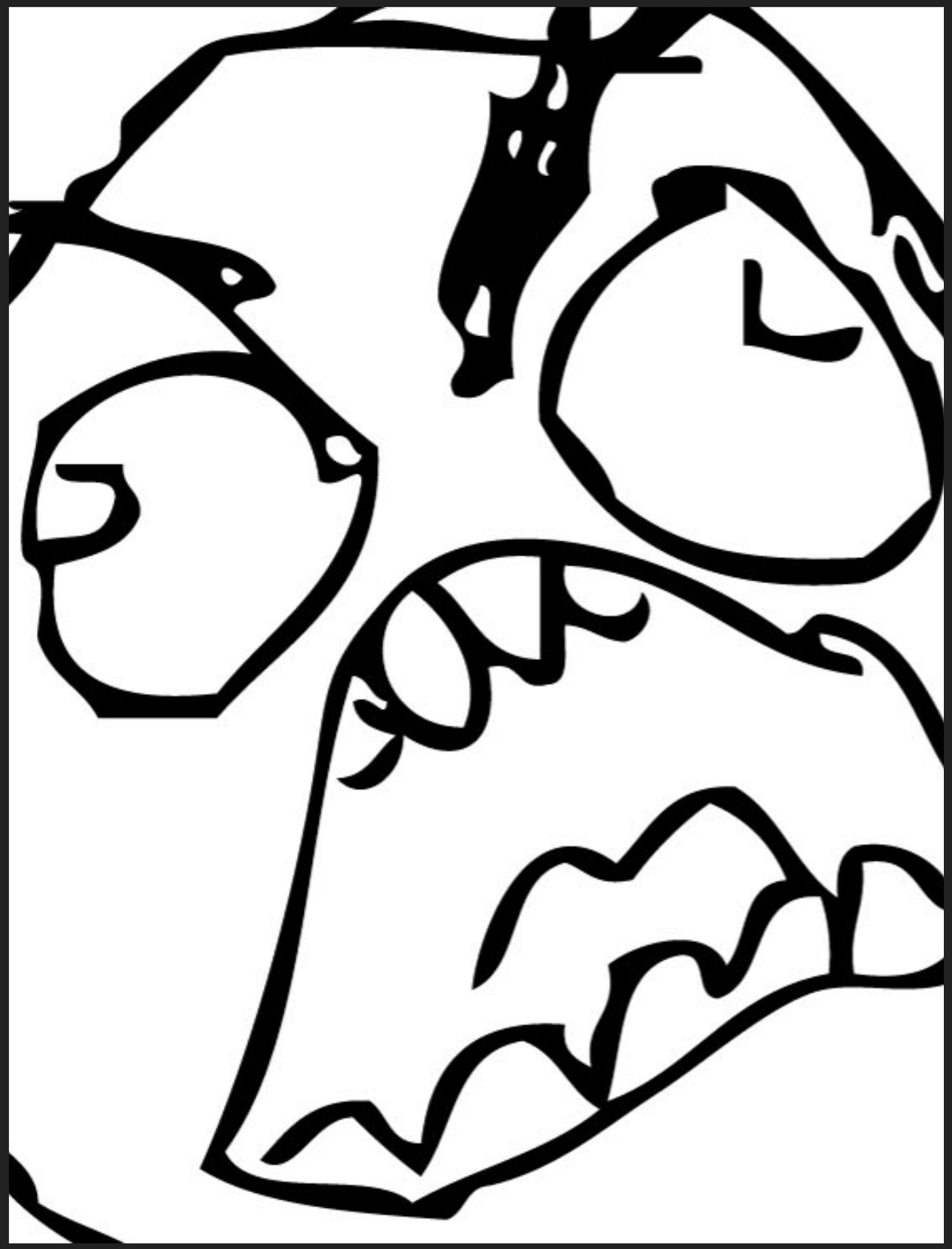
PYTHON CODE

TODAY WE'LL TALK ABOUT . . .

- Writing consistent Python code.
- Tools for enforcing code consistency.
- Type hints and `mypy`.
- Writing consistent docstrings.
- … will not talk about unit testing.

MOTIVATION

- Make your programming life easier.
- Inefficient workflow, wasted time on individual coding quirks.
- Simple tools can help you become a better programmer.
- Which tools make sense in a data science context?



INCONSISTENCY IS THE HOBGOBLIN OF LITTLE MINDS.

PEP 8: Style Guide for Python Code

WHY SHOULD YOU CARE ABOUT CODING STYLE?

- The mental health of your future self.
- The mental health of your coworkers.
- Spend less time on formatting, more on logic.

PEP 8 – THE OFFICIAL STYLE GUIDE

- **P**ython **E**nhancement **P**roposal.
- PEP 8 formalises a recommended programming style.
- PEP 8 covers:
  - Naming styles and conventions.
  - Whitespace, maximum line lengths, indentations, trailing commas, and much more.

EXAMPLE: NAMING STYLES

Type	Example
Function/method	`function, my_function`
Variable	`variable, my_variable`
Class	`Class, MyClass`
Constant	`CONSTANT, MY_CONSTANT`
Module	`module.py, my_module.py`
Package	`package, mypackage`

PLEASE, PLEASE, PLEASE, PLEASE READ PEP 8

ENFORCING CONSISTENCY

- Memorise PEP 8? Ain’t nobody got time for dat.
- Use linters!
- Linters check your code for logical errors and compliance with PEP 8.
- Most IDEs already use linting tools.

POPULAR PYTHON LINTERS

- `pylint`
  - Very powerful.
  - User-unfriendly defaults.
- `flake8`
  - Wrapper around `pyflakes`, `pycodestyle` and `mccabe`.
  - User-friendly defaults.

FLAKE8

- `pyflakes` checks your source files for errors. Does not complain about style.
- `pycodestyle` (formerly `pep8`) checks PEP 8 compliance.
- `mccabe` checks the complexity of your code (switched off by default).

EXAMPLE: USING FLAKE8

- Run `flake8` on `code_with_lint.py` through command line interface.
- Clone repository* to play with this example.

https://github.com/smu095/presentations/tree/master/python101

FLAKE8 OUTPUT

`{filename}:{line}:{column}:{error code} {message}`

- `W***/E***` are PEP 8 warnings (`pycodestyle`).
- `F***` are syntax errors (`pyflakes`).
- `C9**` are complexity errors (`mccabe`).
- Customisable, error messages can be ignored.

AUTOFORMATTING CODE

- Linters check your code, doesn’t fix it.
- Autoformatters enforce consistency by refactoring your code.
- **Idea:** Avoid formatting arguments in code review, focus on logic.

BLACK – THE UNCOMPROMISING CODE FORMATTER

- `black` is an opinionated autoformatter that enforces a superset of PEP 8.
- Produces smallest diffs possible to make code review faster.
- Some stylistic deviations from PEP 8, e.g.
  - maximum line length is 88 characters.
  - all single quotes replaced by double quotes.

EXAMPLE: USING BLACK

- Run `black` on unformatted_code`.py` through command line interface.
- Clone repository* to play with this example.

https://github.com/smu095/presentations/tree/master/python101

SO FAR WE HAVE TALKED ABOUT…

- Community guidelines for coding style.
- Linters that check your code for errors.
- Autoformatters that refactor your code so you don’t have to.
- There is a third linting tool, which relies on *type hints*.

STATIC VS. DYNAMIC TYPING

- Statically typed languages:
  - Variables bound to type.
- Dynamically typed languages:
  - Variables not bound to type.
  - Variables are allowed to change type.
  - Types are correctly inferred at runtime.

EXAMPLE: DYNAMIC TYPING IN PYTHON

```
>>> if False:
...     1 + "two"
... else:
...     1 + 2
3

>>> 1 + "two" # This will throw a TypeError
```

```
>>> thing = "Hello"
>>> type(thing)
<class 'str'>
>>> thing = 42
>>> type(thing)
<class 'int'>
```

STATIC TYPE CHECKING WITH MYPY

- `mypy` performs static type checking, i.e. code doesn't need to run to catch type errors.
- Needs your help, in the form of *type annotations*.
- Introduced in PEP 484, also called *type hints*.
- Completely optional, types are suggested but not enforced.

FUNCTION ANNOTATION

```
def ceiling(number):
    rounded = …
    return rounded
```

```
def ceiling(number: float) -> int:
    rounded = …
    return rounded
```

EXAMPLE: USING TYPE HINTS

- Run `mypy` on `type_hinting_example.py` through command line interface.
- Run `mypy` on `variable_hints.py` through command line interface.
- Clone repository* to play with this example.

https://github.com/smu095/presentations/tree/master/python101

SHOULD WE USE TYPE HINTING?

- Adds little value in short, throw-away scripts.
- Potential for a lot of value in bigger, collaborative projects.

TYPE HINTING YES-MEN

- More understandable, helps document code.
- More maintainable, easier to refactor.
- More reliable, catches bugs early.

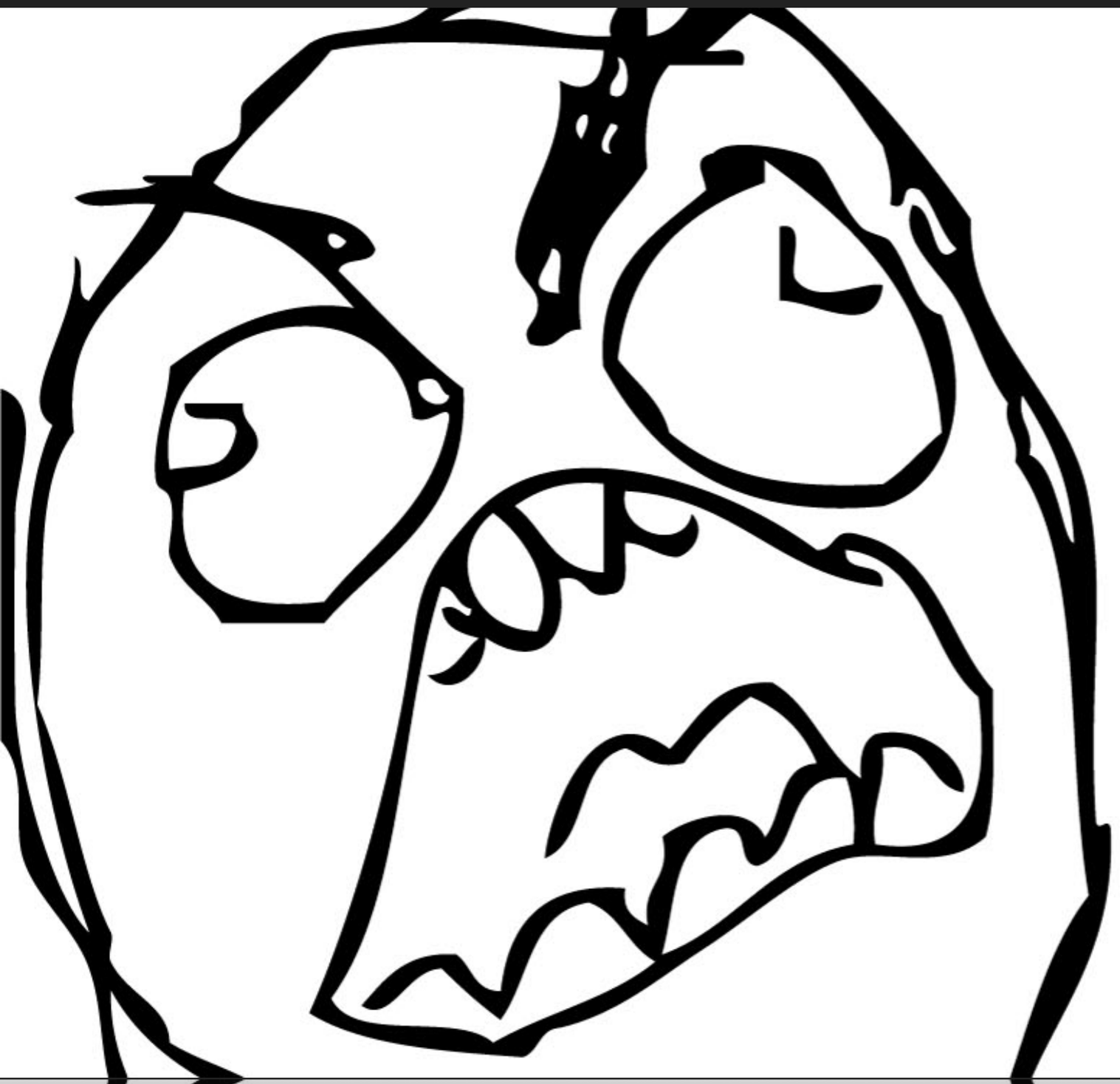
TYPE HINTING NAY-SAYERS

- Requires time and effort.
- Introduces some overhead.
- Introduces un-Pythonic verbosity.
- Only available in Python 3.5+*.
- Use `assert` statements instead.

* Works in earlier versions too, but with different syntax.

TYPE HINTING TAKEAWAYS

- Mildy controversial.
- Completely optional, Python will remain dynamically typed.
- More and more projects use type hinting and `mypy`, worth familiarising yourself with.
- Use your best judgement!



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DOCSTRINGS

- **Problem:** Terribly documented code, took forever to figure out how it worked.
- PEP 257 formalises a style guide for docstrings.
- Docstrings come in different formats.
- Up to you, but stay consistent within your project.

A MINIMAL FUNCTION DOCSTRING

- Every docstring should at the very least contain:
  - A one-liner summarising the function.
  - A description of the parameters.
  - A description of the return value.
- Surround by triple quotes, place immediately after function declaration.

EXAMPLE: UNDOCUMENTED FUNCTION

```
def get_spreadsheet_cols(file_loc, print_cols=False):
    file_data = pd.read_excel(file_loc)
    col_headers = list(file_data.columns.values)

    if print_cols:
        print("\n".join(col_headers))

    return col_headers
```

EXAMPLE: RESTRUCTURED TEXT (RST)

```
"""Gets and prints the spreadsheet's header columns

:param file_loc: The file location of the spreadsheet
:type file_loc: str
:param print_cols: A flag used to print the columns to the console
    (default is False)
:type print_cols: bool
:returns: a list of strings representing the header columns
:rtype: list
"""
```

EXAMPLE: GOOGLE DOCSTRINGS

```
"""Gets and prints the spreadsheet's header columns

Parameters:
    file_loc (str): The file location of the spreadsheet
    print_cols (bool): A flag used to print the columns to the console
        (default is False)

Returns:
    list: a list of strings representing the header columns
"""
```

EXAMPLE: NUMPY/SCIPY DOCSTRINGS

```
"""Gets and prints the spreadsheet's header columns

Parameters
----------
file_loc : str
    The file location of the spreadsheet
print_cols : bool, optional
    A flag used to print the columns to the console (default is False)

Returns
-------
list
    a list of strings representing the header columns
"""
```

INCLUDING EXAMPLES

- The `numpy` docstring format strongly encourages examples in docstrings.
- Examples use the `docstring` module to parse docstrings for runnable examples of code.
- **Idea:** Make sure examples are running as shown, not intended as tests.

BUILDING DOCUMENTATION

- reStructuredText, Google and Numpy docstrings are widely used.
- Can produce well-formatted reference guides using tools like `sphinx` and `autodoc`.

PRACTICAL USE OF LINTING TOOLS

- Typically used in continuous integration pipeline.

```
37  # ------------------- script: run the build script ---------------------------
38  before_script:
39    - pip install . # Install the package
40    - pip show treedoc # Show information about the package
41    - black . --check # Check that code is formatted correctly w.r.t. black
42    - flake8 treedoc --select=F401 --exclude=__init__.py # Unused imports
43    - bash ./linting.sh # Spelling errors
44    - mypy treedoc/*.py --ignore-missing-imports --show-error-context # Static type analysis
```

SUMMARY (FRIENDLY VERSION)

- Read PEP 8.
- Follow the community's recommended style guide.
- Use linting and autoformatting tools when appropriate.
- Probably a good idea to familiarise yourself with type hints.
- Make a habit of writing good docstrings.

SUMMARY (DICTATOR VERSION)

- Agree on an autoformatter and use it religiously.
- Set master protection on repository.
- All merge commits proposed via feature branches.
- Set up CI to fail build if any errors are flagged by linters.
- All pull requests must be reviewed prior to merge.
- Squash merge exclusively.

THE END