PROGRAMMING IN PYTHON I

Classes: Advanced Topics

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Root Class object

- Every class in Python extends the root/base class **object**.
- This means that we inherit everything that is available in `object`, which are several useful **special methods**:[1]
  - `__eq__(self, other)`
  - `__hash__(self)`
  - `__str__(self)`
  - `__lt__(self, other)`
  - `...`
- Examples and explanations (for some) are part of the supplementary code file.

[1] No attributes are inherited because `object` does not have any (instance) attributes.

Example: Overriding Equality Comparison

- Often, it would be nice to check the instances of our custom classes for equality using the == operator, e.g.:

```
class Dog:
    # Implementation

dog1 = Dog(...)
dog2 = Dog(...)
if dog1 == dog2:
    # Do something
```

- By default, this equality comparison falls back to a reference/identity check (`dog1 is dog2`).
- This is the default behavior of the special `object` method `__eq__(self, other)`, which will be automatically invoked when the == operator is used.

Example: Overriding Equality Comparison

- We can **override** this special method to provide custom behavior for our `Dog` objects!

```
class Dog:
    def __eq__(self, other):
        if isinstance(other, Dog):
            # Whatever checks we need to perform
            return self.name == other.name and ...
        return NotImplemented  # See code file
```

- Now, whenever something like `some_dog == x` is encountered, this is automatically translated into `Dog.__eq__(self=some_dog, other=x)`.
- This is also called **operator overloading**, since we changed the behavior of our `Dog`'s `==` operator.

More Operator Overloading

- There are also some operators we can overload that are not part of `object`.
- This means that there is no default support, but we can easily enable it and provide support ourselves.
- Some examples:
  - add **+**: `__add__(self, other)`
  - multiply *****: `__mul__(self, other)`
  - get-indexing **[]**: `__getitem__(self, key)`
  - contains **in**: `__contains__(self, item)`
  - ...

Enabling Support for Python Features

- There also exist special methods that enable support for certain Python **features**.
- Some examples:
  - Iteration (e.g., in for loops): `__iter__(self)`
  - Context managers (**with** statement): `__enter__(self)` and `__exit__(self, exc_type, exc_value, traceback)`
  - Making objects callable (like function invocations): `__call__(self, ...)`
  - `...`

Implementation

- How do we have to implement all these special methods?
- **Read the specification**, which lists the requirements and contains the necessary information!
- Useful links:
  - Data model (among other information, listing the specification of special methods):
    `https://docs.python.org/3/reference/datamodel.html`
  - Python's built-in types:
    `https://docs.python.org/3/library/stdtypes.html`
  - Glossary (listing important terms):
    `https://docs.python.org/3/glossary.html`