CSC148 winter 2018

functional programming, top-down

week 5

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Outline

idiomatic python

going with the (pep) tide

Python is more flexible than the community you are coding in. Try to figure out what the python way is

good read on python customs ...

- don't re-invent the wheel (except for academic exercises), e.g. `sum`, `set` → data type
  ↳ built-in functions
- use comprehensions when you mean to produce a new list (tuple, dictionary, set, ...) — clearer than alternative
- **any** $\approx \exists$ **all** $\approx \forall$
- use ternary `if` when you want an expression that evalutes in different ways, depending on a condition

example: add (cubes of) first 10 natural numbers

- You'll be generating a new list from `range(1, 11)`, so use a comprehension

- You want to add all the numbers in the resulting list, so use `sum`

try sum of cubes 0 ... 4

euclidean distance in 3 dimensions... or more

works for dimensions > 3 !

Suppose `L = [x, y, z]`, using `L`, compute:

$$\sqrt{x^2 + y^2 + z^2}$$

average string length

Try a really large list of words... 

Suppose `L = ["my", "dog", "has", "fancy", "fleas"]`, compute the average string length using `L`

try big list with any/all

```
with open("/usr/share/dict/words", "r") as words_file:
    word_list = words_file.read().split("\n")
```

- what's average length?
- do any contain "yx"?

list differences, lists without duplicates

- python `lists` allow duplicates, python sets don't

  `list(set(my_list))`

- python `sets` have a set-difference operator

  $\{1,2,3\} - \{2,3,4\}$

- python built-in functions `list()` and `set()` convert types

possible test topics

include...

- class design
- special methods
- subclasses
- inheritance
- testing, exceptions
- ADTs, stacks, queues, sacks
- linked lists

valid sudoku

what makes a sudoku square valid?

5	3	4	6	7	8	9	1	2
6	7	2	1	9	5	3	4	8
1	9	8	3	4	2	5	6	7
8	5	9	7	6	1	4	2	3
4	2	6	8	5	3	7	9	1
7	1	3	9	2	4	8	5	6
9	6	1	5	3	7	2	8	4
2	8	7	4	1	9	6	3	5
3	4	5	2	8	6	1	7	9

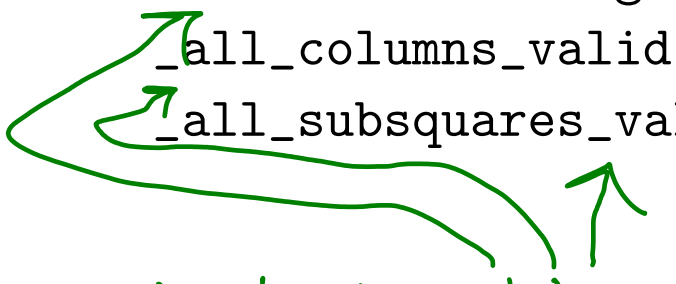
- valid rows
- valid columns
- valid subsquares

write a simple top-level function with these 3 ideas

code it!

use thoughtful wishing ...

```
def valid_sudoku(grid, digit_set: set) -> bool:
"""
Return whether grid represents a valid, complete sudoku.
"""
assert all([len(r) == len(grid) for r in grid])
assert len(grid) == len(digit_set)
return (_all_rows_valid(grid, digit_set) and
        _all_columns_valid(grid, digit_set) and
        _all_subsquares_valid(grid, digit_set))
```



technical detail: these don't exist (yet)

code those non-existent helpers!

```
def _all_rows_valid(grid, digit_set: set) -> bool:
    """
    Return whether all rows in grid are valid and complete.

    Assume grid has same number of rows as elements of digit_set
    and grid has same number of columns as rows.
    """
    assert all([len(r) == len(grid) for r in grid])
    assert len(grid) == len(digit_set)
    return all([_list_valid(r, digit_set) for r in grid])
```

↑ doesn't exist yet

code the helpers' helpers...

```
def _list_valid(r, digit_set: set) -> bool:
    """
    Return whether r contains each element of digit_set
    exactly once.

    Assume r has same number of elements as digit_set.
    """
    assert len(r) == len(digit_set)
    return set(r) == digit_set
```

we've bottomed out...