

KOLT Python

Error Handling, File Input & Output

Ceren Kocaoğullar

Tuesday 10th March, 2020



**KOÇ
UNIVERSITY**

OFFICE OF LEARNING AND TEACHING



Agenda

1. Recap

Python Data Model

Data Structures

2. Dictionaries

3. Error/Exception Handling

4. File Input/Output

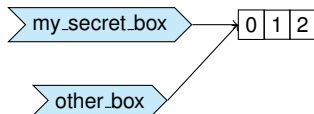
Mutability

Immutable: An `object` with a fixed value.

- **int, float, long complex, strings, frozenset, tuples**
- Such an object cannot be altered
- A new object has to be created if a different value has to be stored

Python Data Model

```
my_secret_box = [0, 1, 2]
other_box = my_secret_box
other_box.remove(2)
print(my_secret_box)
```



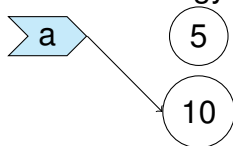
Variables are more like **labels** pointing to **values**!
Assignment links **variables** to **values**!

Object

Everything is an object in Python. Even though variables **do not** have `types`, each object has a **fixed** `type`.

↪ Values at the right side of our label analogy are objects!

```
a = 5  
a = 10
```



Object

Each object has an `identity`, this value can be obtained by using `id()` function.

`==` operator compares values, `is` operator compares identities.

```
a = 1000  
b = 1000  
a == b    # => True  
a is b    # => False
```

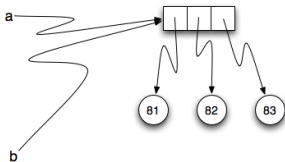
Almost always use `==` to compare values!

Aliasing & Cloning

- More than one variables can refer to **same object**!
- What if we want to clone/copy instead of aliasing?
- For lists, `list.copy()` \Rightarrow returns a shallow copy of the list.
- Shallow: only copy the references, not inner values.

```
>>> import copy
```

```
copy.copy(x) : shallow copy, copy.deepcopy(x) : deepcopy
```



Tuples

- **Immutable** sequence(ordered) of elements.
- Similar to `lists`, you can use **indexing**, **slicing**, and iterate over using `for` loops.
- Elements cannot be added/removed/changed once the tuple is created.
- How to create tuples?

```
my_tuple = (1, [1, 2], 'a')
```

- `len(my_tuple) ⇒`
3

- `my_tuple.append(3) ⇒`

```
AttributeError: 'tuple' object has no  
attribute 'append'
```


Tuples

`()` or `tuple()`: empty tuple,
`(3):int` **3**,
`(3,):tuple` **containing 3**

```
my_list = [1, 2, 3]
my_tuple = ('a', my_list) # ('a', [1, 2, 3, 4])
my_list.append(4)
print(my_tuple)
my_list += [5, 6, 7] # my_list.extend(...)
print(my_tuple)
my_tuple += (1, 2) # my_tuple = my_tuple + (1, 2)
print(my_tuple)
```

Sets

- **Unordered** sequence of **unique** elements.
- **Cannot** use indexing/slicing, can iterate with `for` loops.
- **Mutable**, `add(element)`, `remove(element)` methods.
- Python also has **immutable** sets: `frozenset`
- How to create sets?
`my_set = {1, 2, 3, 4, 2}`
- How to create empty sets?
`set()` (`{ }` is reserved for `dict`)
- Can compute set operations: **union**, **intersection**, **difference**, **symmetric difference**.

1. Recap



2. Dictionaries



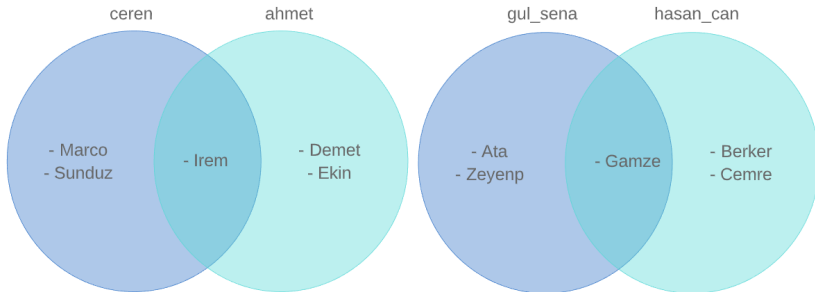
3. Error/Exception Handling



4. File Input/Output



Sets



Sets

```

ceren = {'Marco', 'Irem', 'Sunduz'}
gul_sena = {'Gamze', 'Ata', 'Zeynep'}
hasan_can = {'Gamze', 'Berker', 'Cemre'}
ahmet = {'Irem', 'Demet', 'Ekin'}

# intersection &
print(gul_sena.intersection(hasan_can))  # => {'Gamze'}
print(ceren & gul_sena)  # => set()
# union |
print(ceren.union(ahmet))  # => {'Ekin', 'Irem', 'Demet',
                                # 'Marco', 'Sunduz'}
print(hasan_can | ceren | gul_sena | ahmet)  # => all names
# difference -
print((gul_sena - hasan_can))  # => {'Zeynep', 'Ata'}
# symmetric_difference ^
print(ceren.symmetric_difference(ahmet))
# => {'Marco', 'Ekin', 'Sunduz', 'Demet'}
```

Dictionaries

- Collection of **key–value** pairs.

Dictionaries

- Collection of **key–value pairs**.
- **Cannot** use **indexing/slicing**, can iterate with `for` loops.

Dictionaries

- Collection of **key–value** pairs.
- **Cannot** use **indexing/slicing**, can iterate with `for` loops.
- In general, they are not **ordered**.

Dictionaries

- Collection of **key–value** pairs.
- **Cannot** use **indexing/slicing**, can iterate with `for` loops.
- In general, they are not **ordered**.
- However, in Python 3.7 pairs are guaranteed to be in insertion order.

Dictionaries

- Collection of **key–value** pairs.
- **Cannot** use **indexing/slicing**, can iterate with `for` loops.
- In general, they are not **ordered**.
- However, in Python 3.7 pairs are guaranteed to be in insertion order.
- In other words, we will get pairs in insertion order if we loop over the `dict`.

Dictionaries

- Collection of **key–value** pairs.
- **Cannot** use **indexing/slicing**, can iterate with `for` loops.
- In general, they are not **ordered**.
- However, in Python 3.7 pairs are guaranteed to be in insertion order.
- In other words, we will get pairs in insertion order if we loop over the `dict`.
- How to create dictionaries?

Dictionaries

- Collection of **key–value** pairs.
- **Cannot** use **indexing/slicing**, can iterate with `for` loops.
- In general, they are not **ordered**.
- However, in Python 3.7 pairs are guaranteed to be in insertion order.
- In other words, we will get pairs in insertion order if we loop over the `dict`.
- How to create dictionaries? `{ }/dict()`: empty dictionary

Dictionaries

- Collection of **key–value** pairs.
- **Cannot** use **indexing/slicing**, can iterate with `for` loops.
- In general, they are not **ordered**.
- However, in Python 3.7 pairs are guaranteed to be in insertion order.
- In other words, we will get pairs in insertion order if we loop over the `dict`.
- How to create dictionaries? `{ }/dict()`: empty dictionary
- `d = {'one': 1, 'two': 2, 'three': 3, 'four': 4}`

Dictionaries

- Collection of **key–value** pairs.
- **Cannot** use **indexing/slicing**, can iterate with `for` loops.
- In general, they are not **ordered**.
- However, in Python 3.7 pairs are guaranteed to be in insertion order.
- In other words, we will get pairs in insertion order if we loop over the `dict`.
- How to create dictionaries? `{ }/dict()`: empty dictionary
- `d = {'one': 1, 'two': 2, 'three': 3, 'four': 4}`
- How to access values?

Dictionaries

- Collection of **key–value** pairs.
- **Cannot** use **indexing/slicing**, can iterate with `for` loops.
- In general, they are not **ordered**.
- However, in Python 3.7 pairs are guaranteed to be in insertion order.
- In other words, we will get pairs in insertion order if we loop over the `dict`.
- How to create dictionaries? `{ }/dict()`: empty dictionary
- `d = {'one': 1, 'two': 2, 'three': 3, 'four': 4}`
- How to access values? `print(d['one'])` # \Rightarrow 1

Attendance

Fill out the attendance form:
tiny.cc/kolt-hackathon

Syntax Errors

What happens when you run a syntactically incorrect file?

Syntax Errors

What happens when you run a syntactically incorrect file?

```
for i in range(100)
print(i)
# SyntaxError: invalid syntax
```

Syntax Errors

What happens when you run a syntactically incorrect file?

```
for i in range(100)
print(i)
# SyntaxError: invalid syntax
```

```
while True:
print('Hello')
# IndentationError: expected an indented block
```

Easy to detect: Your code will not work :)

Runtime Exceptions

When a statement is **syntactically correct** does that mean we are safe?

Runtime Exceptions

When a statement is **syntactically correct** does that mean we are safe?

```
print(3/0)
```

Runtime Exceptions

When a statement is **syntactically correct** does that mean we are safe?

```
print(3/0) , int('hello')
```

Runtime Exceptions

When a statement is **syntactically correct** does that mean we are safe?

```
print(3/0) , int('hello') , 'hello'[2] = 'a'
```

Runtime Exceptions

When a statement is **syntactically correct** does that mean we are safe?

```
print(3/0) , int('hello') , 'hello'[2] = 'a'
```

How to be safe in these situations?

Runtime Exceptions

When a statement is **syntactically correct** does that mean we are safe?

```
print(3/0), int('hello'), 'hello'[2] = 'a'
```

How to be safe in these situations?

- Put `if` checks everywhere?

Runtime Exceptions

When a statement is **syntactically correct** does that mean we are safe?

```
print(3/0), int('hello'), 'hello'[2] = 'a'
```

How to be safe in these situations?

- Put `if` checks everywhere?
- Too much effort, and probably we cannot list every condition.

Runtime Exceptions

When a statement is **syntactically correct** does that mean we are safe?

```
print(3/0), int('hello'), 'hello'[2] = 'a'
```

How to be safe in these situations?

- Put `if` checks everywhere?
- Too much effort, and probably we cannot list every condition.
- Solution is `try-except-finally` blocks.

Try Except Blocks

```
try:
    <risky-statements>
    <risky-statements>
    <risky-statements>
    ...
except ValueError as valError:
    print('value error', valError)
except (RuntimeError, TypeError, NameError):
    print('One of the above errors, but not ValueError')
else:
    print('No errors')
finally:
    print('This always runs')
```

Try Except Blocks

```
def divide(x, y):  
    try:  
        result = x / y  
    except ZeroDivisionError:  
        print("division by zero!")  
    else:  
        print("result is", result)  
    finally:  
        print("executing finally clause")
```

Working With Files

Why might we want to work with files?

Working With Files

Why might we want to work with files?

- Work on **structured** data in large quantities.

Working With Files

Why might we want to work with files?

- Work on **structured** data in large quantities.
- Save the current state of the program for later retrieval

Working With Files

Why might we want to work with files?

- Work on **structured** data in large quantities.
- Save the current state of the program for later retrieval
 - How to add save/load functionality to game you have written?
- Save the result of your program.

Working With Files

Why might we want to work with files?

- Work on **structured** data in large quantities.
- Save the current state of the program for later retrieval
 - How to add save/load functionality to game you have written?
- Save the result of your program.
 - Save experiment results to a file.

Working With Files

Why might we want to work with files?

- Work on **structured** data in large quantities.
- Save the current state of the program for later retrieval
 - How to add save/load functionality to game you have written?
- Save the result of your program.
 - Save experiment results to a file.
- Keep logs for large systems.

Working With Files

Why might we want to work with files?

- Work on **structured** data in large quantities.
- Save the current state of the program for later retrieval
 - How to add save/load functionality to game you have written?
- Save the result of your program.
 - Save experiment results to a file.
- Keep logs for large systems.
- ...

Files In Python

Access to a `file` object using `open(filename, mode='r')` function

- **filename**: File name including the **file extension**. Ex: 'data.txt'

Files In Python

Access to a `file` object using `open(filename, mode='r')` function

- **filename**: File name including the **file extension**. Ex: `'data.txt'`
- If you want to access/create a file outside of current **working directory**, you also need to include path. Ex: `'./FolderName/data.txt'`, `'C:/Users/AUYSAL16/Desktop/data.txt'`

Files In Python

Access to a `file` object using `open(filename, mode='r')` function

- **filename**: File name including the **file extension**. Ex: 'data.txt'
- If you want to access/create a file outside of current **working directory**, you also need to include path. Ex: './FolderName/data.txt', 'C:/Users/AUYSAL16/Desktop/data.txt'
- **mode** denotes how the file will be used:

Files In Python

Access to a `file` object using `open(filename, mode='r')` function

- **filename**: File name including the **file extension**. Ex: `'data.txt'`
- If you want to access/create a file outside of current **working directory**, you also need to include path. Ex: `'./FolderName/data.txt'`, `'C:/Users/AUYSAL16/Desktop/data.txt'`
- **mode** denotes how the file will be used:
 - `'r'`: read mode, default

Files In Python

Access to a `file` object using `open(filename, mode='r')` function

- **filename**: File name including the **file extension**. Ex: 'data.txt'
- If you want to access/create a file outside of current **working directory**, you also need to include path. Ex: './FolderName/data.txt', 'C:/Users/AUYSAL16/Desktop/data.txt'
- **mode** denotes how the file will be used:
 - 'r': read mode, default
 - 'w': write mode, overrides the file contents if it already exists

Files In Python

Access to a file object using `open(filename, mode='r')` function

- **filename**: File name including the **file extension**. Ex: 'data.txt'
- If you want to access/create a file outside of current **working directory**, you also need to include path. Ex: './FolderName/data.txt', 'C:/Users/AUYSAL16/Desktop/data.txt'
- **mode** denotes how the file will be used:
 - 'r': read mode, default
 - 'w': write mode, overrides the file contents if it already exists
 - 'x': create & write mode, similar to write mode gives error if file already exists

Files In Python

Access to a file object using `open(filename, mode='r')` function

- **filename**: File name including the **file extension**. Ex: 'data.txt'
- If you want to access/create a file outside of current **working directory**, you also need to include path. Ex: './FolderName/data.txt', 'C:/Users/AUYSAL16/Desktop/data.txt'
- **mode** denotes how the file will be used:
 - 'r': read mode, default
 - 'w': write mode, overrides the file contents if it already exists
 - 'x': create & write mode, similar to write mode gives error if file already exists
 - 'a': append mode, adds content to the end of file

File Methods

How to read file content?

File Methods

How to read file content?

- First open the file `f = open('my_file.txt')`

File Methods

How to read file content?

- First open the file `f = open('my_file.txt')`
- `f.read()`: returns content of entire file as a string

File Methods

How to read file content?

- First open the file `f = open('my_file.txt')`
- `f.read()`: returns content of entire file as a string
- `f.readline()`: returns a single line from file

File Methods

How to read file content?

- First open the file `f = open('my_file.txt')`
- `f.read()`: returns content of entire file as a string
- `f.readline()`: returns a single line from file
- **for** line **in** f: \Rightarrow Iterate over all lines

File Methods

How to read file content?

- First open the file `f = open('my_file.txt')`
- `f.read()`: returns content of entire file as a string
- `f.readline()`: returns a single line from file
- **for** line **in** f: \Rightarrow Iterate over all lines
- `list(f)/f.readlines()`: read file lines to a list

File Methods

How to read file content?

- First open the file `f = open('my_file.txt')`
- `f.read()`: returns content of entire file as a string
- `f.readline()`: returns a single line from file
- **for** line **in** f: \Rightarrow Iterate over all lines
- `list(f)/f.readlines()`: read file lines to a list
- **Always** close the file when you are done: `f.close()`

File Methods

How to create/modify files?

- Open the file with a write enabled mode, e.g, `w`, `x`, `a`

File Methods

How to create/modify files?

- Open the file with a write enabled mode, e.g, `w`, `x`, `a`
- Ex: `f = open('my_file', 'w')`

File Methods

How to create/modify files?

- Open the file with a write enabled mode, e.g, `w`, `x`, `a`
- Ex: `f = open('my_file', 'w')`
- Use `f.write(string)` to write to file

File Methods

How to create/modify files?

- Open the file with a write enabled mode, e.g, `w`, `x`, `a`
- Ex: `f = open('my_file', 'w')`
- Use `f.write(string)` to write to file
- `file.write()` method **only** takes **str** values!

File Methods

How to create/modify files?

- Open the file with a write enabled mode, e.g, `w`, `x`, `a`
- Ex: `f = open('my_file', 'w')`
- Use `f.write(string)` to write to file
- `file.write()` method **only** takes **str** values!
- Close the file when you are done.

File Methods

How to create/modify files?

- Open the file with a write enabled mode, e.g, `w`, `x`, `a`
- Ex: `f = open('my_file', 'w')`
- Use `f.write(string)` to write to file
- `file.write()` method **only** takes **str** values!
- Close the file when you are done.
- `f.close()`

Lecture In-Class Exercises

You can find the in-class exercises' starter codes here:

<https://github.com/koltpython/python-slides/tree/master/Lecture7/lecture-examples>