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

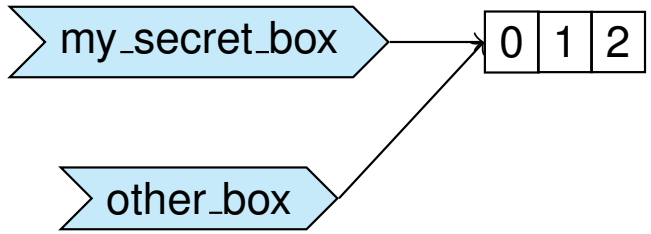
Mutability

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)
```

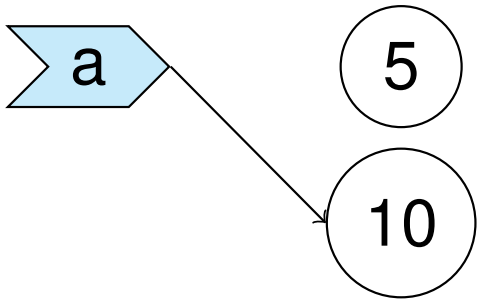


Variables are more like **labels** pointing to **values**!
Assignment links **variables** to **values**!

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

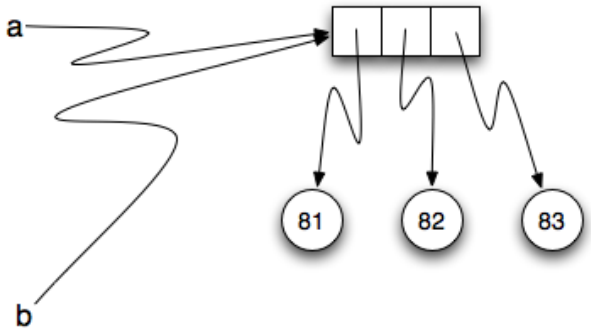
Each object has an `identity`, this value can be obtained by using **`id()`** function.
`==` operator compares values, **`is`** operator compares identities.

```
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()` ⇒ 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

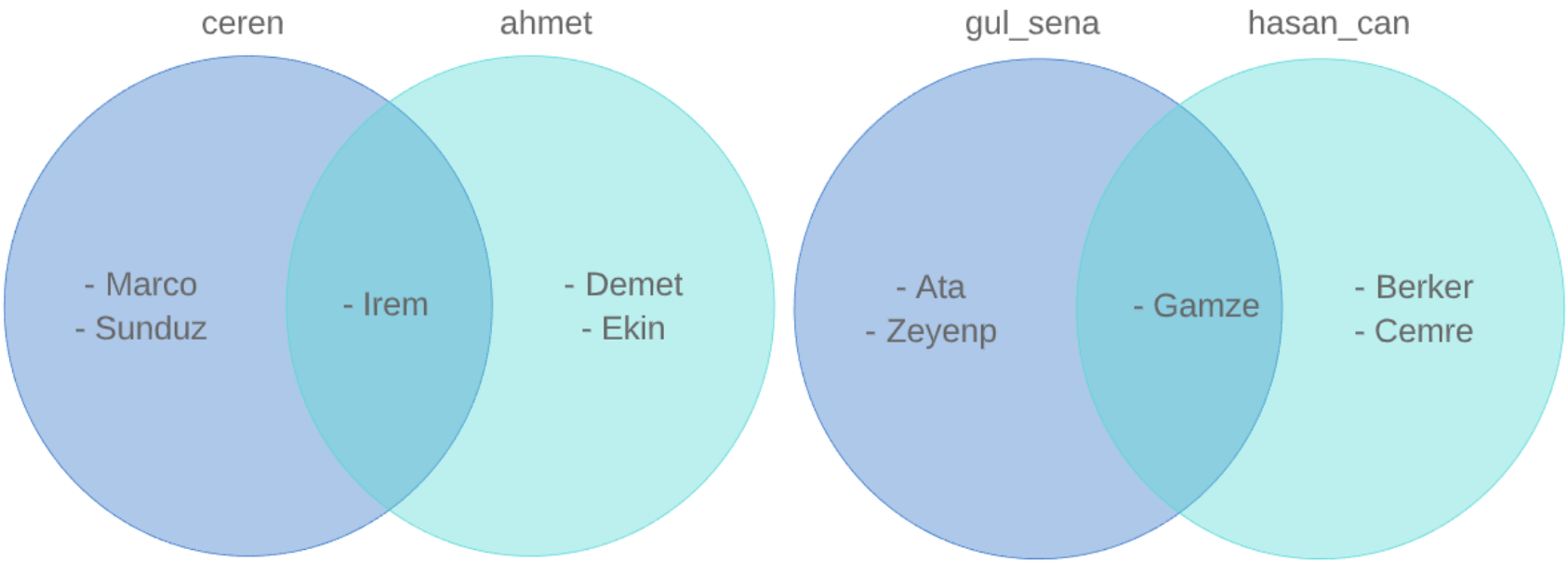
`()` or `tuple()`: empty tuple,
`(3)`: `int` 3,
`(3,)`: `tuple` containing 3

```
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**.

Sets


ceren
ahmet
gul_sena
hasan_can
- Marco
- Sunduz
- Irem
- Demet
- Ekin
- Ata
- Zeyenp
- Gamze
- Berker
- Cemre

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.
- **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'])` # ⇒ 1

Attendance

Fill out the attendance form:

tiny.cc/kolt-hackathon

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?

```
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?

- 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'
- 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?

- 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`
- 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()`