Introduction to Python

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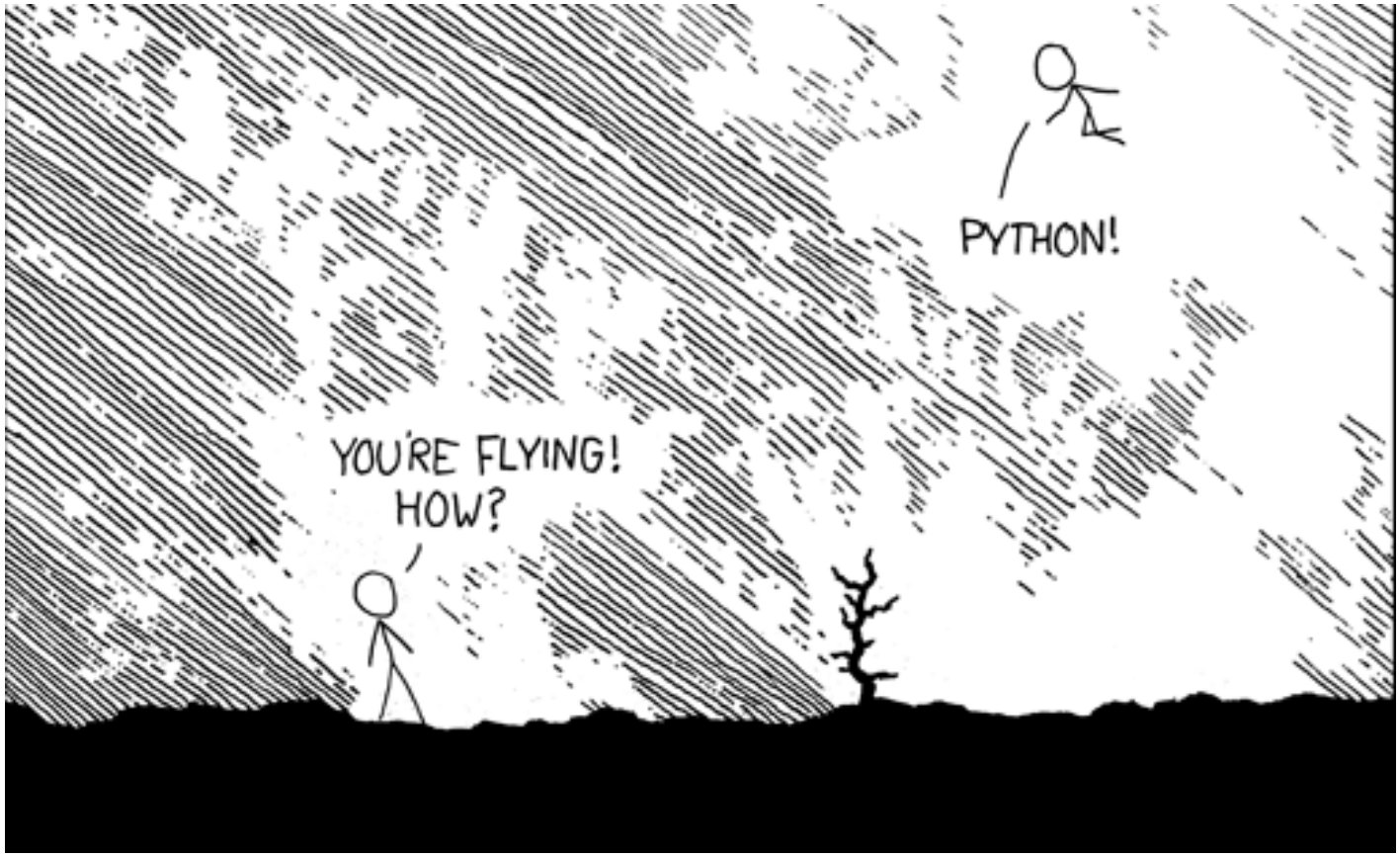
Principles of Programming Languages, BUT FIT, 2019-03-04

Motto

"Python makes you fly."



https://xkcd.com/353/

Why Python? Whetting our Appetite

Feb 2019	Feb 2018	Change	Programming Language	Ratings	Change
1	1		Java	15.876%	+0.89%
2	2		C	12.424%	+0.57%
3	4	▲	Python	7.574%	+2.41%
4	3	▼	C++	7.444%	+1.72%
5	6	▲	Visual Basic .NET	7.095%	+3.02%
6	8	▲	JavaScript	2.848%	-0.32%
7	5	▼	C#	2.846%	-1.61%
8	7	▼	PHP	2.271%	-1.15%
9	11	▲	SQL	1.900%	-0.46%
10	20	⇈	Objective-C	1.447%	+0.32%

http://www.tiobe.com/tiobe-index/

Why Python? Whetting our Appetite

Worldwide, Feb 2019 compared to a year ago:

Rank	Change	Language	Share	Trend
1	↑	Python	26.42 %	+5.2 %
2	↓	Java	21.2 %	-1.3 %
3	↑	Javascript	8.21 %	-0.3 %
4	↑	C#	7.57 %	-0.5 %
5	↓↓	PHP	7.34 %	-1.2 %
6		C/C++	6.23 %	-0.3 %
7		R	4.13 %	-0.1 %
8		Objective-C	3.04 %	-0.8 %
9		Swift	2.56 %	-0.6 %
10		Matlab	1.98 %	-0.4 %

http://pypl.github.io/

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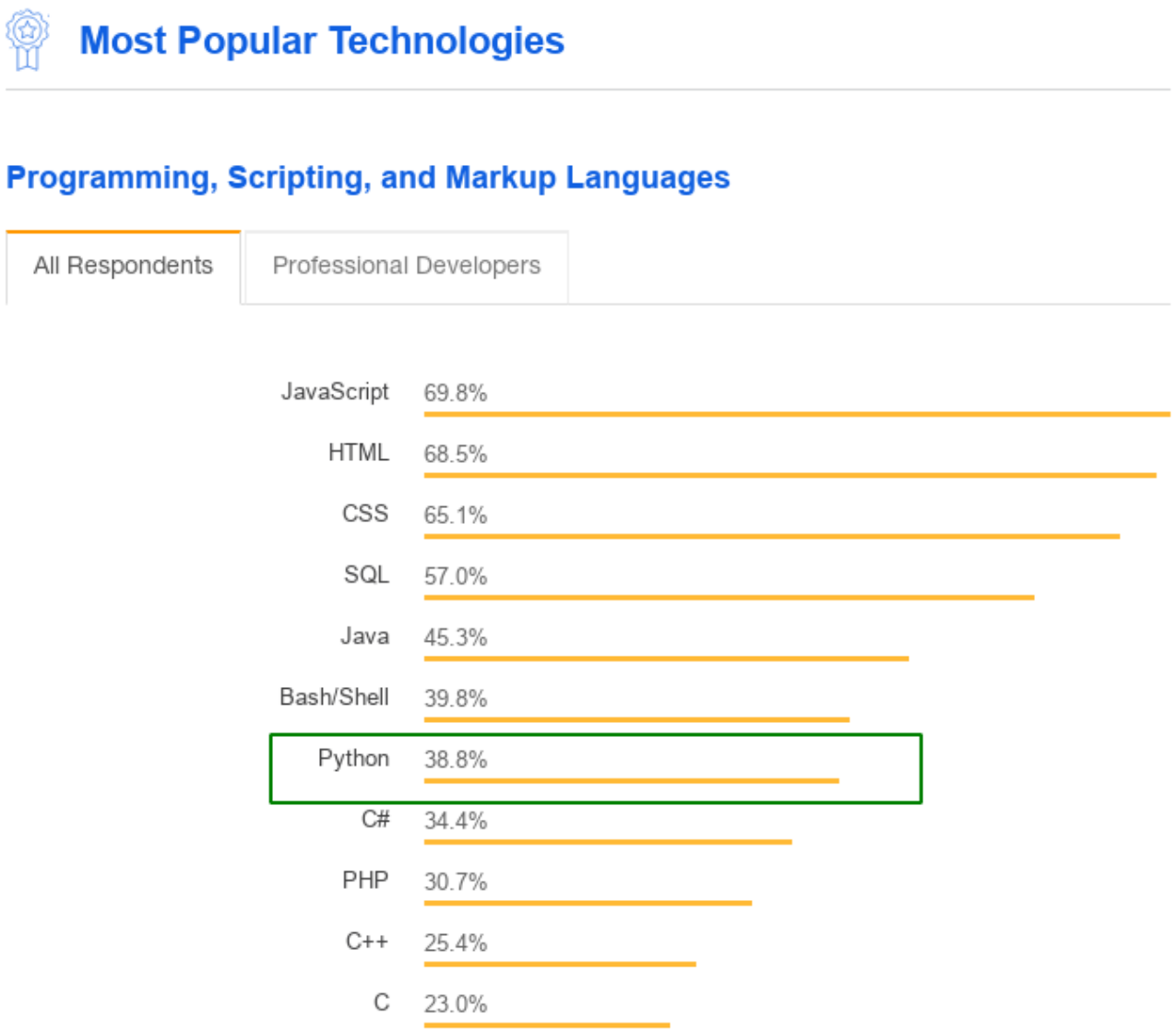

https://insights.stackoverflow.com/survey/2018

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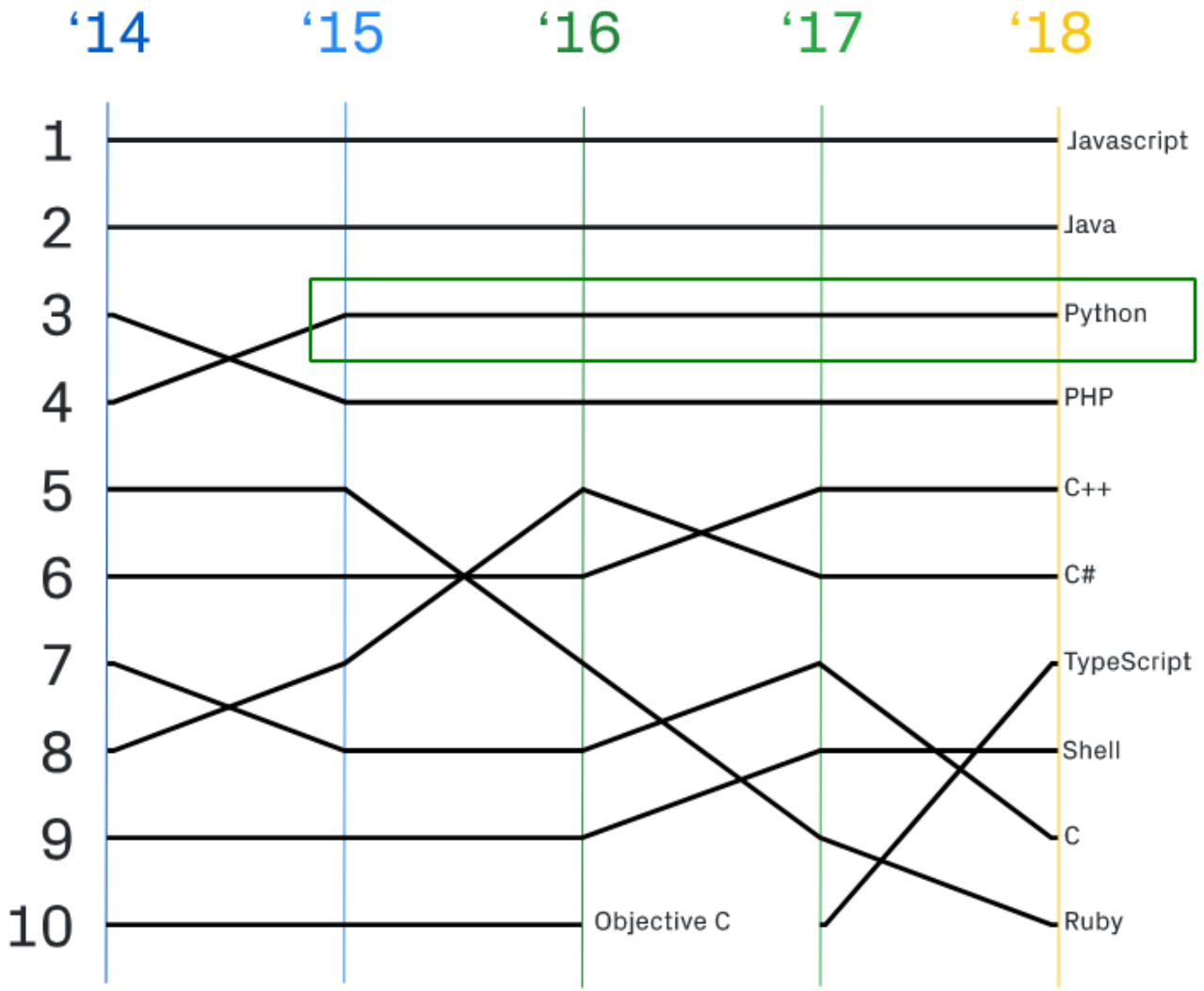

https://octoverse.github.com/projects#languages

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- free (both as in "free speech" and "free beer")

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  - Python 3 (December 2008)
    - Python 3.7 (June 2018) – latest 3.x version

Diving Into Python

- interactive shell

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$ python
Python 3.7.2 (default, Jan 10 2019, 23:51:51)
>>> print('Hello, world!')
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$ python hello.py
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```

- combination

```
$ python -i hello.py
Hello, world!
>>>
```

Built-In Primitive Data Types

- NoneType

```
None
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'Do you like jalapeño peppers?'
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```
'Do you like jalapeño peppers?'
```

- bytes

```
b'\x68\x65\x6c\x6c\x6f'
```

Intermezzo: Encodings

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https://cs-blog.petrzemek.net/2015-08-09-znakova-sada-vs-kodovani

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- set

```
{1, 2, 3, 4, 5}
```

- dict

```
{
    'John': 2.5,
    'Paul': 1.5,
    'Laura': 1,
}
```

Variables and Bindings

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>>>  a
[1, 2, 3]
>>>  b
[1, 2, 3]
>>>  b = [4]                  # a --> [1, 2, 3]; b --> [4]
```

Operations

arithmetic `+` `-` `*` `/` `//` `%` `**` `@`

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arithmetic `+ - * / // % ** @`

comparison `== != < > <= >=`

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Basic Statements

`=` assignment statements

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x = 1
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if conditional execution

```
if x > 10:
    x = 10
elif x < 5:
    x = 5
else:
    print('error')
```

Basic Statements (Continued)

for

traversing collections

```
for color in ['red', 'green', 'blue']:
    print(color)
```

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while repeated execution

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while x > 0:
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break — breaking from a loop

continue — continuing with the next cycle of a loop

assert — assertions

return — returning from a function

pass — does nothing

Functions

```
def factorial(n):
    """Returns the factorial of n."""
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    else:
        return n * factorial(n - 1)

x = factorial(5)  # 120
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- default arguments
- keyword arguments
- variable-length arguments

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        ...  # C
        while cond:
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- `if`, `for`, etc. do not introduce a new scope
- explicit declarations via `global` and `nonlocal`

Lifetimes

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- global variables exist until program exits
- local variables exist until function exits
- explicit deletion via `del`

Namespaces, Modules, and Packages

```
# Example of a custom package:

network/
    __init__.py
    socket.py
    http/
        __init__.py
        request.py
        response.py
        ...
    bittorrent/
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        torrent.py
        bencoding.py
        ...
    ...
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    ...

from network.http.request import Request
```

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import time
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# Import multiple items from a module.
from collections import namedtuple, defaultdict
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# Import under a different name.
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# Import a single item from a module.
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# Import multiple items from a module.
from collections import namedtuple, defaultdict

# Import everything from the given module.
# (Use with caution!)
from email import *
```

Object-Oriented Programming

```
from math import sqrt

class Point:
    """Representation of a point in 2D space."""

    def __init__(self, x, y):
        self.x = x
        self.y = y

    def distance(self, other):
        return sqrt((other.x - self.x) ** 2 +
                    (other.y - self.y) ** 2)

a = Point(1, 2)
b = Point(3, 4)
print(a.distance(b))  # 2.8284271247461903
```

Object-Oriented Programming (Basics)

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- methods versus functions
- classes are first-class objects
- everything is public
- everything can be overridden
- each class automatically inherits from `object`

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- classes are instances of *metaclasses*

Error Handling and Exceptions

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https://cs-blog.petrzemek.net/2013-11-17-jeste-jednou-a-lepe-prace-se-souborem-v-pythonu

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name = 'Joe'
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- list/set/dict comprehensions

```
list = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]
squares = [x ** 2 for x in list if x % 2 == 0]
# [4, 16, 36, 64, 100]
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- conditional expressions

```
cost = 'cheap' if price <= 100 else 'expensive'
```

Some Cool Language Features (Continued)

- `eval()` and `exec()`

```
a = eval('1 + 3')          # a = 4
exec('b = [1, 2, 3]')      # b = [1, 2, 3]
```

Some Cool Language Features (Continued)

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- dynamic typing

```
def print_all(col):
    for i in col:
        print(i)

print_all([1, 2, 3])
print_all(('a', 'b', 'c'))
```

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- `enumerate()`

```
for i, person in enumerate(people):
    print(i, ':', person)
```

Some Cool Language Features (Continued)

- chained comparisons

```
if 1 < x < 5:
    # ...
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1_483_349_803
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- tuple unpacking

```
head, *middle, tail = [1, 2, 3, 4, 5]
```

Some Cool Language Features (Continued)

- generators

```
def fibonacci():
    a, b = 0, 1
    while True:
        yield a
        a, b = b, a + b

fib = fibonacci()
next(fib)   # 0
next(fib)   # 1
next(fib)   # 1
next(fib)   # 2
next(fib)   # 3
next(fib)   # 5
next(fib)   # 8
```

Weird Language Features

- `for` with `else`

```
for item in some_list:
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- mutating default arguments

```
def foo(x=[]):
    x.append(4)
    return x

print(foo([1, 2, 3]))  # [1, 2, 3, 4]
print(foo())           # [4]
print(foo())           # [4, 4]
```

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- non-ASCII identifiers

```
π = 3.1415
```

What We Have Skipped

- metaclasses
- decorators
- descriptors
- context managers
- threading
- multiprocessing
- asynchronous I/O
- coroutines
- annotations (including type hints)
- ... and more ...

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+ productivity (high-level constructs)
+ powerful built-in types
+ elegant and flexible module system
+ excellent standard library
+ reflection
+ multiparadigm (procedural, object oriented)
+ generic programming (duck typing)
+ widely used

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https://cs-blog.petrzemek.net/2014-10-26-co-se-mi-nelibi-na-pythonu

Summary

- imperative language
- multiparadigm (procedural, object oriented)
- strongly typed
- dynamically typed
- interpreted (translated to internal representation)
- modularity is directly supported (packages, modules)

Where to Look for Further Information?

Python Programming Language – Official Website

https://www.python.org/

Python 3 Documentation

https://docs.python.org/3/

Official Python 3 Tutorial

https://docs.python.org/3/tutorial/

Dive into Python 3

http://www.diveintopython3.net/

Learning Python, 5th Edition (2013)

http://shop.oreilly.com/product/0636920028154.do

Fluent Python (2015)

http://shop.oreilly.com/product/0636920032519.do

Témata bakalářských prací v Avastu

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