Comprehensions

Types of comprehensions

- list comprehensions
- set comprehensions
- dictionary compreher

Style!

- declarative
- functional

- **readable**
- **expressive**
- **effective**

```
[ expr(item) for item in iterable ]
```

```
{ expr(item) for item in iterable }
```

```
{ key_expr:value_expr for item in iterable }
```

Duplicates: later keys overwrite earlier keys

Don't cram too much complexity into comprehensions!

```
>>> import os
>>> import glob
>>> file_sizes = {os.path.realpath(p): os.stat(p).st_size
...                for p in glob.glob('*.py')}
>>> pp(file_sizes)
{'/Users/pyfund/examples/exceptional.py': 400,
 '/Users/pyfund/examples/keypress.py': 778,
 '/Users/pyfund/examples/scopes.py': 133,
 '/Users/pyfund/examples/words.py': 1185}
```

Filtering works with:

- list comprehensions
- set comprehensions
- dictionary comprehensions

optional **filtering clause**

```
[ expr(item) for item in iterable if predicate(item) ]
```

python Iteration protocols

Iterable protocol

Iterable objects can be passed to the built-in `iter()` function to get an iterator.

```
iterator = iter(iterable)
```

Iterator protocol

Iterator objects can be passed to the built-in `next()` function to fetch the next item.

```
item = next(iterator)
```

Stateful generators

- Generators resume execution
- Can maintain state in local variables
- Complex control flow
- Lazy evaluation

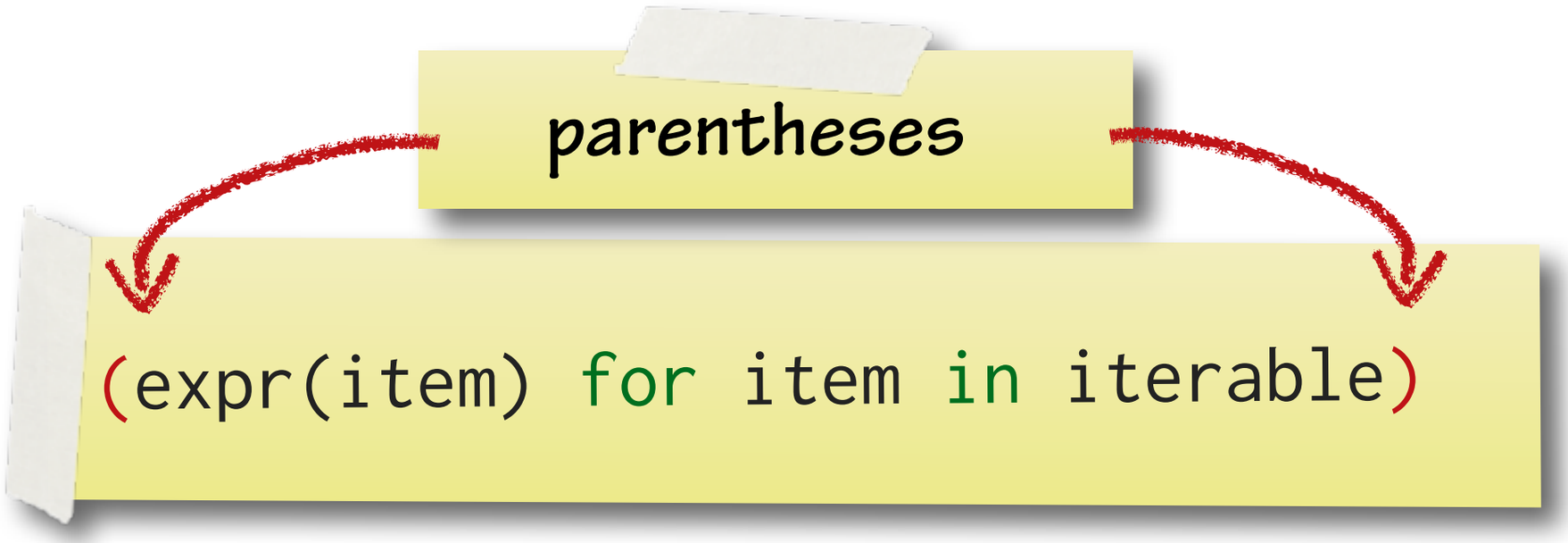
```
def take(count, iterable):
    "Take first count elements"
    counter = 0
    for item in iterable:
        if counter == count:
            return
        counter += 1
        yield item
```

Laziness and the Infinite

- Just in Time Computation
- Infinite (or large) sequences
  - sensor readings
  - mathematical series
  - massive files

Generator comprehensions

- Similar syntax to list comprehensions
- Create a generator object
- Concise
- Lazy evaluation


parentheses
(expr(item) for item in iterable)

Comprehensions, Generators & Iterables Summary

- **Comprehensions**

  - Comprehensions are a concise syntax for describing lists, sets and dictionaries.

  - Comprehensions operate on an iterable source object and apply an optional predicate filter and a mandatory expression, both of which are usually in terms of the current item.

  - Iterables are objects over which we can iterate item by item.

  - We retrieve an iterator from an iterable object using the built-in `iter()` function.

  - Iterators produce items one-by-one-from the underlying iterable series each time they are passed to the built-in `next()` function

Comprehensions, Generators & Iterables Summary

- **Generators**
  - Generator functions allow us to describe series using imperative code.
  - Generator functions contain at least one use of the `yield` keyword.
  - Generators are iterators. When advanced with `next()` the generator starts or resumes execution up to and including the next `yield`.
  - Each call to a generator function creates a new generator object.
  - Generators can maintain explicit state in local variables between iterations.
  - Generators are lazy, and so can model infinite series of data.
  - Generator expressions have a similar syntactic form to list comprehensions and allow for a more declarative and concise way of creating generator objects.

Getting Started – Summary

- **Iteration tools**
  - Built-ins such as
    - `sum()`
    - `any()`
    - `zip()`
    - `all()`
    - `min()`
    - `max()`
    - `enumerate()`
  - Standard library `itertools` module
    - `chain()`
    - `islice()`
    - `count()`
    - many more!