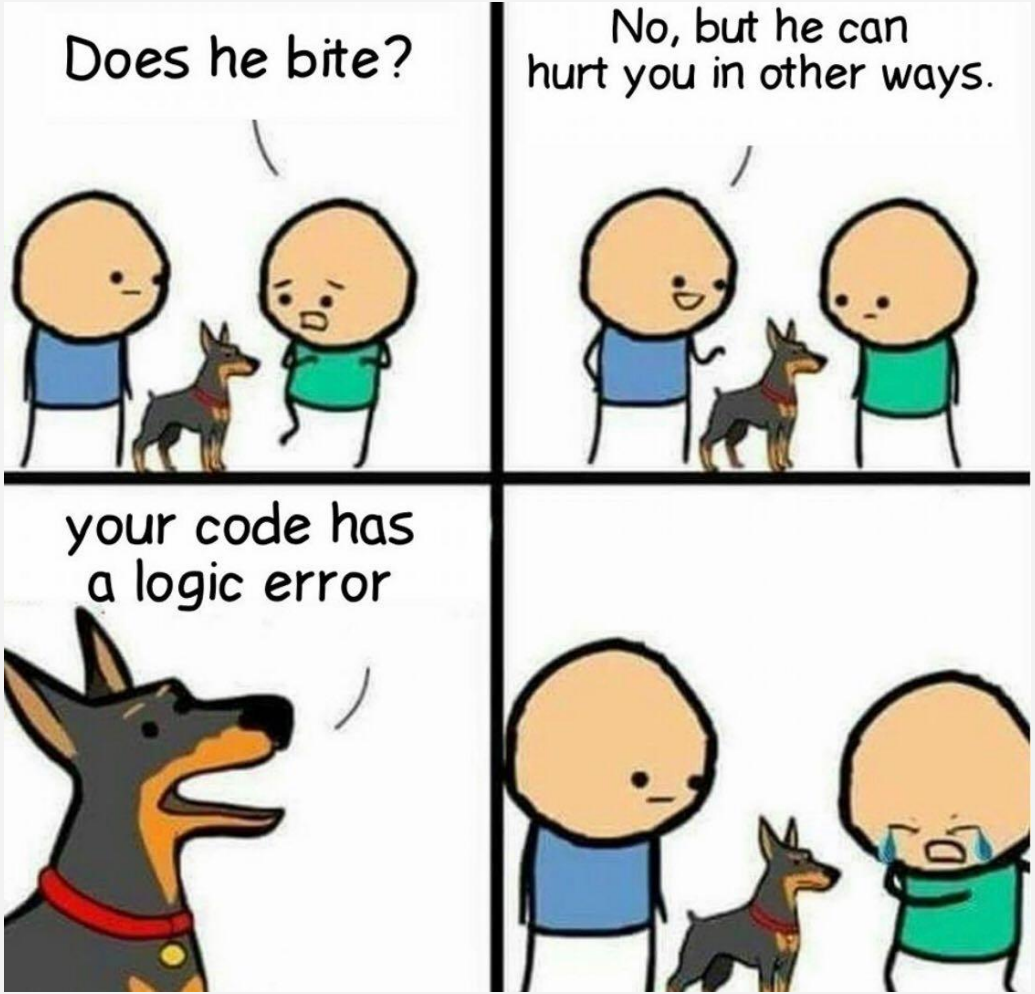
CSc 110 Mapping, Dictionaries

Benjamin Dicken



Data Structure

- **A data-structure is a way of arranging and organizing data in a computer program**
- Python has several useful data-structures built into the language
  - One is a **list** (already covered)
  - Another, **dictionary**
- A data type that stores a single value is generally not considered to be a data structure
  - Integers, boolean, floats

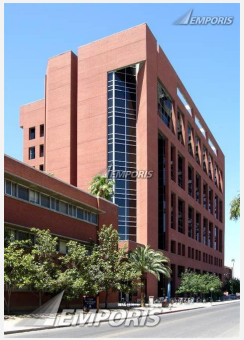
Mapping

- Many data structures allow data to be stored and retrieved using a concept called ***mapping***
- ***Mapping*** is the process of associating one value with another (a **key** with a **value**)
    - Sometimes also referred to as Hashing or Associativity

Mapping example

We can map **addresses** to **buildings**

1040 E. 4th St, Tucson, AZ 85719 → Gould Simpson Building



1428 E. University Blvd, Tucson, AZ 85719 → Old Main Building

1737 E. University Blvd, Tucson, AZ 85719 → Ina Gittings Building

Mapping example:

We can map **Words** to **Definitions**
(http://webstersdictionary1828.com)

Human → Belonging to man or mankind; pertaining or relating to the race of man; as a human voice; human shape; human nature; human knowledge; human life. . . .

Weapon → Any instrument of offense; any thing used or designed to be used in destroying or annoying an enemy. The weapons of rude nations are clubs, stones and bows and arrows. Modern weapons of war are swords, muskets, pistols, cannon and the like. . . .

Attack → To assault; to fall upon with force; to assail, as with force and arms. It is the appropriate word for the commencing act of hostility between armies and navies. . . .

Mapping

- Lists (sort of) map ***keys*** to ***values*** too!
  - Indexes ***of*** the list are the ***keys***
  - Elements ***in*** the list are the ***values***
- Keys (indexes) are used to accessing or modifying the elements in the list

Mapping and Lists

```
numbers = [12, 49, -2, 26, 5, 17, -6]
```

index	0	1	2	3	4	5	6
value	12	49	-2	26	5	17	-6

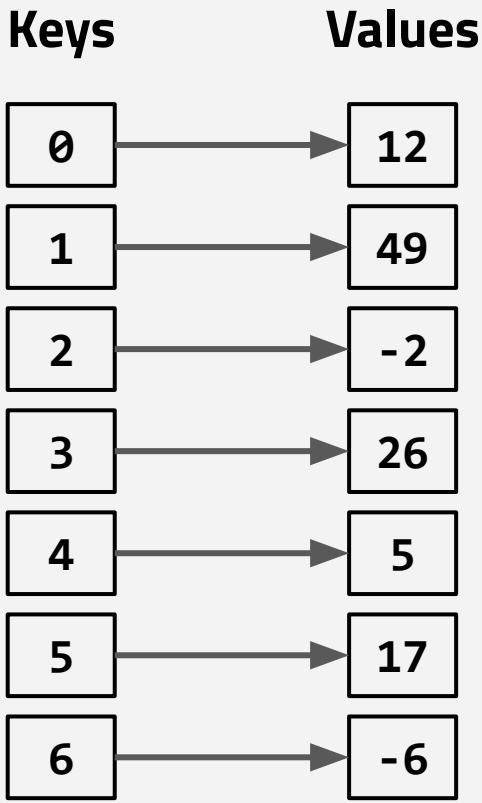
- What are the keys?
- What are the values?
- Which keys “map” to which values?

Mapping and Lists

```
numbers = [12, 49, -2, 26, 5, 17, -6]
```

index	0	1	2	3	4	5	6
value	12	49	-2	26	5	17	-6

- What are the keys?
- What are the values?
- Which keys “map” to which values?



Maps ints to ints

Mapping and Lists

```
numbers = [12, 49, -2, 26, 5, 17, -6]

# Using the key 3 to lookup the associated value of 26
# and then save the value into variable
new = numbers[3]

# Modifying the list so that the key 5 now maps to 77
# instead of 17
numbers[5] = 77
```

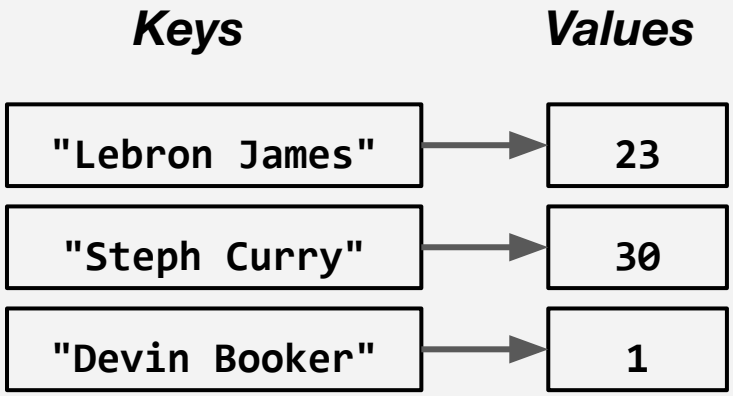
Dictionary

- Associates a set of keys to their corresponding values *(like lists)*
- Each key has exactly 1 associated value *(like lists)*
- The keys can be types other than ints *(unlike lists)*

Dictionary

Example

```
players = { "Lebron James":23,
            "Steph Curry":30 ,
            "Devin Booker":1  }
```



Map strings to ints

Dictionary

```
players = { "Lebron James":23,
            "Steph Curry":30 ,
            "Devin Booker":1  }

# Using the key "Lebron James"
# to lookup the number 23
number = players["Lebron James"]

# Modifying the number associated with
# "Devin Booker" from 1 to 12
numbers["Devin Booker"] = 12
```

Dictionary Questions

What will the keys and values be after this code runs?

```
word_count = {"and":324, "why":134, "cannot":76, "sanded":13}
word_count["cannot"] = 90
word_count["and"]    = 110
word_count["foot"]   = "feet"
word_count["and"]   += 10
print(word_count)
```

Dictionary Questions

What will be in num_to_player at the end of this program?

```
num_to_player = {}   # A valid, but empty dictionary
num_to_player[13] = "Paul George"
num_to_player[3]  = "Chris Paul"
num_to_player[23] = "Lebron James"
num_to_player[13] = "James Harden"
```

Dictionary Operations

- Basic dictionary operations are:
  - **Add** a new mapping from a key to a value
  - **Modify** what value an existing key maps to
  - **Retrieve** a value using a key
  - **Remove** a key/value association
- Some of these look similar to lists

Dictionary Operations

```
scores = {'A': 10, 'B':25, 'C':27, 'D':10, 'E':5}

scores['A+'] = 7      # Adds a key/value pair

scores['B'] = 20      # Changes value associated with a key

c_scores = scores['C']    # Retrieves a value, given a key

del scores['E']       # Removes a key/value pair
```

What will print?

- **`del dictionary[key]`**
  - Deletes the key (and the value it is paired with) from the dictionary

```
word_count = {"and":324, "why":134,
              "cannot":76, "Sanded":13}
del word_count["why"]
del word_count["nothing"]
del word_count["and"]

print(word_count)
```

Check for key

- **`if key in dictionary`**:
  - True condition if key exists in dictionary, false otherwise
- **`if key not in dictionary`**:
  - The opposite

- Important to check for existence of keys if you don’t want to get an error!

What will print? What does it accomplish?

```
ds1 = {}
word = 'statistic'
for c in word:
    if c not in ds1:
        ds1[c] = 0
    ds1[c] += 1
print(ds1)
```

What will print? What does it accomplish?

```
ds2 = {}
grades = [70, 55, 91, 95, 80]
for grade in grades:
    key = int( (grade - 50) / 10 )
    if key not in ds2:
        ds2[key] = 0
    ds2[key] += 1
print(ds2)
```

What will it print?

```
word_counts = {"Beluga" : 1, "Bar" : 15,
               "Bend" : 3, "Behave" : 8}

words = ["end", "have", "bar"]
for word in words:
    if word in word_counts:
        print(word, "has a count")
```

Looping

Looping through a dictionary

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

- This will loop through each key in the dictionary
- Each time the loop iterated, key will be assigned to one of the keys
- No keys will be skipped

Looping

Looping through a dictionary

```
for key, value in dictionary.items():
    print(key)
    print(value)
```

- This will loop through each key+value pairs in the dictionary
- Each time the loop iterated, key and value will be assigned to one of the key+value pairs in dictionary

Looping

What will this print?

```
players = {"Lebron James":23, "Steph Curry":30, "Devin Booker":1}
for key, value in players.items():
    print(key + " wears " + str(value))
```

Looping

What will this print?

```
Lebron James wears 23
Steph Curry wears 30
Devin Booker wears 1
```

```
players = {"Lebron James":23, "Steph Curry":30, "Devin Booker":1}
for key, value in players.items():
    print(key + " wears " + str(value))
```

Activity

Find the odd one out

```
players = {"Lebron James":23, "Steph Curry":30, "Devin Booker":1}
```

```
for key, value in players.items():
    print(key + " wears " + str(value))
```

```
for value, key in players.items():
    print(key + " wears " + str(value))
```

```
for key in players :
    print(key + " wears " + str(players[key]))
```

Implement the function

- Implement a function named **count_st_addresses** that has one parameter, a dictionary mapping addresses to building names
- Should return the number of building whose addresses have **“St”** in it. For example:

```
addresses = {'1040 E 4th St Tucson AZ 85719':  'Gould Simpson Building',
             '10 W 34th St New York NY 10001': 'Empire State Building',
             '3400 E Sky Harbor Blvd Phoenix AZ 85034': 'Sky Harbor Airport'}

count = count_st_addresses(addresses)
print(count) # Should print 2
```

Implement the function

http://webstersdictionary1828.com

- Implement a function named **search_words** that has two parameters, a dictionary with word → definition mapping and a string search term
- Should print out every word that has the search term in the definition.

```
dictionary = {'faith':  '...to conciliate; to believe, to obey...',
              'weapon': 'Any instrument of offense...',
              'town': 'Originally, a walled or fortified place...'}

search_words(dictionary, 'instrument') # Should print 'weapon'
```

Word Count (wc1.py)

- Write a program that:
  - Reads in a text file with words, one per line
  - Then, shows the counts
- Use a dictionary!

```
soccer 2
politics 1
belief 3
beef 1
America 2
```

words1.txt

```
basketball
soccer
politics
soccer
belief
beef
belief
America
belief
America
```

Activity

Word Count (wc1.py)

```
counts = {}
words_file = open('words1.txt', 'r')
for line in words_file:
    # What goes here?
```

words1.txt

```
basketball
soccer
politics
soccer
belief
beef
belief
America
belief
America
```

Word Count (wc1.py)

```
counts = {}
words_file = open('words1.txt', 'r')
for line in words_file:
    word = line.strip('\n')
    if word not in counts:
        counts[word] = 0
    counts[word] += 1

# How to print?
```

words1.txt

```
basketball
soccer
politics
soccer
belief
beef
belief
America
belief
America
```

Word Count (wc1.py)

```
counts = {}
words_file = open('words1.txt', 'r')
for line in words_file:
    word = line.strip('\n')
    if word not in counts:
        counts[word] = 0
    counts[word] += 1

for k, v in counts.items():
    print(k, v)
```

words1.txt

```
basketball
soccer
politics
soccer
belief
beef
belief
America
belief
America
```

Parties (parties.py)

- Write a program that:
  - Reads in a text file of people and their political party association
  - Prints the number of people in each party
- Use a dictionary!

parties1.txt

```
Joe Johnson D
Anne Weaver R
Jacob Cooper R
Diane Fassberg D
Gary Brown R
Xavier Paul R
```

```
R: 4
D: 2
```

parties2.txt

```
Alex Freemont R
Kramer Todd D
Westin Jones D
Arnold Jon D
Joe Jones R
```

```
R: 2
D: 3
```

Parties (parties.py)

```
parties = {}
words_file = open(... , 'r')
for line in words_file:
    # ?
    # ?
    # ?
    # ?

print('R:', parties['R'])
print('D:', parties['D'])
```

parties1.txt

```
Joe Johnson D
Anne Weaver R
Jacob Cooper R
Diane Fassberg D
Gary Brown R
Xavier Paul R
```

```
R: 4
D: 2
```

Parties (parties.py)

```
parties = {}
words_file = open(... , 'r')
for line in words_file:
    c = line.strip('\n').split(' ')
    if c[2] not in parties:
        parties[c[2]] = 0
    counts[c[2]] += 1

print('R:', parties['R'])
print('D:', parties['D'])
```

parties1.txt

```
Joe Johnson D
Anne Weaver R
Jacob Cooper R
Diane Fassberg D
Gary Brown R
Xavier Paul R
```

```
R: 4
D: 2
```

What would this program print?

```
parties = {'D':1452, 'R':2312, 'L':131}
numbers = [15, 105, 30, 700, 1500, 10]
for i in numbers:
    if i > 100:
        parties['L'] += i
largest_population = 0
for key in parties:
    if largest_population < parties[key]:
        largest_population = parties[key]
print(largest_population)
```

What would this program print?

```
parties = {'D':1452, 'R':2312, 'L':131}
numbers = [15, 105, 30, 700, 1500, 10]
for i in numbers:
    if i > 100:
        parties['L'] += i
largest_population = 0
for key in parties:
    if largest_population < parties[key]:
        largest_population = parties[key]
print(largest_population)
```

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