October 2016 meeting.

PyRVA Sub-lightning talk

Today's topic: an example of a list comprehension.

slides: github.com/georgeflanagin/pyrva

First time only: my bio

I am George Flanagin, and I ...

- work at UR as a computer scientist,
- used to teach computer science at VCU,
- have been working in Python 3 daily for two years,
- have a background in compiler writing and natural language processing.


```
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```

For noobs: what is a list comprehension?

A list comprehension replaces subscripting, loops, and maps with compact one-liners.

Wrong way to build "x"

```
x = []
for _ in range(0, len(b)):
    x.append(foo(b[_]))
```

Python way to build "ar"

```
x = [ foo(_) for _ in b ]
```

The Problem with List Comprehensions

- Some list comprehension examples are trivial
- Some list comprehension examples are synthetic
- Some list comprehension examples are … incomprehensible.

Maybe this one is better.

Today's Example

We needed a work-day calendar.
These are usually called "holiday calendars"

Given a date (often today), we need to know if today is a workday, or …
… what is the next workday, or …
… what was the most recent workday.

Simple concept

Build a list of either all the exceptions or …
Build a list of all the work-days …

Find out if the date you want is in (or not in) the list.

What we decided to do

- Make a UR Julian calendar.
- Fill it with the days from say t-10 days to t+400 days (rarely do we know any schedule more than one year into the future)
- Test inclusion.

Step 1: UR Julian Calendar

University of Richmond was founded 1 August 1830. That's Day Zero for us.

```
UR_ZERO_DAY = datetime.datetime(1830, 8, 1)
def urdate(dt:datetime.datetime = None) -> int:
    """
    Return number of days since 1 August 1830.
    """
    if dt is None: dt = datetime.datetime.today()
    return (dt - UR_ZERO_DAY).days
```

Step 2: Define the calendar

Our config files are all in JSON, so …

```
{"urcalendar":{
    "bizdays":[1,2,3,4,5],
    "holidays":[ "November 24 2016", "December 25 2016",
        "January 1 2017", "January 16 2017",
        "May 29 2017", "July 4 2017", "September 4 2017"
        ]
    }
}
```

Step 3: The concept of a workday...

The Python test needs to be simple and clear

```
isWorkday = (d in urcalendar.bizdays and
                d not in urcalendar.holidays)
```

Step 4: Redefine search

This is really what we want:

```
isWorkday = d in big_list_of_days
```

But:

- Searching a long list looks like we don't know what we are doing.
- How do we build this list of days in a clear manner.

Step 5: The fix for inefficiencies

Naturally, there are batteries-included Python modules to help us.

```
import dateutil
import sortedcontainers
```

- dateutil gives us the ability to parse user-readable strings into datetime objects.
- sortedcontainers gives us the ability to binary search a long list.

Step 6: Let's look at the calendar code as a whole (before we examine it line by line

```
def mdays(urcal:dict) -> sortedcontainers.SortedList:
    """
    """
    start = urdate()
    urcal['holidays'] = [ urdate(dateutil.parser.parse(_))
        for _ in urcal['holidays']]
    return sortedcontainers.SortedList([
        _ for _ in
        range(start-10, start+400)
        if _ % 7 in urcal['bizdays']
        and _ not in urcal['holidays']])
```

Step 7: Comprehension #1

```
urcal['holidays'] = [ urdate(dateutil.parser.parse(_))
        for _ in urcal['holidays']]
```

Translation: comprehensions are read right-to-left (!)

- for _ in urcal['holidays'] .... look at each text string in the holidays list
- dateutil.parser.parse(_) ... Parse it!
- urdate(...) ... Change it into an integer offset from 1 August 1830
- [..] ... make a new list
- change the reference of urcal['holidays'] to the new list.

Step 8: Comprehension #2

```
[ _ for _ in
    range(start-10, start+400)
       if _ % 7 in urcal['bizdays']
           and _ not in urcal['holidays']]
```