LEARN CODING

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github.com/ale66/learn-coding

LISTS AND THEIR PRACTICAL LIMITATIONS

SO FAR

While they admit arbitrary members, lists are best understood as iterables of homogeneous values

NESTED LISTS

Represent multi-dimensional data

The meaning of data and the objective of the code guide the organization in lists and sublists

Example: weekend temperatures in Naples (from Thur. to Sun.)

```
1  my2Dlist = [[18, 22, 20, 26], [26, 27, 28, 21], [18, 16, 21, 20]]
```

as with lists of strings, by simple nesting of indices we can access specific data points

Temperature on the first Thursday of October?

```
1 print(my2Dlist[0][0])
```

```
my2Dlist = [[18, 22, 20, 26], [26, 27, 28, 21], [18, 16, 21, 20]]
```

Average temperature on Thursday in October?

```
accumulator = 0
count = 0

for weekend in my2Dlist:
  accumulator += weekend[0]
  count += 1

if count > 0:
  average_temp_thursday = accumulator / count
else:
  # avoid 0 as it is a valid average temp.
  average_temp_thursday = NaN
```

WORK WITH NESTED LISTS

Textual data sets may also be organized in 2-d lists

```
my_writers = [
                ['Dickens', 1812],
                ['King', 1947],
                ['J.K. Rowling', 1965],
                ['Christie', 1890]
]

for row in my_writers:
        print(row)
```

Here a clear semantic structure remains *latent* within the Python variables

Print authors only:

```
1  for row in my_writers:
2    print(row[0])
```

Print authors and they their year of birth?

```
1  for row in my_writers:
2    for element in row:
3        print(element)
```

OBSERVATIONS

To extract the needed data we need to know something about their logical organization: the data structure

- each element is a weekend, starting Thursday

A fixed structure is required for instructions to work:

- each pair is author followed by year

A more flexible data structure is needed

DICTIONARIES

THE NON-LIST

An unsorted bag of values, each with its own label, called key.

```
1  my_data = {'author': 'Agatha Christie',
2             'nickname': 'Mary Westmacott',
3             'year_of_birth': 1890
4           }
```

PROPERTIES

A dictionary is a collection of `key:value` pairs that is

- unordered
- changeable, and
- indexed

Dictionaries are Python most powerful data structure

EXTENSIBILITY

The more we have, the more we can put

```
my_writers = [
  {'author':'Dickens', 'year_of_birth':1812},
  {'author':'King', 'year_of_birth':1947},
  {'author':'J.K. Rowling', 'year_of_birth':1965},
  {'author':'Agatha Christie', 'nickname':'Mary Westmacott', 'year_of_birth':1890}
]
```

ACCESSING ITEMS

```python
my_dict = {'author': 'Agatha Christie',
           'nickname': 'Mary Westmacott',
           'year_of_birth': 1890
}

print(my_dict['author'])
```

```python
NOW = 2024

delta = NOW - my_dict['year_of_birth']

print(f{{my_dict['author']} was born {delta} years ago.})
```

AMENDING VALUES

```
1  my_dict['year_of_birth'] = 2019
2
3  print(my_dict['year_of_birth'])
```

```
1  king = my_writers[1]
2
3  print(king['author'])
4
5  king['author'] = 'Stephen King'
```

We have more information but `my_writers` is unchanged

COMBINING INDICES

```
1  my_writers[1]['author'] = 'Stephen King'
2
3  print(my_writers)
4
5  [{'author':'Dickens', 'year_of_birth':1812},
6   {'author':'Stephen King', 'year_of_birth':1947},
7   {'author':'J.K. Rowling', 'year_of_birth':1965},
8   {'author':'Agatha Christie', 'nickname':'Mary Westmacott', 'year_of_birth':1890}]
```

ITERATION

As the data structure is completely arbitrary, simple indexing (`i=0,1, ...`) does not work anymore.

A lazy iterable, similar to `range`, will serve the `key:value` pairs on request

```
1 # always key first
2 for key, value in my_dict.items():
3   print(key, value)
```

```
1 author Agatha Christie
2 nickname Mary Westmacott
3 year_of_birth 1890
```

THE `key` AND `value` VARIABLE NAMES

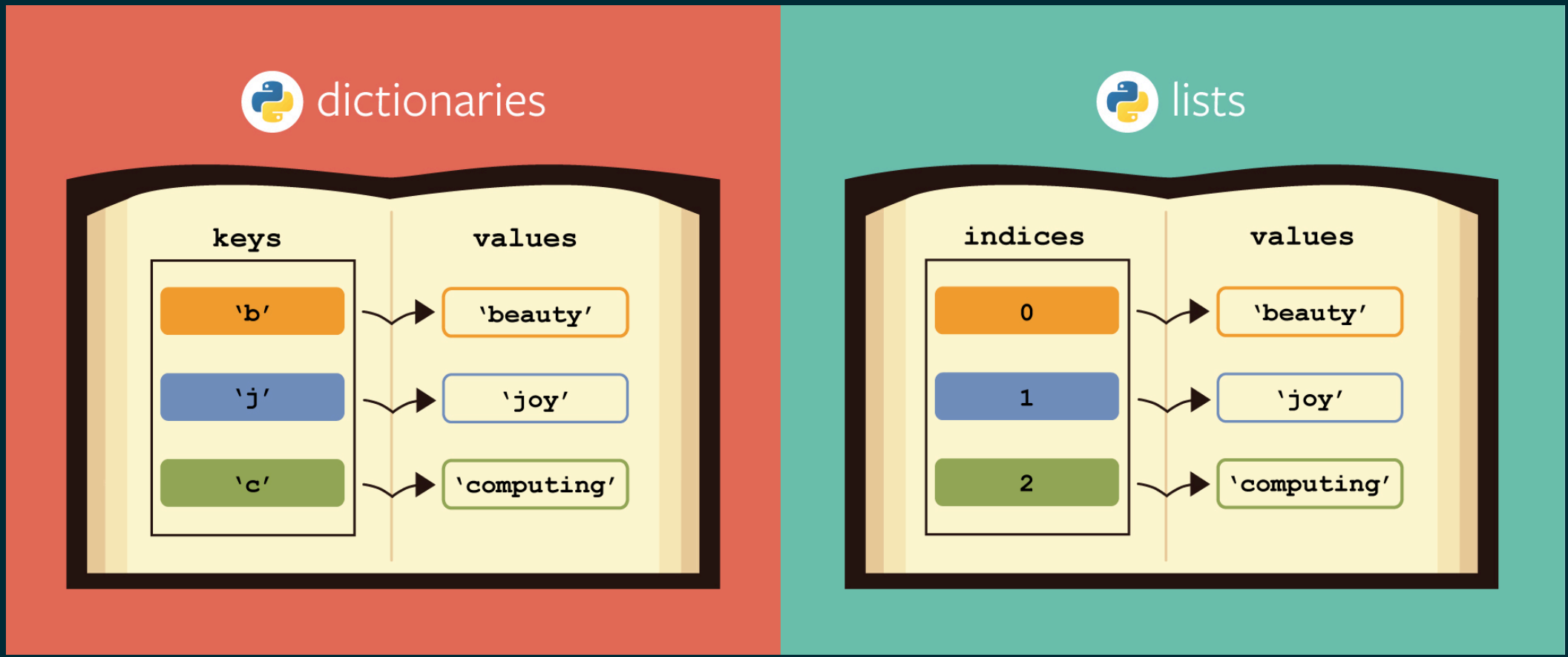
```
1 for key in my_dict.items():
2   print(key)
```

```
1 author
2 nickname
3 year_of_birth
```

```
1 for value in my_dict.items():
2   print(key)
```

```
1 Agatha Christie
2 Mary Westmacott
3 1890
```

LISTS VS DICTIONARIES



GROW A LIST

```
1  my_list = []
2
3  my_list.append(10)
4
5  my_list.append(20)
6
7  print(alist)
8
9  [10, 20]
```

Direct access is always possible:

```
1  print(my_list[-1])
2
3  20
```

GROW A DICTIONARY

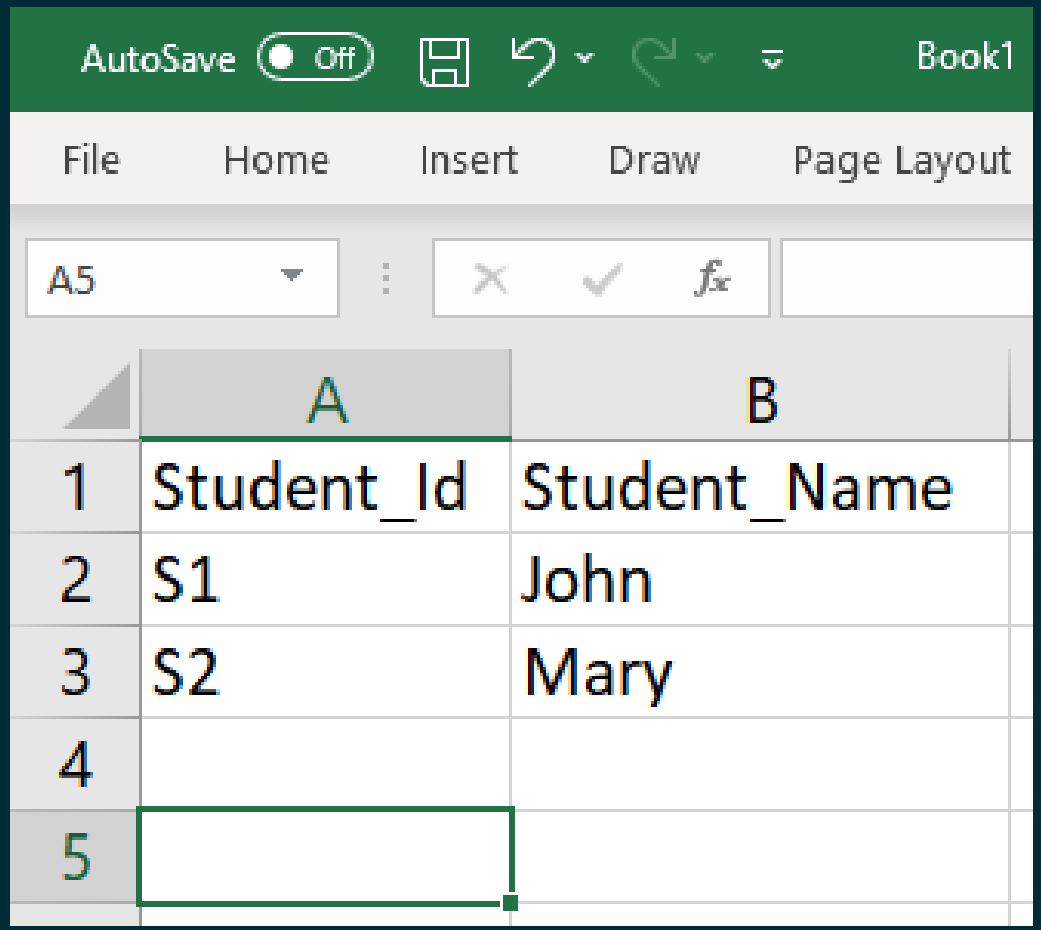
```
1  my_dict = {}
2
3  my_dict['name'] = 'Tom'
4
5  my_dict['age'] = 35
6
7  print(my_dict)
```

```
1  {'name':'Tom', 'age':35}
```

```
1  print(my_dict['name'])
2
3  Tom
```

Disadvantage: dictionaries are inherently unordered

ONE KEY, MANY VALUES




```
my_python = {'Student_ID':['S1','S2'],
             'Student_Name':['John', 'Mary']
}
```

RECAP: COMMON OPERATIONS

```python
# create an empty dictionary
my_dict = {}

# create a new dict with 3 items
my_dict = {'one':1, 'two':2, 'three':3}

# access an element
print(my_dict['two'])
```

Data updates:

```python
# add an entry
my_dict['four'] = 4

# change an entry
my_dict['one'] = 'uno'

# count items
howmany = len(my_dict)
```

keys AND values

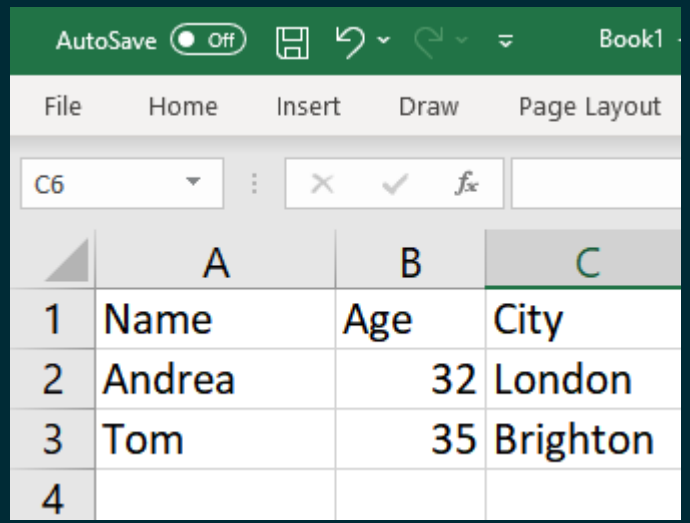
```
1 # iterate over keys
2 for item in my_dict.keys():
3   print (item)
4
5 # iterate over values
6 for item in my_dict.values():
7   print(item)
```

Inspect the data structure:

```
1 # list out the keys
2 my_dict.keys()
3
4 # list out the values
5 my_dict.values()
```

QUIZ!

Create a dictionary out of the following data:



	A	B	C
1	Name	Age	City
2	Andrea	32	London
3	Tom	35	Brighton
4			

Spin up VS Code and create a quick notebook