[301] Dictionaries

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Learning Objectives Today

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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L.sort(), len(L), L.pop(0), L.append(x), update, iterate (for loop), etc

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suggested note-taking

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

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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Common data structure approach:

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

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List example:

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

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- 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:

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

List example:

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List example:

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

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

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

careful! curly braces are for both `sets` and `dicts`

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nums_dict = {“first”:900, “second”:700, “third”:800}
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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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Here are keys are the strings “first”, “second”, and “third”

we put a colon between each key and value

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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_dict["first"] → 900

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nums_dict["third"] → 800

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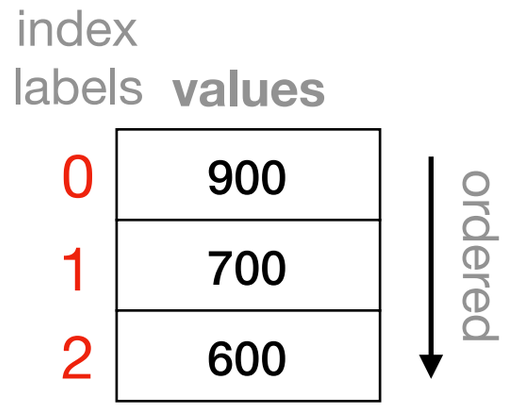

Why call it a dictionary?

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.
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Python dicts don't have order, though

A note on parenthetical characters

common structures **uses**

parentheses: **(** **and** **)**

- specifying order: `(1+2)*3`
- function invocation: `f()`

brackets: **[** **and** **]**

- list creation: `s = [1,2,3]`
- sequence indexing: `s[-1]`
- sequence slicing: `s[1:-2]`
- dict lookup: `d["one"]`

braces: **{** **and** **}**

- dict creation: `d = {"one":1, "two":2}`
- set creation: `{1,2,3}`

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```
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>>> lst[2] = "twenty"
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dictionary updates look like list updates

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Dictionary Deletes

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>>> lst = ["zero", "ten", "not set"]
>>> lst.pop(-1)
'not set'
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“not set” isn’t in the list

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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

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

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

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