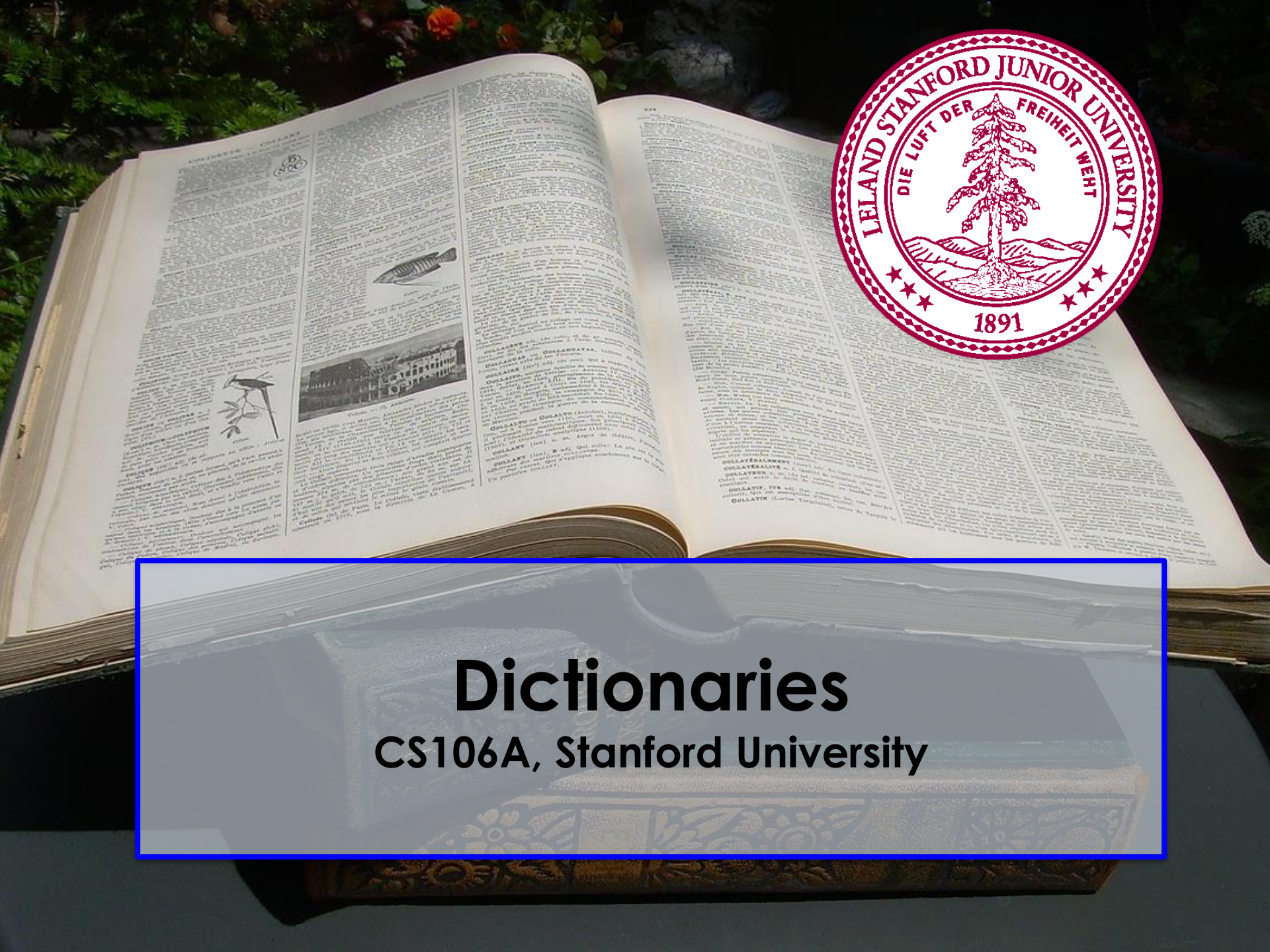
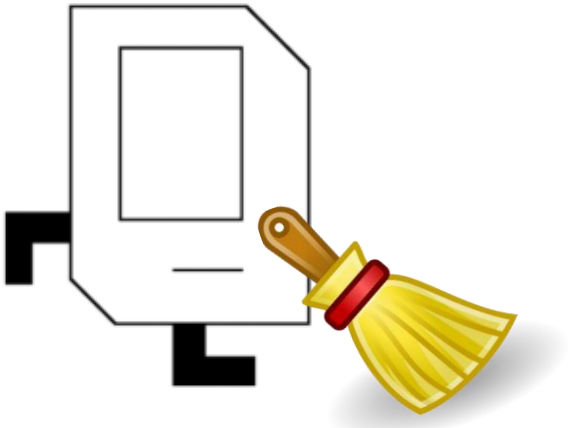


Dictionaries

CS106A, Stanford University

Housekeeping



- Midterm will be on Tuesday, May 3rd from 7pm-9pm
  - Location by first letter of last name:
    - Last name: A-H in room: 420-040
    - Last name: I-Z in room: CEMEX Aud
  - Midterm covers material through class on April 27
  - Open book/notes, but will need to bring printed reference material
- Will be using BlueBook software to take the exam
  - BlueBook will not allow you to access other applications/files on your computer during the exam

Review of String

```
PUNCTUATION = '.!?,-:;'

def delete_punctuation(s):
    """
    Removes punctuation characters from a string and
    returns the resulting string.
    """
    result = ''
    for char in s:
        # Check char is not a punctuation mark
        if char not in PUNCTUATION:
            result += char   # append non-punctuation chars

    return result
```

Calling: `delete_punctuation('REMOVE -the- punctuation!!!')`

Returns: `'REMOVE the punctuation'`

Reading Lines from a File

```
def count_words(filename):
    count = 0
    with open(filename, 'r') as file:  # Open file to read
        for line in file:
            line = line.strip()           # Remove newline
            word_list = line.split()      # Create list of words
            for word in word_list:        # Print words
                print("#" + str(count) + ": " + word)
                count += 1
    print(filename + " contains " + str(count) + " words")
```

testfile.txt

```
Very few
words here.
```

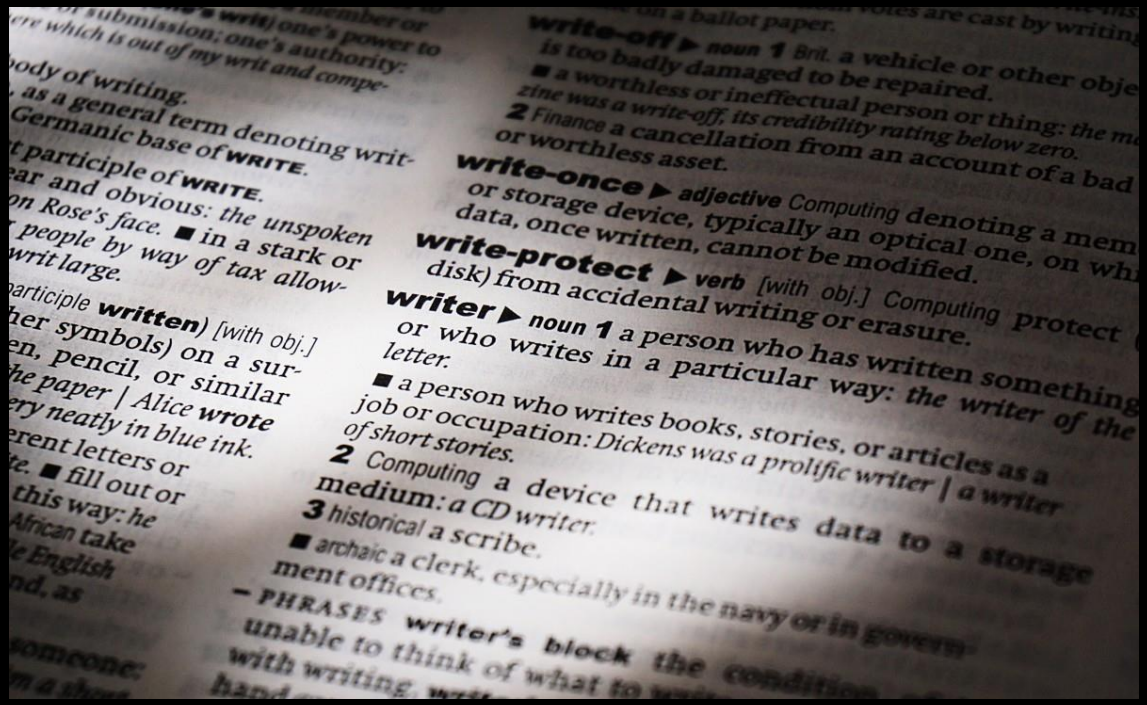
Console:

```
#0: Very
#1: few
#2: words
#3: here.
testfile.txt contains 4 words
```

Learning Goals

1. Learning about dictionaries
2. Building programs using dictionaries

Dictionaries



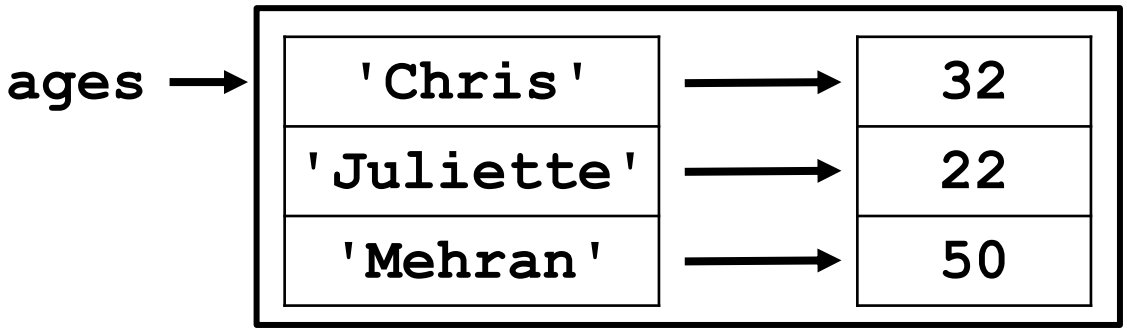
What are Dictionaries?

- Dictionaries associate a ***key*** with a ***value***
  - Key is a *unique* identifier
  - Value is something we associate with that key
- Examples in the real world:
  - Phonebook
    - Keys: names
    - Values: phone numbers
  - Dictionary
    - Keys: words
    - Values: word definitions
  - US Government
    - Keys: Social Security number
    - Values: Information about an individual's employment

Dictionaries in Python

- Creating dictionaries
  - Dictionary start/end with braces
  - Key:Value pairs separated by colon
  - Each pair is separated by a comma

```
ages = {'Chris': 32, 'Juliette': 22, 'Mehran': 50}
squares = {2: 4, 3: 9, 4: 16, 5: 25}
phone = {'Pat': '555-1212', 'Jenny': '867-5309'}
empty_dict = {}
```

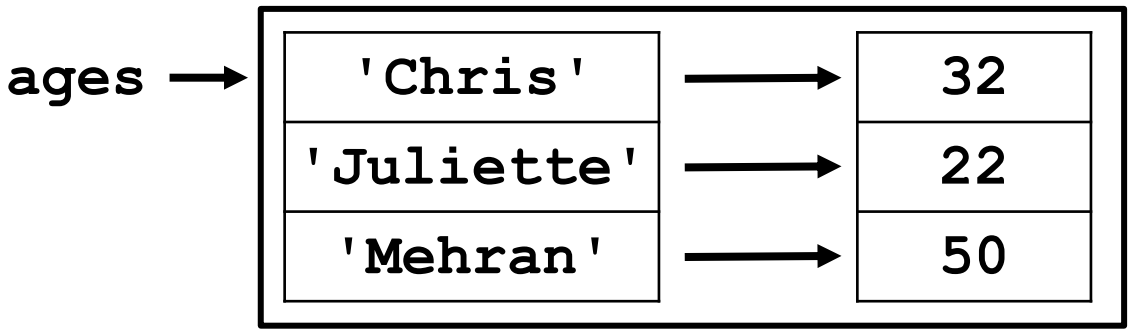


Accessing Elements of Dictionary

- Consider the following dictionary:

```
ages = {'Chris': 32, 'Juliette': 22, 'Mehran': 50}
```

- Like a set of variables that are indexed by keys



- Use key to access associated value:

`ages['Chris']` is `32`

`ages['Mehran']` is `50`

Accessing Elements of Dictionary

- Consider the following dictionary:

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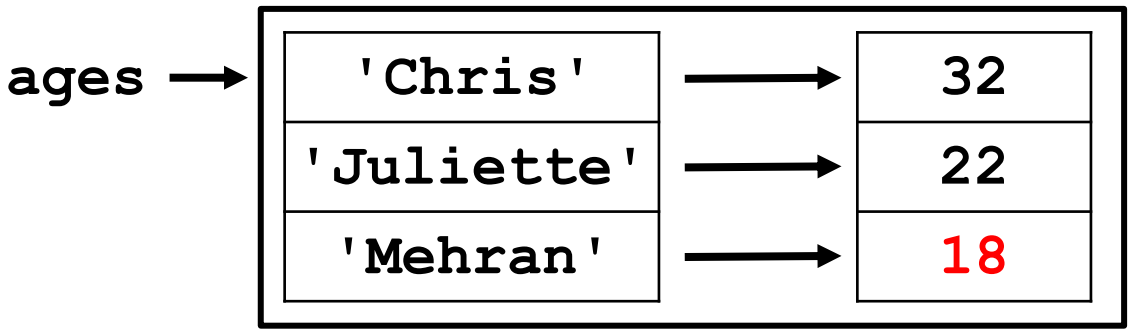

- Use key to access associated value:

`ages['Chris']` is `32`

`ages['Mehran']` is `50`

- Can set values like regular variable:

```
ages['Mehran'] = 18
```

Accessing Elements of Dictionary

- Consider the following dictionary:

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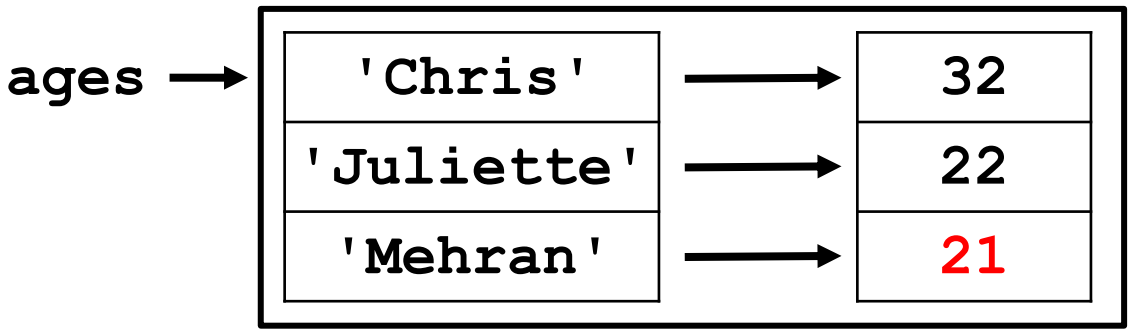


- Use key to access associated value:

```
ages['Chris'] is 32
ages['Mehran'] is 50
```

- Can set values like regular variable:

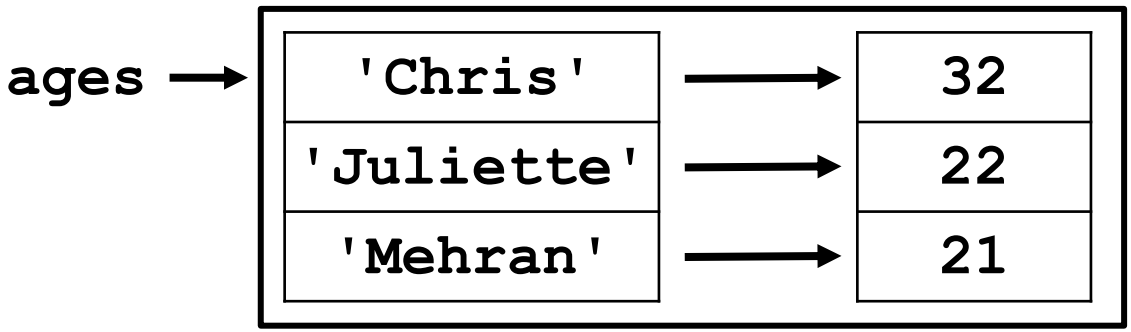
```
ages['Mehran'] = 18
ages['Mehran'] += 3
```

Accessing Elements of Dictionary

- Consider the following dictionary:

```
ages = {'Chris': 32, 'Juliette': 22, 'Mehran': 50}
```

- Like a set of variables that are indexed by keys



- Good and bad times with accessing pairs:

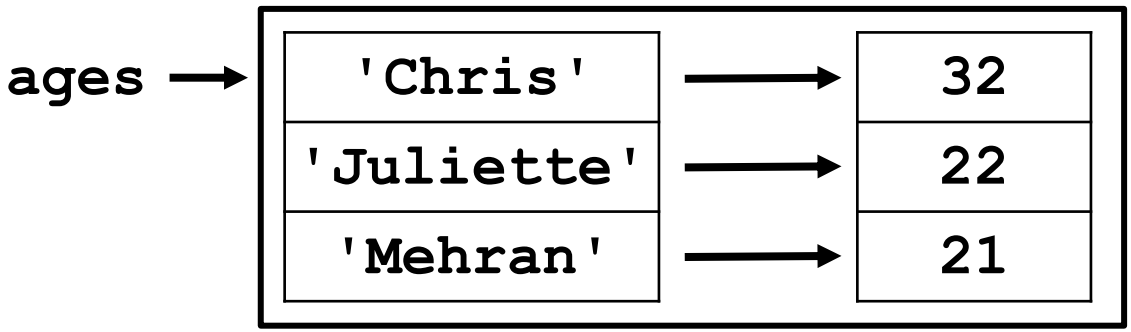
```
>>> juliettes_age = ages['Juliette']
>>> juliettes_age
22
>>> santas_age = ages['Santa Claus']
KeyError: 'Santa Claus'
```

Accessing Elements of Dictionary

- Consider the following dictionary:

```
ages = {'Chris': 32, 'Juliette': 22, 'Mehran': 50}
```

- Like a set of variables that are indexed by keys



- Checking membership

```
>>> 'Juliette' in ages
True
>>> 'Santa Claus' not in ages
True
```

Adding Elements to Dictionary

- Can add pairs to a dictionary:

```
phone = {}
```

Adding Elements to Dictionary

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```
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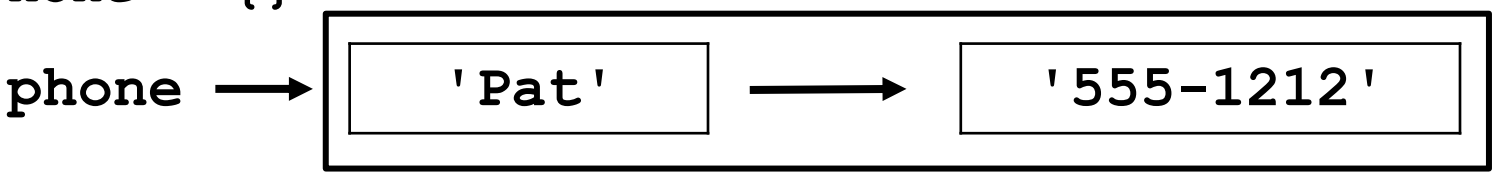
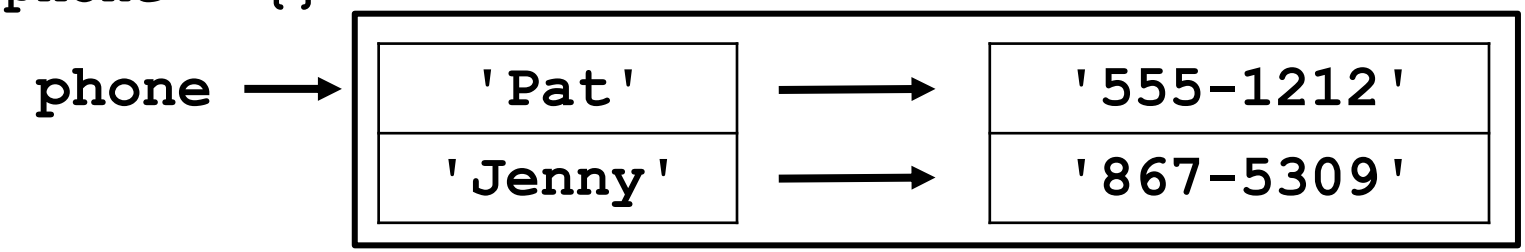



```
phone['Pat'] = '555-1212'
```

Adding Elements to Dictionary

- Can add pairs to a dictionary:

```
phone = {}
```

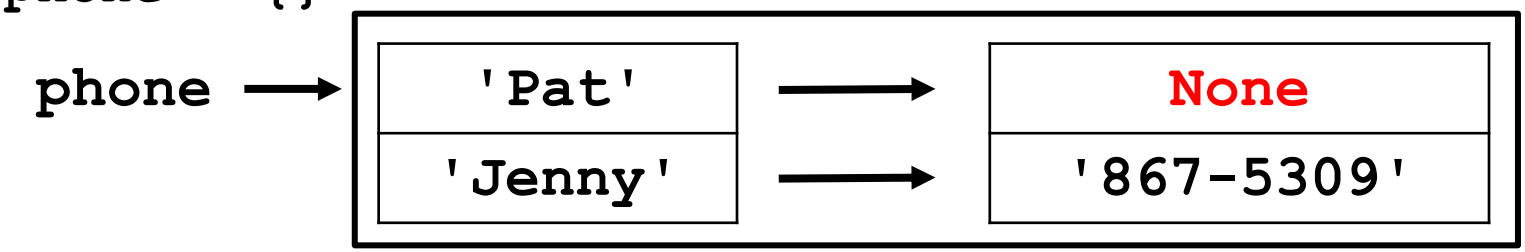



```
phone['Pat'] = '555-1212'
phone['Jenny'] = '867-5309'
```

Adding Elements to Dictionary

- Can add pairs to a dictionary:

```
phone = {}
```

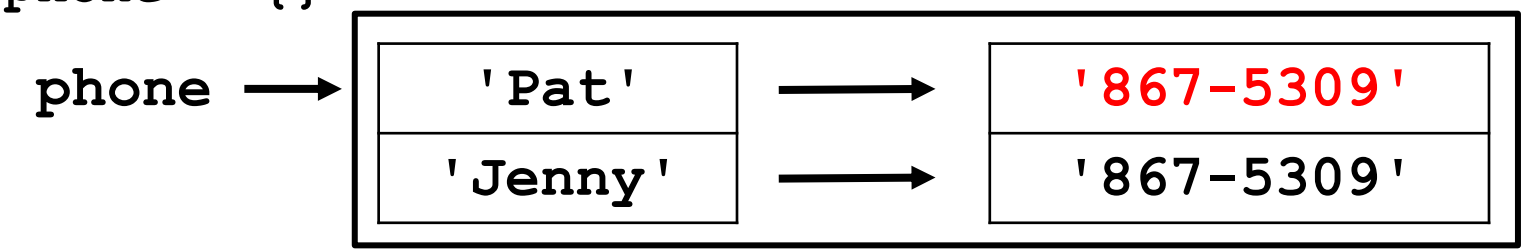



```
phone['Pat'] = '555-1212'
phone['Jenny'] = '867-5309'
phone['Pat'] = None
```

Adding Elements to Dictionary

- Can add pairs to a dictionary:

```
phone = {}
```




```
phone['Pat'] = '555-1212'
phone['Jenny'] = '867-5309'
phone['Pat'] = None
phone['Pat'] = '867-5309'
```

A Word About Keys/Values

- Keys must be immutable types
  - E.g., int, float, string
  - Keys cannot be changed in place
  - If you want to change a key, need to remove key/value pair from dictionary and then add key/value pair with new key.
- Values can be mutable or immutable types
  - E.g., int, float, string, lists, dictionaries
  - Values can be changed in place
- Dictionaries are mutable
  - Changes made to a dictionary in a function persist after the function is done.

Changing List in a Function

```
def have_birthday(dict, name):
    print("You're one year older, " + name + "!")
    dict[name] += 1

def main():
    ages = {'Chris': 32, 'Juliette': 22, 'Mehran': 50}
    print(ages)
    have_birthday(ages, 'Chris')
    print(ages)
    have_birthday(ages, 'Mehran')
    print(ages)
```

Terminal:

```
{'Chris': 32, 'Juliette': 22, 'Mehran': 50}
You're one year older, Chris!
{'Chris': 33, 'Juliette': 22, 'Mehran': 50}
You're one year older, Mehran!
{'Chris': 33, 'Juliette': 22, 'Mehran': 51}
```

Dicta-palooza! (Part 1)

```
ages = {'Chris': 32, 'Juliette': 22, 'Mehran': 50}
```

- Function: ***dict*.get(key)**
  - Returns value associated with key in dictionary. Returns **None** if key doesn't exist.

```
>>> print(ages.get('Chris'))
32
>>> print(ages.get('Santa Claus'))
None
```

- Function: ***dict*.get(key, default)**
  - Returns value associated with key in dictionary. Returns default if key doesn't exist.

```
>>> print(ages.get('Chris', 100))
32
>>> print(ages.get('Santa Claus', 100))
100
```

Dicta-palooza! (Part 2)

```
ages = {'Chris': 32, 'Juliette': 22, 'Mehran': 50}
```

- Function: ***dict*.keys()**
  - Returns something similar to a range of the keys in dictionary
  - Can use that to loop over all keys in a dictionary:

```
for key in ages.keys():
    print(str(key) + " -> " + str(ages[key]))
```

Terminal:

```
Chris -> 32
Juliette -> 22
Mehran -> 50
```

  - Can turn **keys()** into a list, using the **list** function

```
>>> list(ages.keys())
['Chris', 'Juliette', 'Mehran']
```

Dicta-palooza! (Part 3)

```
ages = {'Chris': 32, 'Juliette': 22, 'Mehran': 50}
```

- Can also loop over a dictionary using for-each loop just using name of dictionary:

```
for key in ages:
    print(str(key) + " -> " + str(ages[key]))
```

Terminal:

```
Chris -> 32
Juliette -> 22
Mehran -> 50
```

Dicta-palooza! (Part 4)

```
ages = {'Chris': 32, 'Juliette': 22, 'Mehran': 50}
```

- Function: ***dict*.values()**
  - Returns something similar to a range of the values in dictionary
  - Can use that to loop over all keys in a dictionary:

```
for value in ages.values():
    print(value)
```

Terminal:

```
32
22
50
```

  - Can turn **values()** into a list, using the **list** function

```
>>> list(ages.values())
[32, 22, 50]
```

Dicta-palooza! (Part 5)

```
ages = {'Chris': 32, 'Juliette': 22, 'Mehran': 50}
```

- Function: ***dict*.pop(key)**
  - Removes key/value pair with the given key. Returns value from that key/value pair.

```
>>> ages
>>> {'Chris': 32, 'Juliette': 22, 'Mehran': 50}
>>> ages.pop('Mehran')
50
>>> ages
{'Chris': 32, 'Juliette': 22}
```

- Function: ***dict*.clear()**
  - Removes all key/value pairs in the dictionary.

```
>>> ages.clear()
>>> ages
{}
```

Functions You Can Apply

```
ages = {'Chris': 32, 'Juliette': 22, 'Mehran': 50}
```

- Function: `len(`*dict*`)`
  - Returns number of key/value pairs in the dictionary

```
>>> ages
{'Chris': 32, 'Juliette': 22, 'Mehran': 50}
>>> len(ages)
3
```

- Function: `del` *dict*`[key]`
  - Removes key/value pairs in the dictionary.
  - Similar to `pop`, but doesn't return anything.

```
>>> ages
{'Chris': 32, 'Juliette': 22, 'Mehran': 50}
>>> del ages['Mehran']
>>> ages
{'Chris': 32, 'Juliette': 22}
```

Putting it all together:
count_each_word.py

(And we'll also throw in files as a bonus concept!)

Bonus fun:
phonebook.py

Learning Goals

1. Learning about dictionaries
2. Building programs using dictionaries

{'breakfast':  ,
'lunch':  ,
'dinner':  }