Duck Typing in Python

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Introduction

Python is an ***interpreted***, ***multi-paradigm*** language. It was initially designed by Guido van Rossum in 1991 and developed by Python Software Foundation. It supports:

- **Functional programming** (non pure);
- **Procedural programming**;
- **Objected oriented**.

Python's semantic

Could be useful to first recall the difference between ***strict*** and ***lazy*** evaluation:

1. **Strict evaluation strategy**: the arguments of a function are fully evaluated to values before evaluating the function call (call by value);
2. **Non-strict or Lazy evaluation:** arguments are evaluated only if it is needed in the function body (*call by name*)

Python:

- implements **strict semantic**;
- uses **whitespace indentation**, rather than curly brackets or keywords, to delimit blocks.

Semantic: Python vs Haskell

In Python we never get *true* beacause he forced the evaluation of the function wich is an infinite loop:

```
def infiniteLoop(x):
    while True:
       print("do something with x")
    return x

5 in [5, 10, infiniteLoop(5)]
```

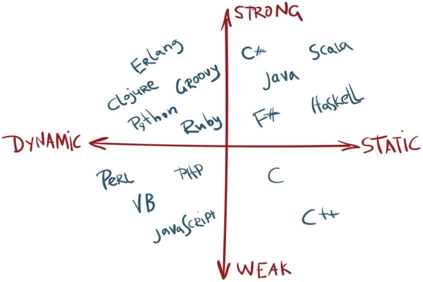
If we write the same code in **haskell** we get the *true* value:

```
elem 2 [2, 4, noreturn 5]
```

Type checker (1)

Type checking is the process of verifying and enforces the typing rules of a language.

1. **Dynamic vs. Static**
2. **Weak vs Strong**.



Type checker (2)

1. **Dynamic vs. Static**
   - **Statically-typed languages**: typechecking is done at compile-time, in order to guarantee the absence of run-time (type) errors: formal proof of type-safety.
   - **Dynamically-typed languages:** dynamic type checking is the process of verifying type constraints at runtime, during execution.
2. **Weak vs Strong**
   - AGGIUNGERE STRONGLY
   - AGGIUNGERE WEAKLY

Python’s type checker

1. Python is **dynamic**:
   - objects have a type but it is determined at runtime;
   - variables are not explicitly typed
   - an assignement binds a name to an object anche the object could be of any type
2. Python is also **strongly typed**.

Let’s see the implications by some example.

Python’s dynamic typing example (1)

```python
if False:
    print(10+"ten")
else:
    print(10+10)
```

The first branch never execute, so the type checking ignore the type incongruency.
If we try to execute **separately** the first branch, the type check raise a type error:

```
TypeError: unsupported operand type(s) for +: 'int' and 'str'
```

Python’s dynamic typing example (2)

Another consequnce is that programmers are **free to bind the same names (variables) to different objects with a different type**. Then the following statements are perfectly legal:

```
variable = 10
variable = "ten"
```

So long as you only perform operations valid for the type the interpreter doesn’t care what type they actually are.

Python’s strong typing example

Python is not allowed to perform operations inappropriate to the type of the object:

```
print(10+"ten")
```

In a **weakly-typed** language, like PHP, the integer is forced to be a string and no type error is raised:

```
$temp = "ten";
$temp = $temp + 10; // no error caused
echo $temp;
```

The output will be "ten10".

Some exceptions (1)

There are some operations allowed even in case of type incongruence.
The **boolean equivalence** is permitted in Python 2 and 3:

```
print("10" == 10)
print("10" != 10)
```

Returning:

```
False
True
```

Some exceptions (2)

In Python 2 "*grather than*" and *"less than"* are permitted:

```
print("10">10)
print("10"<10)
```

Returning:

```
True
False
```

Python 3 do not allowed to do "*grather than*" and *"less than"* controls like these.

Annotations