

LEARN CODING

ale66

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])
```

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

Average temperature on Thursday in October?

```
1 accumulator = 0
2 count = 0
3
4 for weekend in my2Dlist:
5     accumulator += weekend[0]
6     count += 1
7
8 if count > 0:
9     average_temp_thursday = accumulator / count
10 else:
11     # avoid 0 as it is a valid average temp.
12     average_temp_thursday = NaN
```

WORK WITH NESTED LISTS

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

```
1 my_writers = [
2     ['Dickens', 1812],
3     ['King', 1947],
4     ['J.K. Rowling', 1965],
5     ['Christie', 1890]
6 ]
7
8 for row in my_writers:
9     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 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

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

ACCESSING ITEMS

```
1 my_dict = {'author': 'Agatha Christie',  
2             'nickname': 'Mary Westmacott',  
3             'year_of_birth': 1890  
4 }  
5  
6 print(my_dict['author'])
```

```
1 NOW = 2024  
2  
3 delta = NOW - my_dict['year_of_birth']  
4  
5 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
```

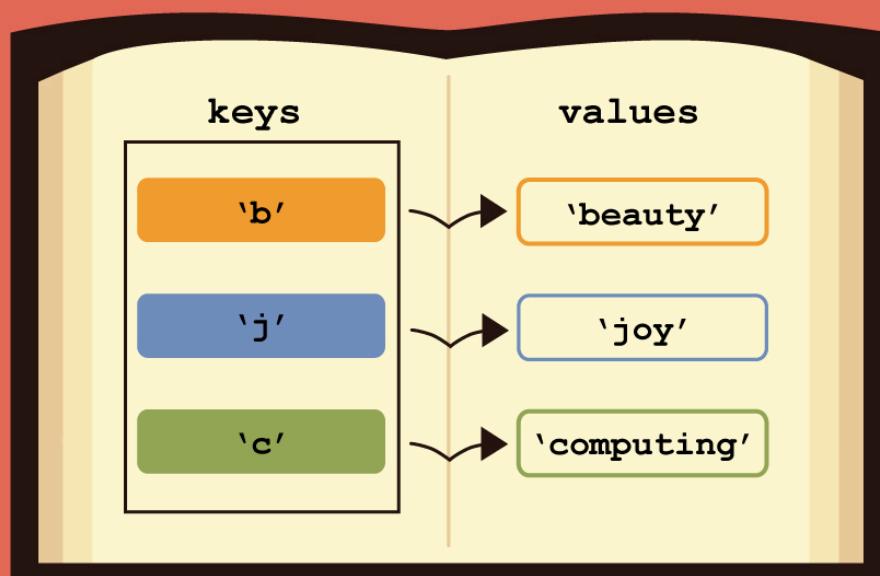
```
1 for value in my_dict.items():
2     print(key)
```

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

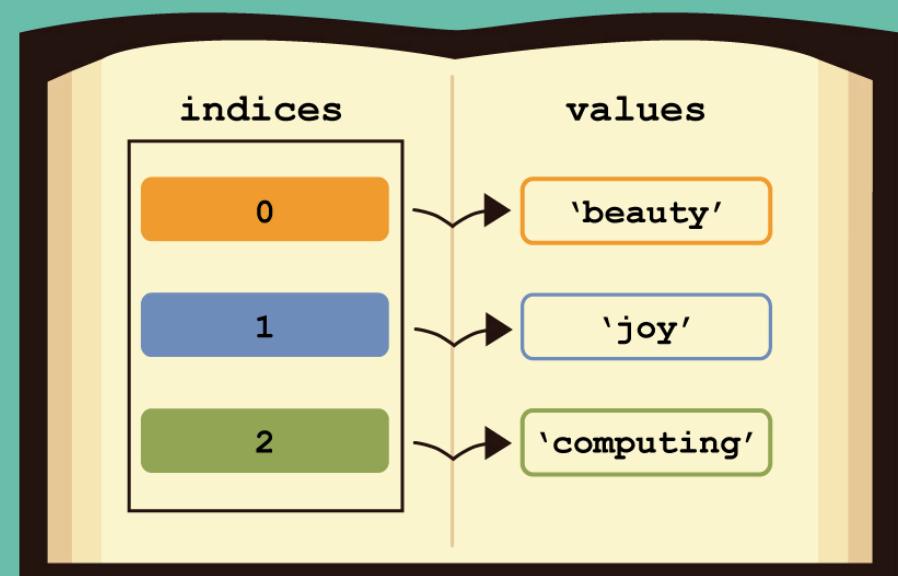
LISTS VS DICTIONARIES



dictionaries



lists



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

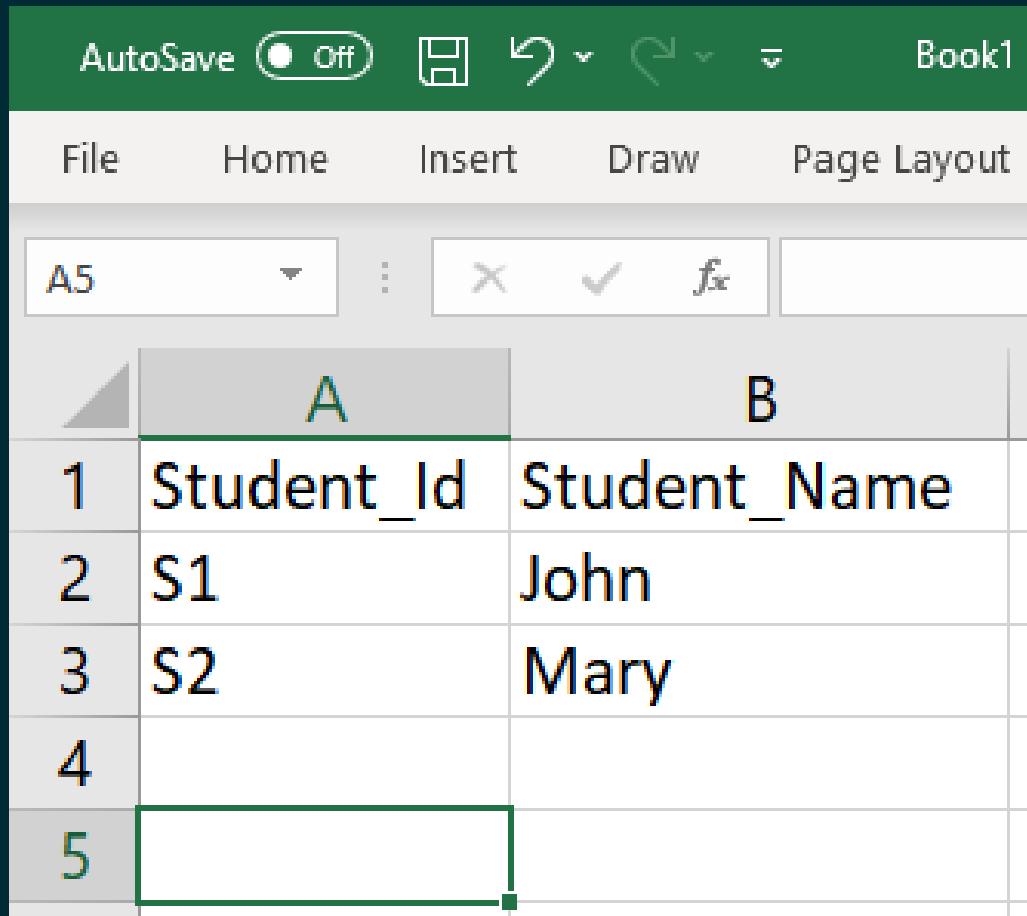
```
1 my_dict = {}  
2  
3 my_dict['name'] = 'Tom'  
4  
5 my_dict['age'] = 35  
6  
7 print(my_dict)
```

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

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

Disadvantage: dictionaries are inherently unordered

ONE KEY, MANY VALUES



| | A | B |
|---|------------|--------------|
| 1 | Student_Id | Student_Name |
| 2 | S1 | John |
| 3 | S2 | Mary |
| 4 | | |
| 5 | | |

```
1 my_python = {'Student_ID':['S1','S2'],
2                 'Student_Name':['John', 'Mary']
3 }
```

RECAP: COMMON OPERATIONS

```
1 # create an empty dictionary
2 my_dict = {}
3
4 # create a new dict with 3 items
5 my_dict = {'one':1, 'two':2, 'three':3}
6
7 # access an element
8 print(my_dict['two'])
```

Data updates:

```
1 # add an entry
2 my_dict['four'] = 4
3
4 # change an entry
5 my_dict['one'] = 'uno'
6
7 # count items
8 howmany = len(my_dict)
```

keys AND values

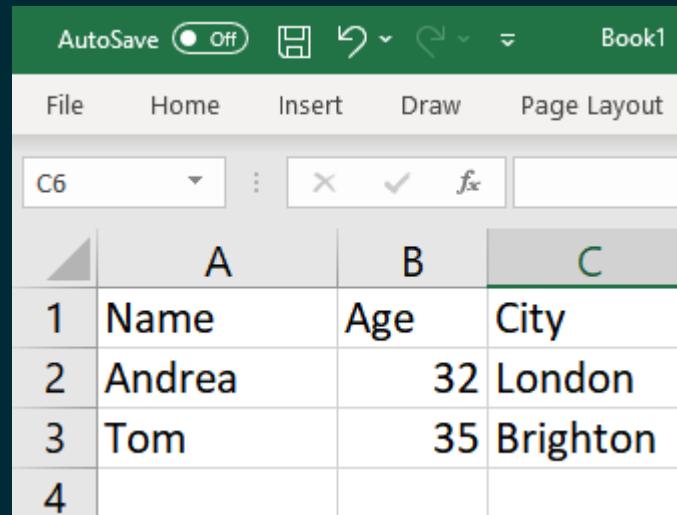
```
1 # iterate over keys
2 for item in my_dict.keys():
3     print(item)
4
5 # iterate over values
6 for item in my_dict.values():
7     print(item)
```

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