Pair exercise, Introduction to Dictionaries

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For DSE5002

Dictionaries are Python data storage structures that use a key-value pair storage system, this is a hashed data storage system. We saw hashed storage once before, it is also used in sets. Dictionaries are a more "direct" form of hashed storage, a more general purpose version.

You store, and look up values, by providing a key associated with the value we want to store

This approach is common in NOSQL database systems.

The Redis database is of form of NOSQL, key-value hashed storage system, that can be used with many different languages

https://redis.io/lp/try1/?utm_campaign=gg_s_core_amer_en_brand_acq_21168833255&utm_source=google&utm_
26YDiDmRlGgiTZEEbf6UoQaArsHEALw_wcB

The lookup is fast, since dictionaries hash the key to find the value, they don't have to sort through the dictionary to find the value.

The key can be an integer or a string

If you need to do a lot of look-up or searching based on a string, use a dictionary, not a list, to produce code that will run faster.

Dictionaries are declared using curly brackets {}

When the system looks up a value in a dictionary, it computes a hash (complicated function) of the key and that value indicates where the data is stored. Hashing is quick relative to searching for an value in a list or a column of a data frame.

Think Python

https://allendowney.github.io/ThinkPython/chap10.html

Many SQL databases use Hashed Storages of variables that are keys or foreign keys in a table, since this greatly improves lock-up time.

In [1]:
```
# creating a dictionary

# note the use of curly brackets to indicate this is a dictionary structure
# keys and values are separated by semi-colons

# keys must be strings or integers

dictionary_emp1={"first":"Bob","middle":"J.","last":"Smith"}
```

In [2]:
```
#retrieve values using the key

dictionary_emp1["last"]
```

Out[2]:
```
'Smith'
```

In [3]:
```
# what do we have for Member functions

dir(dictionary_emp1)
```

Out[3]:
```
['__class__',
 '__class_getitem__',
 '__contains__',
 '__delattr__',
 '__delitem__',
 '__dir__',
 '__doc__',
 '__eq__',
 '__format__',
 '__ge__',
 '__getattribute__',
 '__getitem__',
 '__getstate__',
 '__gt__',
 '__hash__',
 '__init__',
 '__init_subclass__',
 '__ior__',
 '__iter__',
 '__le__',
 '__len__',
 '__lt__',
 '__ne__',
 '__new__',
 '__or__',
 '__reduce__',
 '__reduce_ex__',
 '__repr__',
 '__reversed__',
 '__ror__',
 '__setattr__',
 '__setitem__',
 '__sizeof__',
 '__str__',
 '__subclasshook__',
 'clear',
 'copy',
 'fromkeys',
 'get',
 'items',
 'keys',
 'pop',
 'popitem',
 'setdefault',
 'update',
 'values']
```

In [4]:
```python
# list of all keys

dictionary_emp1.keys()
```

Out[4]:
```
dict_keys(['first', 'middle', 'last'])
```

In [5]:
```python
#list of all values
```

```
dictionary_emp1.values()
```

Out[5]:
```
dict_values(['Bob', 'J.', 'Smith'])
```

In [6]:
```
#getting all the items in a dictionary, as the key-value pairs

# this returns a list of lists

dictionary_emp1.items()
```

Out[6]:
```
dict_items([('first', 'Bob'), ('middle', 'J.'), ('last', 'Smith')])
```

In [10]:
```
#adding one dictionary to another

address1={"street":"156 Broadway","town":"Milwaukee","state":"Wisconson","zi

#add the address1 dictionary to dictionary_emp1

dictionary_emp1.update(address1)

dictionary_emp1
```

Out[10]:
```
{'first': 'Bob',
 'middle': 'J.',
 'last': 'Smith',
 'street': '156 Broadway',
 'town': 'Milwaukee',
 'state': 'Wisconson',
 'zip': '34098'}
```

In [11]:
```
a=dictionary_emp1.pop('zip')
print(a)
print(dictionary_emp1)
```

```
34098
{'first': 'Bob', 'middle': 'J.', 'last': 'Smith', 'street': '156 Broadway',
'town': 'Milwaukee', 'state': 'Wisconson'}
```

Default values

We can set dictionaries to return default values if a particular key is not in the dictionary

Since there is no listing for the pets in the employee dictionary, the get returns "None", which has been set as the default

In [12]:
```
z= dictionary_emp1.get("pets:","None")
print(z)
```

```
None
```

The In operator and dictionaries

This will tell you if a particular string or integer is a key to a dictionary

```
In [13]: 'first' in dictionary_emp1
```

```
Out[13]: True
```

```
In [14]: 'biscuit' in dictionary_emp1
```

```
Out[14]: False
```

Mutability

We can change a dictionary once created

```
In [15]: dictionary_emp1['first']="Robert"
         dictionary_emp1
```

```
Out[15]: {'first': 'Robert',
          'middle': 'J.',
          'last': 'Smith',
          'street': '156 Broadway',
          'town': 'Milwaukee',
          'state': 'Wisconson'}
```

Dictionaries are iterable but they are not ordered

The ordering can be random

```
In [16]: #interating on key


         for key in dictionary_emp1:
             print(key)
```

```
first
middle
last
street
town
state
```

```
In [17]: #iteration on the values

         for value in dictionary_emp1:
             print(value)
```

```
first
middle
last
street
town
state
```

In [18]:
```
#iterating on both at once

for key,value in dictionary_emp1.items():
    print(key+" : "+value)
```

```
first : Robert
middle : J.
last : Smith
street : 156 Broadway
town : Milwaukee
state : Wisconson
```

In [19]:
```
# a comprehension using both key and value

a=[key+"-"+value for key,value in dictionary_emp1.items()]
a
```

Out[19]:
```
['first-Robert',
 'middle-J.',
 'last-Smith',
 'street-156 Broadway',
 'town-Milwaukee',
 'state-Wisconson']
```

Question/Action

Set up a short dictionary, where each key is an item on your desktop and each value is the color.

Put 5 items in your dictionary

Use a comprehension to print out the list of items with their colors

In [26]:
```
# short dictionary
desktop = {"chrome":"blue",
           "rainbow_folder":"red",
           "github_desktop":"purple",
           "terminal":"black",
           "anaconda":"green"
          }
# use comprehension to a create a list of items
desktop_list = [key+" is "+value for key, value in desktop.items()]
print(desktop_list)
```

```
['chrome is blue', 'rainbow_folder is red', 'github_desktop is purple', 'ter
minal is black', 'anaconda is green']
```

Default Dictionary

This is a version of a dictionary that has a default value used when the key is not found

Note that in the earlier use of a default value, we had to use it within a "get()" function and include the default value when we called get(), so the defaultdict form is a bit "cleaner" to use

In [27]:
```
from collections import defaultdict


# Defining the dict and passing
# lambda as default_factory argument
d = defaultdict(lambda: "Not Present")
d["a"] = 1
d["b"] = 2

print(d["a"])
print(d["b"])
print(d["c"])
```

```
1
2
Not Present
```

Dictionaries as collections of counters

One classic application of a dictionary is to develop counts of events, such as the number of times a word appears in a document.

We work our way through the document, word by word. If the word is not in the dictionary, we add it with a value of 1, if it is in the dictionary already we increase the count by 1

In [32]:
```
filename = 'dr_jeckyl-1.txt'
```

In [33]:
```
# we are going to open the file, and pull in all the words in at once
# as reach line is read it, it will be split into individual words

word_list = open(filename,encoding="utf8").read().split()
len(word_list)
```

Out[33]:
```
28739
```

In [34]:
```
# set up dictionary

word_count={}

for word in word_list:
    target=word.lower()
    if(target in word_count):
        word_count[target]=word_count[target]+1
    else:
        word_count[target]=1
```

In [35]:
```
word_count['hyde']
```

Out[35]:
```
53
```

In [36]:
```
word_count['doctor']
```

Out[36]:
```
13
```

Setting up forward and reverse Dictionaries

Let's create a dictionary of all the words in the file, but assign each one a numerical value as we go

This first word will be coded as 1 and we'll go from there

In [37]:
```
# create a forward dictionary

forward = {}
count=0

for word in word_list:
    target=word.lower()
    if  not target in forward:
        forward[target]=count
        count=count+1

len(forward)
```

Out[37]:
```
6441
```

In [38]:
```
forward['hyde']
```

Out[38]:
```
12
```

In [39]:
```
forward['a']
```

Out[39]:
```
136
```

This gives us a numeric code for each word in the document, so we could code the words for input to a neural net for example, this is a tokenization of the language

We will need a reverse dictionary, to go from codes to words

In [40]:
```
# just do a list comprehension using the forward items and reverse the key:v
# a dictionary where we can look up the words based on their codes

reverse=[ {value:key} for key,value in forward.items()]
```

```
In [41]: reverse[12]

Out[41]: {12: 'hyde'}

In [42]: reverse[11]

Out[42]: {11: 'mr.'}
```

Question/Action

Take the dictionary of items on your desktop you created earlier, of items (key) and color (value)

Alter it to make sure each item has a distinct color (so if red appears twice, call one "bright-red", or "crimson"

Then, create a reverse dictionary using the method above and show that you can look up items on your desk using their color

```
In [51]: reverse = {value:key for key, value in desktop.items()}
         reverse["red"]

Out[51]: 'rainbow_folder'

In [52]: reverse["purple"]

Out[52]: 'github_desktop'

In [53]: reverse["blue"]

Out[53]: 'chrome'

In [ ]:
```