KOLT Python

Containers, Aliasing & Mutability

Gül Sena Altıntaş

Monday 4th November, 2019

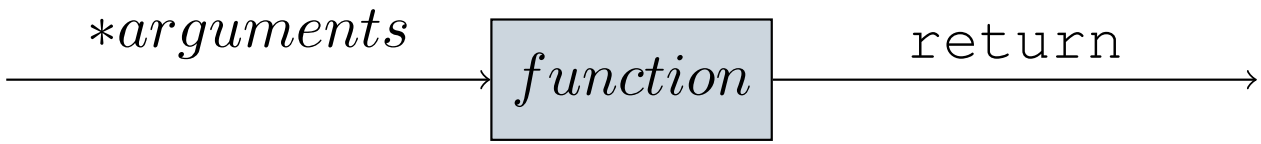
Agenda

Functions

Lists

1. Data Model
2. Aliasing & Cloning
3. Objects
4. Mutability
5. Tuples
6. Sets
7. Dictionaries

Functions




```
def function_name(parameter2, parameter2, ...):
    <expression>
    ...
    return value
```

```
fib_100 = fibonacci_series(100)
what_is_going_on = print(fib_100)
```

return Statement

Every function returns one value!
What type does each function return?

```
def square(x):
    return x**2
```

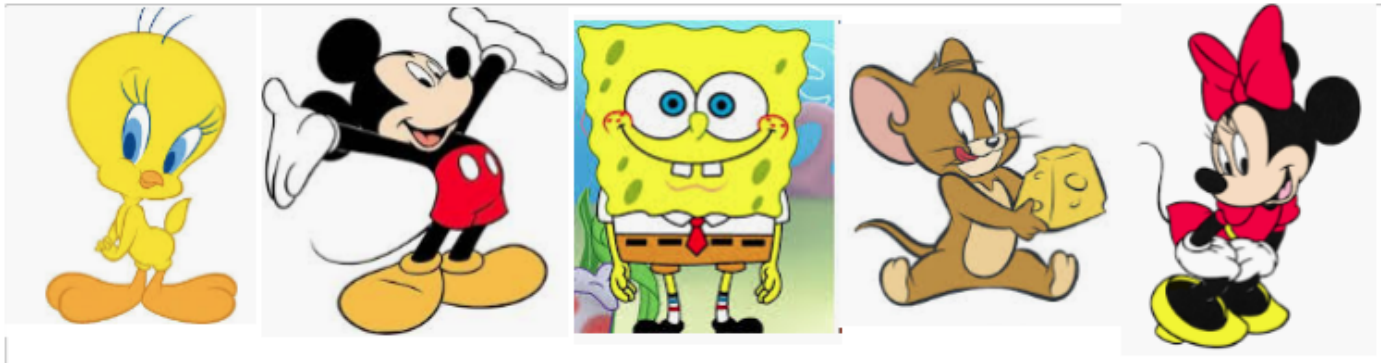
```
def your_full_name(name, surname):
    return name + ' ' + surname
```

```
def what_is_the_meaning_of_life(life):
    print("I guess it's nothing")
```

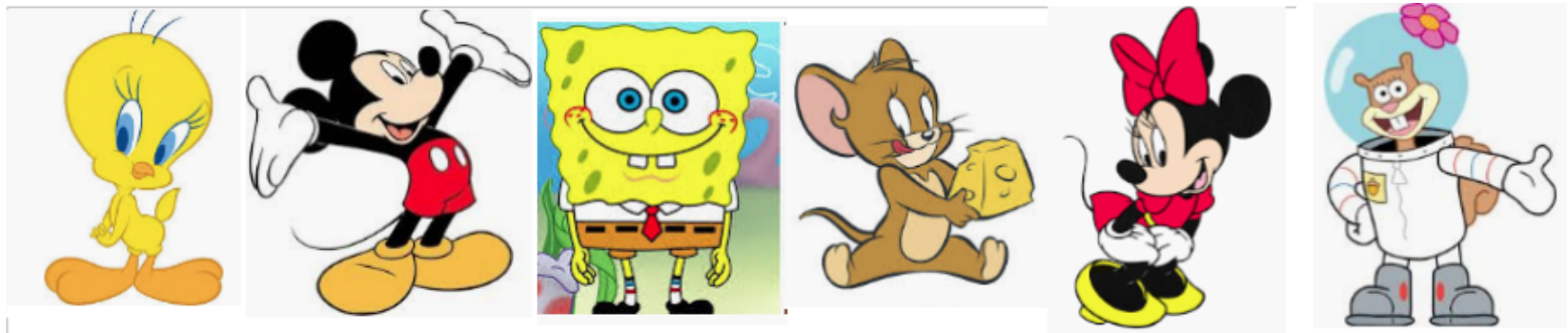
```
def who_are_my_instructors(student):
    instructors = ['Ahmet', 'Ceren', 'Gül Sena', 'Hasan Can']
    return instructors
```

Sponge Bob seeks for Sandy

```
cartoon_characters=['Tweety', 'Mickey', 'Sponge Bob', 'Jerry',
'Minnie']
```



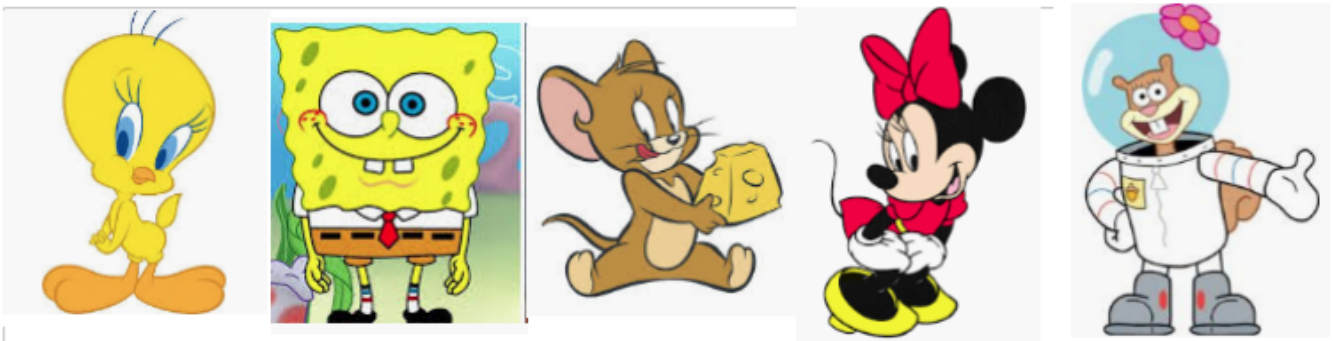
```
cartoon_characters.append('Sandy')
```



Let's play

But, what good is Mickey without being near to Minnie?

```
cartoon_characters.remove('Mickey')
```




```
cartoon_characters.insert(4, 'Mickey')
```

List Operations

Be quick!

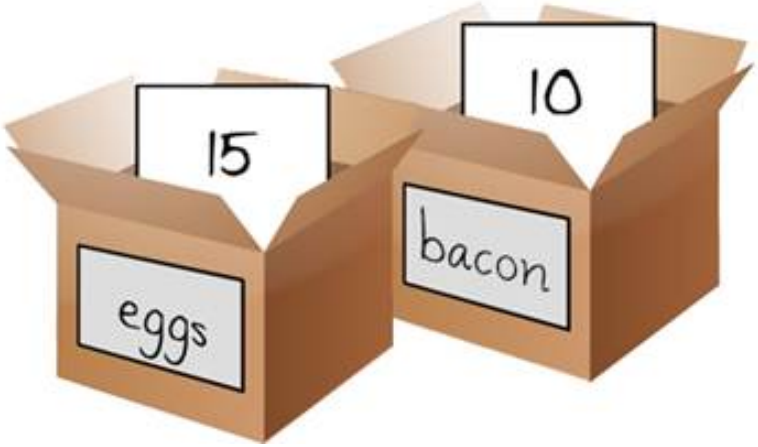
`len(cartoon_characters)` ⇒ 6
`cartoon_characters[6]` ⇒ Error
`'Jerry'in cartoon_characters` ⇒ False
`cartoon_characters.index('Tweety')` ⇒ 0

Don't let me forget you

Fill out the attendance form: *tiny.cc/kolt-python*
Password: **Recycle**

Python Data Model

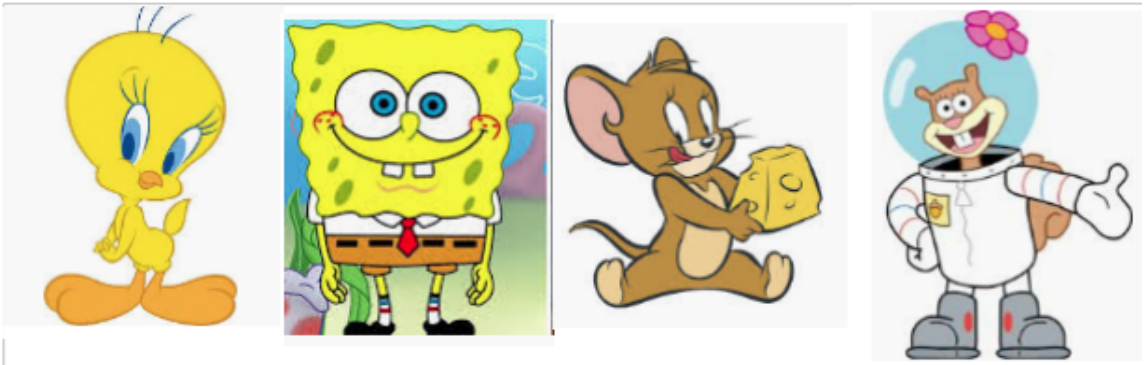
How did we represent data in Python? **Variables!**
How do they work? Do they store the data themselves?



Box Analogy

```
my_age = 9
my_age += 12
print(my_age)    # => 21
```

```
mickeys_leaving = cartoon_characters
mickeys_leaving.remove('Mickey')
mickeys_leaving.remove('Minnie')
print(cartoon_characters)
```



Did we just changed inside of a closed box?
Box analogy **does not** work!

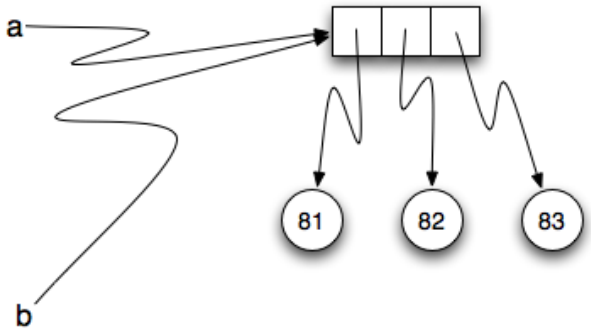
Python Data Model

```
cartoon_characters = ['Tweety',
'Sponge Bob', 'Jerry', 'Minnie',
'Mickey', 'Sandy']
mickeys_leaving =
cartoon_characters
mickeys_leaving.remove('Mickey')
mickeys_leaving.remove('Minnie')
print(cartoon_characters)
```

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

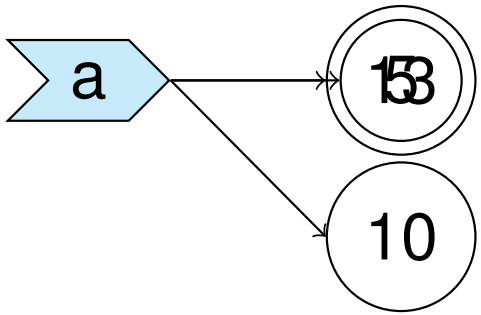


What if we copied the cartoon characters

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!

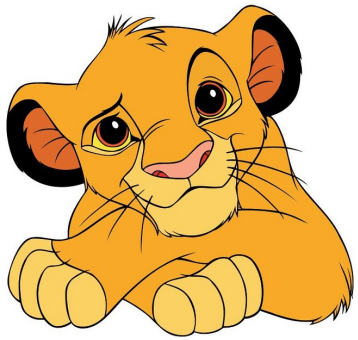
```
a = 5
a = 10
a += 3
print(a)
```



Object

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

```
simba_2019 = 'Simba'
simba_cartoon = 'Simba'
simba_2019 == simba_cartoon       # => True
simba_2019 is simba_cartoon       # => False
```



Almost always use **`==`** to compare values!

Mutability

Immutable:

An `object` with a fixed value. Immutable objects include **numbers**, **strings** and **tuples**. Such an object cannot be altered. A new object has to be created if a different value has to be stored. They play an important role in places where a constant **hash value** is needed, for example as a **key** in a `dictionary`.

```
a = 5
a = 10
a += 3
```

```
hello = 'hello'
hallo = hello[0] + 'a' + hello[2:]
```

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)`** $\Rightarrow$ 3
- **`my_tuple.append(3)`** $\Rightarrow$ **`AttributeError:`** `'tuple' object has no attribute 'append'`

Tuples

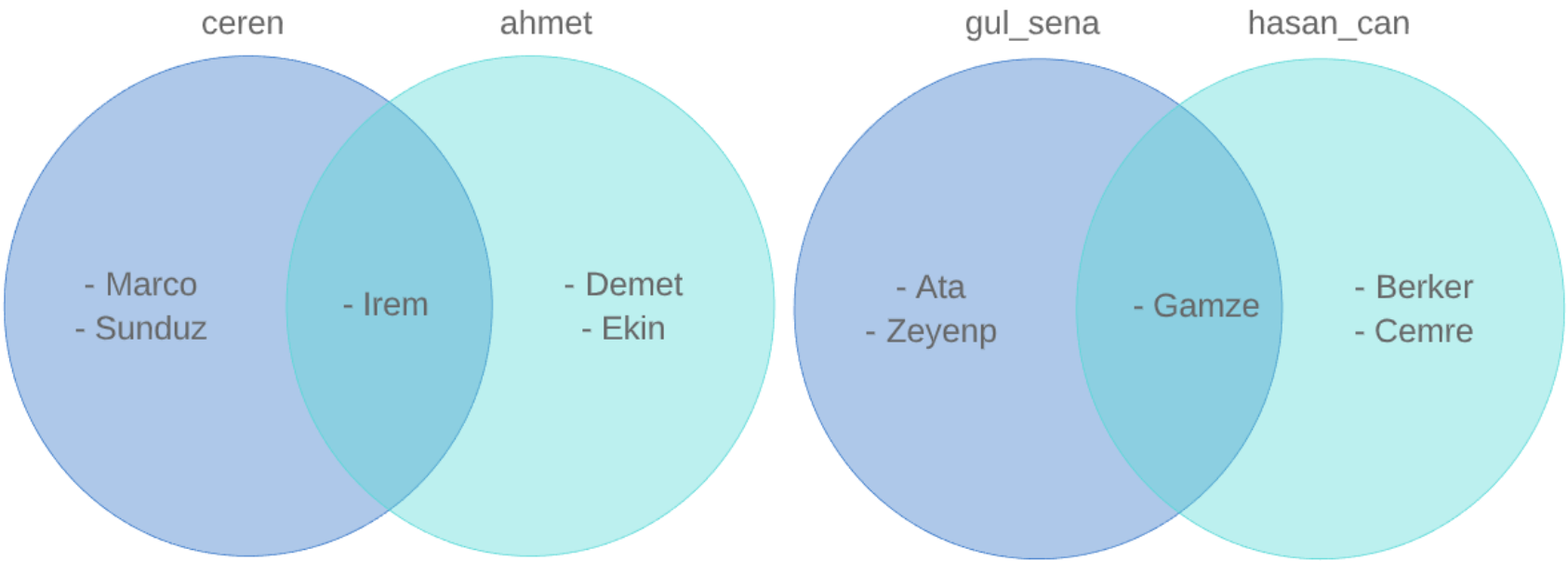
`()` / `tuple()`: empty tuple,
`(3)`: `int` 3,
`(3,)`: `tuple` containing 3

```
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

Confused Section Leader Gul Sena

```
# I need a way to keep track of my students
my_students = {'Ayse': ['economics', 'freshman'],
               'Emir': ['psychology', 'master'],
               'Emirhan': ['business administration', 'junior'],
               'Furkan': ['law', 'junior'],
               'Mahsa': ['material science', 'phd'],
               'Meva': ['international relations', 'freshman']}

for student, info in my_students.items():
    print(f'{student} studies {info[0]}')
# Emir left my class :(
my_students.pop('Emir')
# someone new in my class
my_students['Canan'] = ['industrial engineering', 'junior']
# Ayse passed another year
my_students['Ayse'][1] = 'sophomore'
```