COMPSCI 101

Principles of Programming

Lecture 23 – More on dictionaries, using dictionaries to manage a small database of information

Learning outcomes

At the end of this lecture, students should be able to:

- Delete key:value pairs from a dictionary
- Create a list of keys, values, key:value tuples from a dictionary
- Use dictionary objects to manage a small file of information

Recap

Dictionaries - dictionaries are used to store key:value pairs (items)

- An empty dictionary object can be created in two ways
- items can be added to a dictionary
- Items can be retrieved from the dictionary
- the pairs in a dictionary can be traversed using for … in

```
def main():
  english_italian = {"yes":"si", "bye":"ciao",
                     "no":"no", "maybe":"forse",
                          "thank you":"grazie"}
  english_italian["never"] = "mai"
  print(english_italian["bye"])
  for word in english_italian:
      print(english_italian[word])
  print(len(english_italian))

main()
```

```
ciao
ciao
forse
mai
grazie
no
si
6
```


Deleting a key:value pair from the dict object

The **del** operator is used to delete a key:value pair from the dictionary.

```
def main():
  my_dict = {"a": 4, "b": 6, "c": 5}
  print("1.", my_dict)

  del my_dict["b"]
  print("2.", my_dict)

  del my_dict["a"]
  print("3.", my_dict)

main()
```

```
1. {'a': 4, 'b': 6, 'c': 5}
2. {'a': 4, 'c': 5}
3. {'c': 5}
```

Deleting a key:value pair from a dict object

The **del** operator gives an error if the key of the key:value pair being deleted is not in the dictionary. Because of this, it is customary to check before deleting a key:value pair.

```
def main():
  my_dict = {"a": 4, "b": 6, "c": 5}
  print("1.", my_dict)

  if "b" in my_dict:      #Check first
     del my_dict["b"]
  print("2.", my_dict)

  del my_dict["z"]
  print("3.", my_dict)

main()
```

```
1. {'a': 4, 'b': 6, 'c': 5}
2. {'a': 4, 'c': 5}
…. Other error information
KeyError: 'z'
```


Methods which can be used with a dict object

The keys, the values, the associations as tuples, can be obtained from a dictionary object using the following three methods:

my_dict = {…}

my_dict.**items()** – to access all the key/value pairs as tuples

my_dict.**keys()** – to access all the keys

my_dict.**values()** – to access all the values

The elements in these collections can be accessed using a **for … in** loop.

```
def main():
  my_dict = {"a": 4, "b": 6, "c": 5}
  for letter in my_dict.keys():
     print(letter)
  for number in my_dict.values():
     print(number)
  for item in my_dict.items():
     print(item)
main()
```

```
b
c
a
6
5
4
('b', 6)
('c', 5)
('a', 4)
```


Methods which can be used with a dict object

When a `for … in` loop is used with a dictionary object, the loop variable is assigned a reference to **each key** of the dictionary in turn:

```
def main():
  my_dict = {"a": 4, "b": 6, "c": 5}
  for letter in my_dict.keys():
     print(letter)
  print()
  for key in my_dict:
     print(key)

main()
```

Note that both these loops do exactly the same job.

```
b
c
a

b
c
a
```


Methods which can be used with a dict object

Often it is useful to convert the collection of keys (or values, or item tuples) of the dictionary into lists by enclosing the collection of keys (or values, or item tuples) in `list(…)`:

```
def main():
  my_dict = {"a": 4, "b": 6, "c": 5}
  items_list = list(my_dict.items())
  keys_list = list(my_dict.keys())
  values_list = list(my_dict.values())

  print("items list", items_list)
  print("keys list", keys_list)
  print("values list", values_list)

main()
```

```
items list [('a', 4), ('c', 5), ('b', 6)]
keys list ['a', 'c', 'b']
values list [4, 5, 6]
```

Note on deleting dict objects

You should never remove elements from the underlying data structure, such as a `dict` object, when using a `for … in` loop to iterate through the data structure itself. Instead, create a **separate** list of the dictionary keys (or items), iterate through the list, and delete any unwanted items from the `dict` object, e.g.,

```
def main():
  my_dict = {"and": 4, "many": 2, "for": 5, "very": 1}

  items_list = list(my_dict.items())
  for key, value in items_list:
      if value < 3:
          del my_dict[key]

  print("Dictionary:", my_dict)

main()
```

```
Dictionary: {'and': 4, 'for': 5}
```


Using dictionaries - Our file information

We wish to manage a small file of ratings for four films.

The film list is:

```
film_list = ["Lolita", "The Piano", "Aliens", "Shrek"]
```

The text file, "Ratings.txt", stores the ratings made by seven people of the four films (0 means the person didn't rate the film, 1 means the person hated the film, 9 means they loved it):

Ratings.... — Edited

```
Mary 2 0 6 2
Joy 2 8 3 9
Adam 7 2 0 7
Li 0 2 3 8
Jo 3 2 0 8
Sam 9 2 3 8
John 0 9 4 8
```


Loading the information

Firstly all the lines of text are read from the file into a list (without any newline characters - "\n").

Ratings.... — Edited

```
Mary 2 0 6 2
Joy 2 8 3 9
Adam 7 2 0 7
Li 0 2 3 8
Jo 3 2 0 8
Sam 9 2 3 8
John 0 9 4 8
```

```
def get_lines_from_file(filename):




def main():
   film_list = ["Lolita", "The Piano", "Aliens", "Shrek"]

   number_of_films = len(film_list)
   filename = "Ratings.txt"

   lines_of_text = get_lines_from_file(filename)

main()
```

```
["Mary 2 0 6 2", "Joy 2 8 3 9", …]
```


Loading the file information into dictionaries

From the 'lines of text' list: `["Mary 2 0 6 2", "Joy 2 8 3 9", …]`

create a dictionary: person_name : list of ratings

```
def get_people_ratings_dict(lines_of_text):
   people_ratings = {}









   return people_ratings

def main():
   film_list = ["Lolita", "The Piano", "Aliens", "Shrek"]
   number_of_films = len(film_list)
   filename = "Ratings.txt"
   lines_of_text = get_lines_from_file(filename)
   people_ratings_dict = get_people_ratings_dict(lines_of_text)

main()
```

```
{'Mary': [2, 0, 6, 2],
 'Joy': [2, 8, 3, 9], …   }
```

Loading the file information into dictionaries

The dictionary has key, value pairs:

person_name : list of ratings

i.e., the person_name is the key and the list of four ratings is the corresponding value.

Ratings.... — Edited

```
Mary 2 0 6 2
Joy 2 8 3 9
Adam 7 2 0 7
Li 0 2 3 8
Jo 3 2 0 8
Sam 9 2 3 8
John 0 9 4 8
```

→ `["Mary 2 0 6 2", "Joy 2 8 3 9", …]`

↓

```
{
    "Mary": [2, 0, 6, 2],
    "Joy": [2, 8, 3, 9],
     …
}
```


Loading the information into dictionaries

From the people dictionary: `{"Mary": [2, 0, 6, 2], "Joy": [2, 8, 3, 9], … }`, create another dictionary: film_title : list of ratings

```
def get_film_ratings_dict(film_list, people_ratings_dict):
   #Lolita – get the first rating from every person
   #The Piano – get the second rating from every person, etc.
   film_index = 0
   film_ratings_dict = {}


   return film_ratings_dict
def main():
   film_list = ["Lolita", "The Piano", "Aliens", "Shrek"]
   number_of_films = len(film_list)
   filename = "Ratings.txt"
   lines_of_text = get_lines_from_file(filename)
   people_ratings_dict = get_people_ratings_dict(lines_of_text)
   film_ratings_dict = get_film_ratings_dict(film_list,
                                             people_ratings_dict)
main()
```

`{'Lolita': [7, 3, 9, 2, 0, 0, 2], 'The Piano': [2, 2, 2, 0, 9, 2, 8], 'Aliens': [0, … }`

Loading the file information into dictionaries

`film_list = ["Lolita", "The Piano","Aliens","Shrek"]`

person_name : list of ratings dictionary (see slides 11 and 12)

film_title : list of ratings dictionary, i.e., the film_title is the key and the list of seven ratings (one from each person) is the corresponding value.

Ratings.... — Edited

```
Mary 2 0 6 2
Joy 2 8 3 9
Adam 7 2 0 7
Li 0 2 3 8
Jo 3 2 0 8
Sam 9 2 3 8
John 0 9 4 8
```

`["Mary 2 0 6 2", "Joy 2 8 3 9", …]`

↓

```
{   "Mary": [2, 0, 6, 2],
     "Joy": [2, 8, 3, 9],
      …
}
```

↓

```
{ 'Lolita': [7, 3, 9, 2, 0, 0, 2],
   'The Piano': [2, 2, 2, 0, 9, 2, 8],
   'Aliens': [0 …      ],
     …
}
```


The two dictionaries

So far, from the film list:

`film_list = ["Lolita", "The Piano", "Aliens", "Shrek"]`

and the ratings file information:

Ratings.... — Edited

```
Mary 2 0 6 2
Joy 2 8 3 9
Adam 7 2 0 7
Li 0 2 3 8
Jo 3 2 0 8
Sam 9 2 3 8
John 0 9 4 8
```

we have created the following two dictionaries:

people_ratings_dict

```
{
'Mary': [2, 0, 6, 2],
'John': [0, 9, 4, 8],
'Adam': [7, 2, 0, 7],
'Sam': [9, 2, 3, 8],
'Joy': [2, 8, 3, 9],
'Jo': [3, 2, 0, 8],
'Li': [0, 2, 3, 8]
}
```

film_ratings_dict

```
{
'Lolita': [7, 3, 9, 2, 0, 0, 2],
'Aliens': [0, 0, 3, 6, 4, 3, 3],
'Shrek': [7, 8, 8, 2, 8, 8, 9],
'The Piano': [2, 2, 2, 0, 9, 2, 8]
}
```

Using the dictionaries

The application allows the user to select a person's name from the list of dictionary keys, see the person's ratings as well as the average of all the non-zero ratings.

```
def process_person_ratings_request(people_ratings_dict):

def main():
   …
   process_person_ratings_request(people_ratings_dict)
main()
```

people_ratings_dict

```
{
'Mary': [2, 0, 6, 2],
'John': [0, 9, 4, 8],
'Adam': [7, 2, 0, 7],
'Sam': [9, 2, 3, 8],
'Joy': [2, 8, 3, 9],
'Jo': [3, 2, 0, 8],
'Li': [0, 2, 3, 8]
}
```

Example execution of the completed application.

```
John
Mary
Adam
Jo
Joy
Li
Sam
Enter name: Sam
[9, 2, 3, 8] Sam - average rating: 5.5
```


Using the dictionaries

The application allows the user to select a person from the list of dictionary keys and see the person's ratings as well as the average of all their non-zero ratings.

```
{"Mary": [2, 0, 6, 2],
 "Joy": [2, 8, 3, 9], …   }
```

```
def process_person_ratings_request(people_ratings_dict):
   #See the code on the next slide
def display_keys(dictionary):

def get_average_rating(list_of_numbers):

def main():
   film_list = ["Lolita", "The Piano", "Aliens", "Shrek"]
   number_of_films = len(film_list)
   filename = "Ratings.txt"
   lines_of_text = get_lines_from_file(filename)
   people_ratings_dict = get_people_ratings_dict(lines_of_text)
   film_ratings_dict = get_film_ratings_dict(film_list, people_ratings_dict)
   print("Process People-Rating Request")
   process_person_ratings_request(people_ratings_dict)
```


Using the dictionaries

```
{"Mary": [2, 0, 6, 2],
 "Joy": [2, 8, 3, 9], …   }
```

```
def main():
   #...
   process_person_ratings_request(people_ratings_dict)
def process_person_ratings_request(people_ratings_dict):
    display_keys(people_ratings_dict)
    name = input("Enter name: ")
    ratings_list = people_ratings_dict[name]
    average = get_average_rating(ratings_list)
    print(people_ratings_dict[name], name,
        "- average rating:", average)

def display_keys(dictionary):


def get_average_rating(list_of_numbers):
```

Example execution of the completed application.

```
John
Mary
Adam
Jo
Joy
Li
Sam
Enter name: Sam
[9, 2, 3, 8] Sam –
    average rating: 5.5
```


Using the dictionaries

The application allows the user to select a film from the list of film titles, see the film's ratings as well as the average of all the non-zero ratings for the film.

film_ratings_dict

```
{
'Lolita': [7, 3, 9, 2, 0, 0, 2],
'Aliens': [0, 0, 3, 6, 4, 3, 3],
'Shrek': [7, 8, 8, 2, 8, 8, 9],
'The Piano': [2, 2, 2, 0, 9, 2, 8]
}
```

```
def process_film_ratings_request(film_list, film_ratings_dict):

def main():
   …
   process_film_ratings_request(film_list, film_ratings_dict)
main()
```

Example execution of the completed application.

```
1 Lolita
2 The Piano
3 Aliens
4 Shrek
Enter selection: 2
[9, 0, 2, 2, 8, 2, 2] The Piano - average rating: 4.2
```

Using the dictionaries

The application allows the user to select a film from the list of film titles, see the film's ratings as well as the average of all the non-zero ratings for the film.

```
{'Lolita':[7, 3, 9, 2, 0, 0, 2],
 'The Piano':[2, 2, 2, 0, 9, 2, 8], …  }
```

```
def process_film_ratings_request(film_list, film_ratings_dict):
    #See the code on the next slide

def display_numbered_list(list_of_items):

def get_average_rating(list_of_numbers):
   #see previous code

def main():
   film_list = ["Lolita", "The Piano", "Aliens", "Shrek"]
   number_of_films = len(film_list)
   filename = "Ratings.txt"
   lines_of_text = get_lines_from_file(filename)
   people_ratings_dict = get_people_ratings_dict(lines_of_text)
   film_ratings_dict = get_film_ratings_dict(film_list, people_ratings_dict)
   print("Process Movie-Rating Request")
   process_film_ratings_request(film_list, film_ratings_dict)
```


Using the dictionaries

```
{'Lolita':[7, 3, 9, 2, 0, 0, 2],
 'The Piano':[2, 2, 2, 0, 9, 2, 8], …  }
```

```
def main():
  #...
  process_film_ratings_request(film_list, film_ratings_dict)

def process_film_ratings_request(film_list, film_ratings_dict):
  display_numbered_list(film_list)
  number = int(input("Enter selection: "))
  film_title = film_list[number - 1]
  film_ratings = film_ratings_dict[film_title]
  average = get_average_rating(film_ratings)
  print(film_ratings_dict[film_title], film_title,
                                  "- average rating:", average)

def display_numbered_list(list_of_items):

def get_average_rating(
          list_of_numbers):
   #see previous code
```

Example execution of the completed application.

```
1 Lolita
2 The Piano
3 Aliens
4 Shrek
Enter selection: 2
[9, 0, 2, 2, 8, 2, 2] The Piano –
                    average rating: 4.2
```


Summary

The **del** operator is used to delete an key:value pair from the dictionary.

The keys, the values, the associations as tuples can be obtained from a dictionary object using the methods:

my_dict.**items()** – to access all the key/value pairs as tuples

my_dict.**keys()** – to access all the keys

my_dict.**values()** – to access all the values

Often it is useful to convert the individual keys (or values, or item tuples) of the dictionary into lists by enclosing the keys (or values, or item tuples) inside **list(…)**

Python features used in this lecture

```
my_dict = {"a": 4, "b": 6, "c": 5}

for letter in my_dict.keys():
   print(letter)
for number in my_dict.values():
   print(number)
for item in my_dict.items():
   print(item)

items_list = list(my_dict.items())
keys_list = list(my_dict.keys())
values_list = list(my_dict.values())

print("items list", items_list)
print("keys list", keys_list)
print("values list", values_list)

if "b" in my_dict:      #Check first
   del my_dict["b"]
```