

[301] Dictionaries

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Learning Objectives Today

One more thing about lists:

<https://tyler.caraza-harter.com/cs301/spring19/materials/lec-18.html>

Data structures

- definition
- motivation

Dictionaries in Python

- creation, lookup
- updates, deletes

When to use dictionaries over lists

- holes in the labels
- non-integer labels

Chapter 11 of Think Python



Today's Outline

Data Structures

Mappings

Dictionaries

Updates and Deletes

Coding examples

Vocabulary: a list is an
example of a **data structure**

Data Structures


Definition (from Wikipedia):

a **data structure** is a **collection of data values**,
the **relationships** among them,
and the functions or **operations**
that can be applied to the data

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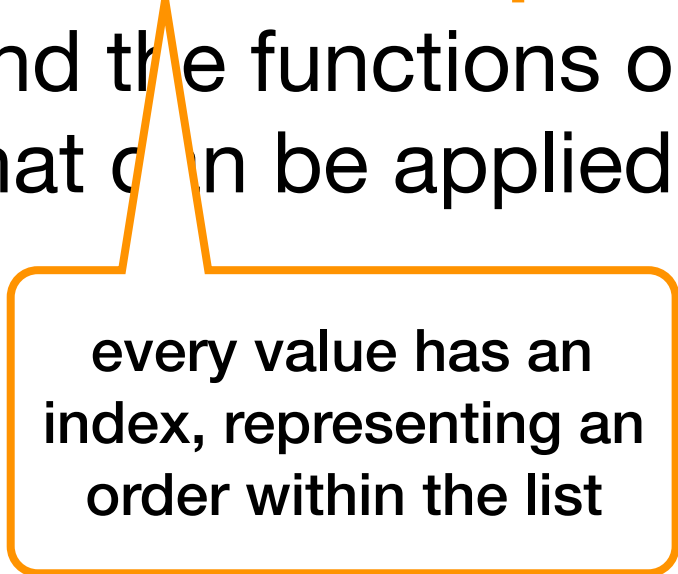


a list can contain a
bunch of values of
varying types


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every value has an
index, representing an
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`L.sort()`, `len(L)`, `L.pop(0)`, `L.append(x)`,
update, iterate (for loop), etc

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	values	relationships	operations
list	anything	ordered (0,1,...)	indexing, pop, len, index, slicing, in, iteration (for), ...
set	?????	no ordering	in, ==
dict			
...			

*suggested
note-taking*

Why do we need data structures to organize values?

Instead of just creating lots of variables?

Motivation

For loops:

- copy/paste is a pain
- don't know how many times to copy/paste before program runs

For data structures:

- creating many variables is a pain
(imagine your program analyzes ten thousand values)
- don't know how many values you will have before program runs

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Mappings

Common data structure approach:

- store many values
- give each value a label
- use labels to lookup values

Mappings

Common data structure approach:

- **store many values**
- give each value a label
- use labels to lookup values

List example:

nums = [300, 200, 400, 100]



we can have many values

Mappings

Common data structure approach:

- store many values
- **give each value a label**
- use labels to lookup values

List example:

nums = [300, 200, 400, 100]
 0 1 2 3

the “labels” are indexes, which are implicitly attached to values



Mappings

Common data structure approach:

- store many values
- give each value a label
- **use labels to lookup values**

List example:

```
nums = [300, 200, 400, 100]
```

```
x = nums[2] # x = 400
```



we use the “label” (i.e., the index)
to lookup the value (here 400)

Mappings

Common data structure approach:

- store many values
- give each value a **label**
- use **labels** to lookup values

lists are an **inflexible** mapping structure, because we don't have control over **labels**

List example:

```
nums = [300, 200, 400, 100]
```

```
x = nums[2]    # x=400
```

Mappings

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- store many values
- give each value a **label**
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lists are an **inflexible** mapping structure, because we don't have control over **labels**

List example:

what if we don't want consecutive integers as labels? E.g., 0, 10, and 20 (but not between)?

```
nums = [300, 200, 400, 100]
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```

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x = nums[2]    # x=400
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what if we don't want consecutive integers as labels? E.g., 0, 10, and 20 (but not between)?

what if we want to use strings as labels?

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Dictionary

Dictionaries map labels (called keys, rather than indexes) to values

- values can be anything we choose (as with lists)
- keys can be nearly anything we choose (must be immutable)

```
nums_list = [900, 700, 800]
```

```
nums_list[1] → 700
```

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a dictionary would let us give 700 a label other than its position



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```
nums_dict = {"first":900, "second":700, "third":800}
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we have the same values

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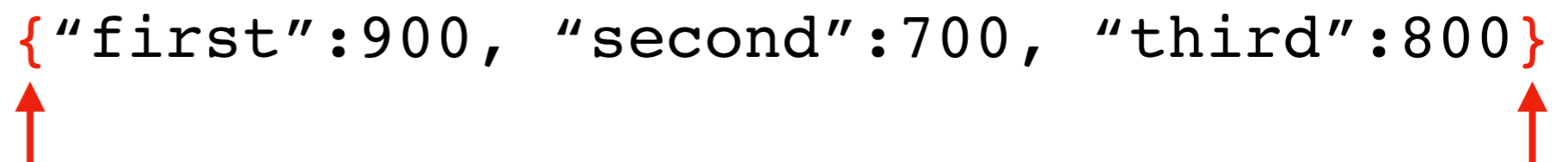
```
nums_list = [900, 700, 800]
```

A diagram showing a list of three numbers: 900, 700, and 800. Two red arrows point downwards from above to the first element (900) and the last element (800).

```
nums_list[1] → 700
```

A diagram showing the expression 'nums_list[1]' followed by a red arrow pointing to the right, which then points to the value '700'.

```
nums_dict = {"first":900, "second":700, "third":800}
```

A diagram showing a dictionary with three key-value pairs: "first":900, "second":700, and "third":800. Two red arrows point upwards from below to the keys "first" and "third".

we use **curly braces** instead of **square brackets**

careful! curly braces are for both sets and dicts

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we choose the label (called a key) for each value.
Here are keys are the strings "first", "second", and "third"

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we choose the label (called a key) for each value.
Here are keys are the strings “first”, “second”, and “third”

we put a colon between each key and value

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```

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nums_dict = {"first":900, "second":700, "third":800}
```

```
nums_dict["second"] → 700
```

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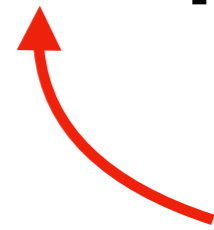
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```
nums_dict["second"] → 700
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lookup for a dict is like indexing for a list (label in brackets). Just use a key (that we chose) instead of an index.

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nums_list[1] → 700
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```

```
nums_dict["first"] → 900
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```

```
nums_dict["third"] → 800
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nums_list[1] → 700
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```
nums_dict = {"first": 900, "second": 700, "third": 800}
```

```
nums_dict["third"] → 800
```

index
labels values

0	900
1	700
2	600

ordered

key
labels values

"third"	600
"first"	900
"second"	700

no order

Why call it a dictionary?

break·fast

/ˈbrekfəst/ 

noun

noun: **breakfast**; plural noun: **breakfasts**

1. a meal eaten in the morning, the first of the day.
"I often have toast for my breakfast"

verb

verb: **breakfast**; 3rd person present: **breakfasts**; past tense: **breakfasted**; past participle: **breakfasted**;
gerund or present participle: **breakfasting**

1. eat breakfast.
"she **breakfasted on** French toast and bacon"

Why call it a dictionary?

this key
(the word)

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this value
(the definition)

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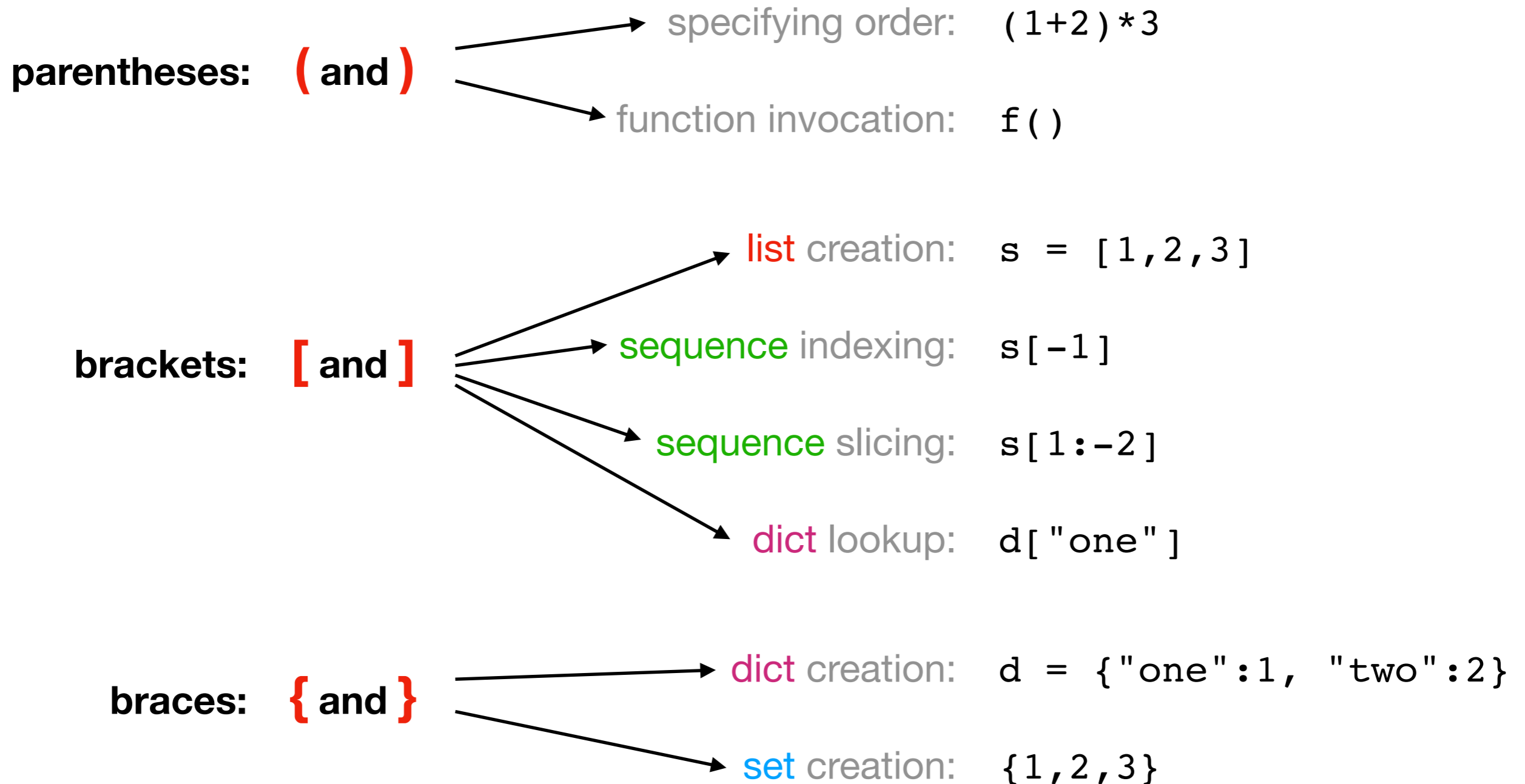
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Python dicts don't have order, though

A note on parenthetical characters

common structures

uses



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Dictionary Updates

```
>>> lst = ["zero", "ten", "not set"]  
>>> lst[2] = "twenty"
```


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['zero', 'ten', 'twenty']
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```

```
>>> lst[2] = "twenty"
```

```
>>> lst
```

```
['zero', 'ten', 'twenty']
```

```
>>> d = {0: "zero", 10: "ten", 20: "not set"}
```

dictionary updates look like list updates

Dictionary Updates

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>>> lst = ["zero", "ten", "not set"]
```

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```

```
>>> lst
```

```
['zero', 'ten', 'twenty']
```

```
>>> d = {0: "zero", 10: "ten", 20: "not set"}
```

```
>>> d[20] = "twenty"
```

dictionary updates look like list updates

Dictionary Updates

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>>> lst = ["zero", "ten", "not set"]  
>>> lst[2] = "twenty"  
>>> lst  
['zero', 'ten', 'twenty']
```

```
>>> d = {0: "zero", 10: "ten", 20: "not set"}  
>>> d[20] = "twenty"  
>>> d
```

dictionary updates look like list updates

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>>> lst = ["zero", "ten", "not set"]
>>> lst[2] = "twenty"
>>> lst
['zero', 'ten', 'twenty']
```

```
>>> d = {0: "zero", 10: "ten", 20: "not set"}
>>> d[20] = "twenty"
>>> d
{0: 'zero', 20: 'twenty', 10: 'ten'}
```

dictionary updates look like list updates

Dictionary Deletes

```
>>> lst = ["zero", "ten", "not set"]  
>>> lst.pop(-1)  
'not set'
```

Dictionary Deletes

```
>>> lst = ["zero", "ten", "not set"]
```

```
>>> lst.pop(-1)
```

```
'not set'
```

```
>>> lst
```

```
['zero', 'ten']
```



"not set" isn't in the list

Dictionary Deletes

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>>> lst = ["zero", "ten", "not set"]
```

```
>>> lst.pop(-1)
```

```
'not set'
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```
>>> lst
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```
['zero', 'ten']
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>>> d = {0: "zero", 10: "ten", 20: "not set"}
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dictionary deletes look like list deletes

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>>> d.pop(20)
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```
'not set'
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```
>>> d
```

```
{0: 'zero', 10: 'ten'}
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dictionary deletes look like list deletes

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Demo 1: Score Keeping App

Goal: let users enter scores for various players

Input:

- Commands: set score, lookup score, get highest

Output:

- The champion and their score

Example:

```
prompt> python scores.py
```

```
enter a cmd (type "help" for descriptions): set alice 10
```

```
enter a cmd (type "help" for descriptions): high
```

```
Alice: 10
```

```
enter a cmd (type "help" for descriptions): q
```

```
exiting
```



<https://www.google.com/url?sa=i&source=images&cd=&cad=rja&uact=8&ved=0ahUKEwi37NJD--bgAhUI5IMKHUXvAnUQMwahrKAEwAQ&url=https%3A%2F%2Fwww.amazon.com%2FTachikara-Porta-Score-Flip-Scoreboard%2Fdp%2FB006VP8M26&psig=AOvVaw2vUf2T1DoEbyB-Qj9Bi7Ws&ust=1551736624958766&ictx=3&uact=3>

Demo 2: Print Tornados per Year

Goal: given a CSV of tornados,
print how many occurred per year

Input:

- A CSV

Output:

- number per year

Example:

```
prompt> python tornados.py
```

```
...
```

```
2015: 9
```

```
2016: 2
```

```
2017: 4
```



<https://en.wikipedia.org/wiki/Tornado>

Demo 3: Wizard of Oz

Goal: count how often each word appears in the Wizard of Oz

Input:

- Plaintext of book (from Project Gutenberg)

Output:

- The count of each word



[https://en.wikipedia.org/wiki/The_Wizard_of_Oz_\(1939_film\)](https://en.wikipedia.org/wiki/The_Wizard_of_Oz_(1939_film))