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# OWLAPY

*Release 0.1.2*

**Ontolearn Team**

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OWLAPY<sup>1</sup>: Representation of OWL objects in python.

## 1 About owlapy

**Version:** owlapy 1.0.1

**GitHub repository:** <https://github.com/dice-group/owlapy>

**Publisher and maintainer:** DICE<sup>2</sup> - data science research group of Paderborn University<sup>3</sup>.

**Contact:** [onto-learn@lists.uni-paderborn.de](mailto:onto-learn@lists.uni-paderborn.de)

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<sup>1</sup> <https://github.com/dice-group/owlapy>

<sup>2</sup> <https://dice-research.org/>

<sup>3</sup> <https://www.uni-paderborn.de/en/university>

## 1.1 What is owlapy?

Owlapy is an open-source software library in python that is used to represent entities in OWL 2 Web Ontology Language.

We identified the gap of having a library that will serve as a base structure for representing OWL entities in python and like that, owlapy was created. Owlapy is loosely based on its java-counterpart, *owlapi*. Owlapy is currently utilized by powerful libraries such as [Ontolearn](https://github.com/dice-group/Ontolearn)<sup>4</sup> and [OntoSample](https://github.com/alkidbaci/OntoSample)<sup>5</sup>.

Owlapy is the perfect choice for machine learning projects that are built in python and focus on knowledge graphs and class expression learnings.

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## 1.2 What does owlapy have to offer?

- Represent every notation in [OWL 2 Structural Specification and Functional-Style Syntax](https://www.w3.org/TR/owl2-syntax/)<sup>6</sup> including:
  - Entities, Literals, and Anonymous Individuals
  - Property Expressions
  - Data Ranges
  - Class Expressions
  - Axioms
  - Annotations
- Construct complex class expressions.
- Provide interfaces for OWL Ontology, Ontology manager and Reasoner.
- Convert owl expression to SPARQL queries.
- Render owl expression to Description Logics or Manchester syntax.
- Parse Description Logics or Manchester expression to owl expression.

## 1.3 How to install?

Installation from source:

```
git clone https://github.com/dice-group/owlapy
conda create -n temp_owlapy python=3.10.13 --no-default-packages && conda activate _
↪temp_owlapy && pip3 install -e .
```

or using PyPI:

```
pip3 install owlapy
```

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<sup>4</sup> <https://github.com/dice-group/Ontolearn>

<sup>5</sup> <https://github.com/alkidbaci/OntoSample>

<sup>6</sup> <https://www.w3.org/TR/owl2-syntax/>

## 2 Usage

The main usage for owlapy is to use it for class expression construction. Class expression learning algorithms require such basic structure to work upon. Let's walk through an example of constructing some class expressions.

In this example we will be using the *family* ontology, a simple ontology with namespace: `http://example.com/family#`. Here is a hierarchical diagram that shows the classes and their relationship:



It contains only one object property which is `hasChild` and in total there are six persons (individuals), of which four are males and two are females.

### 2.1 Atomic Classes

To represent the classes `male`, `female`, and `person` we can simply use the class `OWLClass`<sup>7</sup>:

```
from owlapy.class_expression import OWLClass
from owlapy.iri import IRI

namespace = "http://example.com/family#"

male = OWLClass(IRI(namespace, "male"))
female = OWLClass(IRI(namespace, "female"))
person = OWLClass(IRI(namespace, "person"))
```

Notice that we created an `IRI` object for every class. `IRI`<sup>8</sup> is used to represent an *IRI*. Every named entity requires an *IRI*, whereas Anonymous entities does not. However, in owlapy you can create an `OWLClass` by passing the *IRI* directly as a string, like so:

```
male = OWLClass("http://example.com/family#male")
```

### 2.2 Object Property

To represent the object property `hasChild` we can use the class `OWLObjectProperty`<sup>9</sup>:

```
from owlapy.owl_property import OWLObjectProperty

hasChild = OWLObjectProperty("http://example.com/family#hasChild")
```

**Tip:** In owlapy the naming of the classes is made in accordance with the notations from OWL 2 specification but with the word “OWL” in the beginning. Example: “*OWLObjectProperty*” represents the notation “*ObjectProperty*”.

<sup>7</sup> [https://dice-group.github.io/owlapy/autoapi/owlapy/class\\_expression/owl\\_class/index.html#owlapy.class\\_expression.owl\\_class.OWLClass](https://dice-group.github.io/owlapy/autoapi/owlapy/class_expression/owl_class/index.html#owlapy.class_expression.owl_class.OWLClass)

<sup>8</sup> <https://dice-group.github.io/owlapy/autoapi/owlapy/iri/index.html#owlapy.iri.IRI>

<sup>9</sup> [https://dice-group.github.io/owlapy/autoapi/owlapy/owl\\_property/index.html#owlapy.owl\\_property.OWLObjectProperty](https://dice-group.github.io/owlapy/autoapi/owlapy/owl_property/index.html#owlapy.owl_property.OWLObjectProperty)

## 2.3 Complex class expressions

Now that we have these atomic entities, we can construct more complex class expressions. Let's say we want to represent all individuals which are `male` and have at least 1 child.

We already have the concept of `male`. We need to find the appropriate class for the second part: *"have at least 1 child"*. In OWL 2 specification that would be `ObjectMinCardinality`<sup>10</sup>. In owlapy, as we said, we simply add the word "OWL" upfront to find the correct class:

```
from owlapy.class_expression import OWLObjectMinCardinality

has_at_least_one_child = OWLObjectMinCardinality(
    cardinality = 1,
    property = hasChild,
    filler = person
)
```

As you can see, to create an object of class `OWLObjectMinCardinality`<sup>11</sup> is as easy as that. You specify the cardinality which in this case is 1, the object property where we apply this cardinality restriction and the filler class in case you want to restrict the domain of the class expression. In this case we used `person`.

Now let's merge both class expressions together using `OWLObjectIntersectionOf`<sup>12</sup>:

```
from owlapy.class_expression import OWLObjectIntersectionOf

ce = OWLObjectIntersectionOf([male, has_at_least_one_child])
```

## 2.4 Convert to SPARQL, DL or Manchester syntax

Owlapy is not just a library to represent OWL entities, you can also use it to convert owl expressions into other formats:

```
from owlapy import owl_expression_to_sparql, owl_expression_to_dl, owl_expression_to_manchester

print(owl_expression_to_dl(ce))
# Result: male ∃ (≥ 1 hasChild.person)

print(owl_expression_to_sparql(ce))
# Result: SELECT DISTINCT ?x WHERE { ?x a <http://example.com/family#male> . { SELECT_
↪ ?x WHERE { ?x <http://example.com/family#hasChild> ?s_1 . ?s_1 a <http://example.
↪ com/family#person> . } GROUP BY ?x HAVING ( COUNT ( ?s_1 ) >= 1 ) } }

print(owl_expression_to_manchester(ce))
# Result: male and (hasChild min 1 person)
```

To parse a DL or Manchester expression to owl expression you can use the following convenient methods:

```
from owlapy import dl_to_owl_expression, manchester_to_owl_expression

print(dl_to_owl_expression("∃ hasChild.male", namespace))
# Result: OWLObjectSomeValuesFrom(property=OWLObjectProperty(IRI('http://example.com/

(continues on next page)
```

<sup>10</sup> [https://www.w3.org/TR/owl2-syntax/#Minimum\\_Cardinality](https://www.w3.org/TR/owl2-syntax/#Minimum_Cardinality)

<sup>11</sup> [https://dice-group.github.io/owlapy/autoapi/owlapy/class\\_expression/restriction/index.html#owlapy.class\\_expression.restriction.OWLObjectMinCardinality](https://dice-group.github.io/owlapy/autoapi/owlapy/class_expression/restriction/index.html#owlapy.class_expression.restriction.OWLObjectMinCardinality)

<sup>12</sup> [https://dice-group.github.io/owlapy/autoapi/owlapy/class\\_expression/nary\\_boolean\\_expression/index.html#owlapy.class\\_expression.nary\\_boolean\\_expression.OWLObjectIntersectionOf](https://dice-group.github.io/owlapy/autoapi/owlapy/class_expression/nary_boolean_expression/index.html#owlapy.class_expression.nary_boolean_expression.OWLObjectIntersectionOf)

(continued from previous page)

```
↪family#','hasChild')),filler=OWLClass(IRI('http://example.com/family#','male'))))

print(manchester_to_owl_expression("female and (hasChild max 2 person)", namespace))
# Result: OWLObjectIntersectionOf((OWLClass(IRI('http://example.com/family#','female
↪')), OWLObjectMaxCardinality(property=OWLObjectProperty(IRI('http://example.com/
↪family#','hasChild')),2,filler=OWLClass(IRI('http://example.com/family#','person
↪')))))
```

In these examples we showed a fraction of **owlapy**. You can explore the *api documentation* to learn more about all classes in owlapy.

## 3 owlapy

### 3.1 Subpackages

#### **owlapy.class\_expression**

OWL Class Expressions [https://www.w3.org/TR/owl2-syntax/#Class\\_Expressions](https://www.w3.org/TR/owl2-syntax/#Class_Expressions) ClassExpression :=

owl\_class.py:      Class    nary\_boolean\_expression.py:      ObjectIntersectionOf,    ObjectUnionOf  
class\_expression.py: ObjectComplementOf  
  
restriction.py:    ObjectOneOf,    ObjectSomeValuesFrom,    ObjectAllValuesFrom,    ObjectHas-  
Value,ObjectHasSelf, ObjectMinCardinality, ObjectMaxCardinality, ObjectExactCardinality, Data-  
SomeValuesFrom, DataAllValuesFrom, DataHasValue, DataMinCardinality, DataMaxCardinality,  
DataExactCardinality

#### **Submodules**

#### **owlapy.class\_expression.class\_expression**

OWL Base Classes Expressions

#### **Module Contents**

#### **Classes**

<i>OWLClassExpression</i>	OWL Class expressions represent sets of individuals by formally specifying conditions on the individuals' properties;
<i>OWLAnonymousClassExpression</i>	A Class Expression which is not a named Class.
<i>OWLBooleanClassExpression</i>	Represent an anonymous boolean class expression.
<i>OWLObjectComplementOf</i>	Represents an ObjectComplementOf class expression in the OWL 2 Specification.

**class** owlapy.class\_expression.class\_expression.OWLClassExpression

Bases: *owlapy.owl\_data\_ranges.OWLPropertyRange*

OWL Class expressions represent sets of individuals by formally specifying conditions on the individuals' properties; individuals satisfying these conditions are said to be instances of the respective class expressions. In the structural specification of OWL 2, class expressions are represented by ClassExpression. ([https://www.w3.org/TR/owl2-syntax/#Class\\_Expressions](https://www.w3.org/TR/owl2-syntax/#Class_Expressions))

**\_\_slots\_\_** = ()

**abstract is\_owl\_thing** () → bool

Determines if this expression is the built in class owl:Thing. This method does not determine if the class is equivalent to owl:Thing.

**Returns**

Thing.

**Return type**

True if this expression is owl

**abstract is\_owl\_nothing** () → bool

Determines if this expression is the built in class owl:Nothing. This method does not determine if the class is equivalent to owl:Nothing.

**abstract get\_object\_complement\_of** () → *OWLObjectComplementOf*

Gets the object complement of this class expression.

**Returns**

A class expression that is the complement of this class expression.

**abstract get\_nnf** () → *OWLClassExpression*

Gets the negation normal form of the complement of this expression.

**Returns**

A expression that represents the NNF of the complement of this expression.

**class** owlapy.class\_expression.class\_expression.OWLAnonymousClassExpression

Bases: *OWLClassExpression*

A Class Expression which is not a named Class.

**is\_owl\_nothing** () → bool

Determines if this expression is the built in class owl:Nothing. This method does not determine if the class is equivalent to owl:Nothing.

**is\_owl\_thing** () → bool

Determines if this expression is the built in class owl:Thing. This method does not determine if the class is equivalent to owl:Thing.

**Returns**

Thing.

**Return type**

True if this expression is owl

**get\_object\_complement\_of** () → *OWLObjectComplementOf*

Gets the object complement of this class expression.

**Returns**

A class expression that is the complement of this class expression.

**get\_nnf** () → *OWLClassExpression*

Gets the negation normal form of the complement of this expression.

**Returns**

A expression that represents the NNF of the complement of this expression.

**class** owlapy.class\_expression.class\_expression.OWLBooleanClassExpression

Bases: *OWLAnonymousClassExpression*

Represent an anonymous boolean class expression.

**\_\_slots\_\_** = ()

**class** owlapy.class\_expression.class\_expression.OWLObjectComplementOf (  
    *op: OWLClassExpression*)

Bases: *OWLBooleanClassExpression*, *owlapy.meta\_classes*.  
*HasOperands[OWLClassExpression]*

Represents an ObjectComplementOf class expression in the OWL 2 Specification.

**\_\_slots\_\_** = '\_operand'

**type\_index**: Final = 3003

**get\_operand** () → *OWLClassExpression*

**Returns**

The wrapped expression.

**operands** () → Iterable[*OWLClassExpression*]

Gets the operands - e.g., the individuals in a sameAs axiom, or the classes in an equivalent classes axiom.

**Returns**

The operands.

**\_\_repr\_\_** ()

Return repr(self).

**\_\_eq\_\_** (*other*)

Return self==value.

**\_\_hash\_\_** ()

Return hash(self).

**owlapy.class\_expression.nary\_boolean\_expression**

OWL nary boolean expressions

## Module Contents

### Classes

<i>OWLNaryBooleanClassExpression</i>	OWLNaryBooleanClassExpression.
<i>OWLObjectUnionOf</i>	A union class expression <code>ObjectUnionOf( CE1 ... CEn )</code> contains all individuals that are instances
<i>OWLObjectIntersectionOf</i>	An intersection class expression <code>ObjectIntersectionOf( CE1 ... CEn )</code> contains all individuals that are instances

```
class owlapy.class_expression.nary_boolean_expression.  
    OWLNaryBooleanClassExpression (  
        operands: Iterable[owlapy.class_expression.class_expression.OWLClassExpression])  
Bases: owlapy.class_expression.class_expression.OWLBooleanClassExpression,  
        owlapy.meta_classes.HasOperands[owlapy.class_expression.class_expression.  
        OWLClassExpression]  
OWLNaryBooleanClassExpression.  
__slots__ = ()  
  
operands () → Iterable[owlapy.class_expression.class_expression.OWLClassExpression]  
    Gets the operands - e.g., the individuals in a sameAs axiom, or the classes in an equivalent classes axiom.  
  
    Returns  
        The operands.  
  
__repr__ ()  
    Return repr(self).  
  
__eq__ (other)  
    Return self==value.  
  
__hash__ ()  
    Return hash(self).  
  
class owlapy.class_expression.nary_boolean_expression.OWLObjectUnionOf (  
    operands: Iterable[owlapy.class_expression.class_expression.OWLClassExpression])  
Bases: OWLNaryBooleanClassExpression  
A union class expression ObjectUnionOf( CE1 ... CEn ) contains all individuals that are instances of at least one  
class expression CEi for  $1 \leq i \leq n$ . (https://www.w3.org/TR/owl2-syntax/#Union\_of\_Class\_Expressions)  
__slots__ = '_operands'  
  
type_index: Final = 3002  
  
class owlapy.class_expression.nary_boolean_expression.  
    OWLObjectIntersectionOf (  
        operands: Iterable[owlapy.class_expression.class_expression.OWLClassExpression])  
Bases: OWLNaryBooleanClassExpression  
An intersection class expression ObjectIntersectionOf( CE1 ... CEn ) contains all individuals that are instances of  
all class expressions CEi for  $1 \leq i \leq n$ . (https://www.w3.org/TR/owl2-syntax/#Intersection\_of\_Class\_Expressions)
```



```
__slots__ = '_operands'

type_index: Final = 3001
```

`owlapy.class_expression.owl_class`

OWL Class

## Module Contents

### Classes

<i>OWLClass</i>	An OWL 2 named Class. Classes can be understood as sets of individuals.
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```
class owlapy.class_expression.owl_class.OWLClass (iri: owlapy.iri.IRI | str)
```

Bases: *owlapy.class\_expression.class\_expression.OWLClassExpression*, *owlapy.owl\_object.OWLEntity*

An OWL 2 named Class. Classes can be understood as sets of individuals. (<https://www.w3.org/TR/owl2-syntax/#Classes>)

```
property iri: owlapy.iri.IRI
```

Gets the IRI of this object.

#### Returns

The IRI of this object.

```
property str
```

Gets the string representation of this object

#### Returns

The IRI as string

```
property reminder: str
```

The reminder of the IRI

```
__slots__ = ('_iri', '_is_nothing', '_is_thing')
```

```
type_index: Final = 1001
```

```
is_owl_thing() → bool
```

Determines if this expression is the built in class owl:Thing. This method does not determine if the class is equivalent to owl:Thing.

#### Returns

Thing.

#### Return type

True if this expression is owl

```
is_owl_nothing() → bool
```

Determines if this expression is the built in class owl:Nothing. This method does not determine if the class is equivalent to owl:Nothing.

**get\_object\_complement\_of()**

→ *owlapy.class\_expression.class\_expression.OWLObjectComplementOf*

Gets the object complement of this class expression.

**Returns**

A class expression that is the complement of this class expression.

**get\_nnf()** → *OWLClass*

Gets the negation normal form of the complement of this expression.

**Returns**

A expression that represents the NNF of the complement of this expression.

**owlapy.class\_expression.restriction**

OWL Restrictions

**Module Contents**

## Classes

<i>OWLRestriction</i>	Represents an Object Property Restriction or Data Property Restriction in the OWL 2 specification.
<i>OWLHasValueRestriction</i>	Represent a HasValue restriction in the OWL 2
<i>OWLObjectRestriction</i>	Represents an Object Property Restriction in the OWL 2 specification.
<i>OWLQuantifiedRestriction</i>	Represents a quantified restriction.
<i>OWLCardinalityRestriction</i>	Base interface for owl min and max cardinality restriction.
<i>OWLQuantifiedObjectRestriction</i>	Represents a quantified object restriction.
<i>OWLObjectCardinalityRestriction</i>	Represents Object Property Cardinality Restrictions in the OWL 2 specification.
<i>OWLObjectMinCardinality</i>	A minimum cardinality expression <i>ObjectMinCardinality</i> ( <i>n</i> OPE CE ) consists of a nonnegative integer <i>n</i> , an object
<i>OWLObjectMaxCardinality</i>	A maximum cardinality expression <i>ObjectMaxCardinality</i> ( <i>n</i> OPE CE ) consists of a nonnegative integer <i>n</i> , an object
<i>OWLObjectExactCardinality</i>	An exact cardinality expression <i>ObjectExactCardinality</i> ( <i>n</i> OPE CE ) consists of a nonnegative integer <i>n</i> , an object
<i>OWLObjectSomeValuesFrom</i>	An existential class expression <i>ObjectSomeValuesFrom</i> ( OPE CE ) consists of an object property expression OPE and
<i>OWLObjectAllValuesFrom</i>	A universal class expression <i>ObjectAllValuesFrom</i> ( OPE CE ) consists of an object property expression OPE and a
<i>OWLObjectHasSelf</i>	A self-restriction <i>ObjectHasSelf</i> ( OPE ) consists of an object property expression OPE,
<i>OWLObjectHasValue</i>	A has-value class expression <i>ObjectHasValue</i> ( OPE a ) consists of an object property expression OPE and an
<i>OWLObjectOneOf</i>	An enumeration of individuals <i>ObjectOneOf</i> ( <i>a</i> <sub>1</sub> ... <i>a</i> <sub><i>n</i></sub> ) contains exactly the individuals <i>a</i> <sub><i>i</i></sub> with 1 ≤ <i>i</i> ≤ <i>n</i> .
<i>OWLDataRestriction</i>	Represents a Data Property Restriction.
<i>OWLQuantifiedDataRestriction</i>	Represents a quantified data restriction.
<i>OWLDataCardinalityRestriction</i>	Represents Data Property Cardinality Restrictions.
<i>OWLDataMinCardinality</i>	A minimum cardinality expression <i>DataMinCardinality</i> ( <i>n</i> DPE DR ) consists of a nonnegative integer <i>n</i> , a data
<i>OWLDataMaxCardinality</i>	A maximum cardinality expression <i>ObjectMaxCardinality</i> ( <i>n</i> OPE CE ) consists of a nonnegative integer <i>n</i> , an object
<i>OWLDataExactCardinality</i>	An exact cardinality expression <i>ObjectExactCardinality</i> ( <i>n</i> OPE CE ) consists of a nonnegative integer <i>n</i> , an
<i>OWLDataSomeValuesFrom</i>	An existential class expression <i>DataSomeValuesFrom</i> ( DPE <sub>1</sub> ... DPE <sub><i>n</i></sub> DR ) consists of <i>n</i> data property expressions
<i>OWLDataAllValuesFrom</i>	A universal class expression <i>DataAllValuesFrom</i> ( DPE <sub>1</sub> ... DPE <sub><i>n</i></sub> DR ) consists of <i>n</i> data property expressions DPE <sub><i>i</i></sub> ,
<i>OWLDataHasValue</i>	A has-value class expression <i>DataHasValue</i> ( DPE <i>l</i> <sub><i>t</i></sub> ) consists of a data property expression DPE and a literal <i>l</i> <sub><i>t</i></sub> ,
<i>OWLDataOneOf</i>	An enumeration of literals <i>DataOneOf</i> ( <i>l</i> <sub><i>t</i></sub> <sub>1</sub> ... <i>l</i> <sub><i>t</i></sub> <sub><i>n</i></sub> ) contains exactly the explicitly specified literals <i>l</i> <sub><i>t</i></sub> <sub><i>i</i></sub> with
<i>OWLDatatypeRestriction</i>	A datatype restriction <i>DatatypeRestriction</i> ( DT F <sub>1</sub> <i>l</i> <sub><i>t</i></sub> <sub>1</sub> ... F <sub><i>n</i></sub> <i>l</i> <sub><i>t</i></sub> <sub><i>n</i></sub> ) consists of a unary datatype DT and <i>n</i> pairs
<i>OWLFacetRestriction</i>	A facet restriction is used to restrict a particular datatype.

## Attributes

### *Literals*

`owlapy.class_expression.restriction.Literals`

**class** `owlapy.class_expression.restriction.OWLRestriction`

Bases: `owlapy.class_expression.class_expression.OWLAnonymousClassExpression`

Represents an Object Property Restriction or Data Property Restriction in the OWL 2 specification.

`__slots__ = ()`

**abstract** `get_property()` → `owlapy.owl_property.OWLPropertyExpression`

**Returns**

Property being restricted.

`is_data_restriction()` → bool

Determines if this is a data restriction.

**Returns**

True if this is a data restriction.

`is_object_restriction()` → bool

Determines if this is an object restriction.

**Returns**

True if this is an object restriction.

**class** `owlapy.class_expression.restriction.OWLHasValueRestriction` (*value: `_T`*)

Bases: `Generic[_T]`, `OWLRestriction`, `owlapy.meta_classes.HasFiller[_T]`

Represent a HasValue restriction in the OWL 2

**Parameters**

`_T` – The value type.

`__slots__ = ()`

`__eq__` (*other*)

Return `self==value`.

`__hash__` ()

Return `hash(self)`.

`get_filler()` → `_T`

Gets the filler for this restriction. In the case of an object restriction this will be an individual, in the case of a data restriction this will be a constant (data value). For quantified restriction this will be a class expression or a data range.

**Returns**

the value

**class** `owlapy.class_expression.restriction.OWLObjectRestriction`

Bases: `OWLRestriction`

Represents an Object Property Restriction in the OWL 2 specification.

```

__slots__ = ()

is_object_restriction() → bool
    Determines if this is an object restriction.

    Returns
        True if this is an object restriction.

abstract get_property() → owlapy.owl_property.OWLObjectPropertyExpression

    Returns
        Property being restricted.

```

**class** owlapy.class\_expression.restriction.OWLQuantifiedRestriction

Bases: Generic[\_T], *OWLRestriction*, owlapy.meta\_classes.HasFiller[\_T]

Represents a quantified restriction.

**Parameters**

    \_T – value type

```
__slots__ = ()
```

**class** owlapy.class\_expression.restriction.OWLCardinalityRestriction(

*cardinality: int, filler: \_F*)

Bases: Generic[\_F], *OWLQuantifiedRestriction*[\_F], owlapy.meta\_classes.HasCardinality

Base interface for owl min and max cardinality restriction.

**Parameters**

    \_F – Type of filler.

```
__slots__ = ()
```

**get\_cardinality()** → int

Gets the cardinality of a restriction.

**Returns**

    The cardinality. A non-negative integer.

**get\_filler()** → \_F

Gets the filler for this restriction. In the case of an object restriction this will be an individual, in the case of a data restriction this will be a constant (data value). For quantified restriction this will be a class expression or a data range.

**Returns**

    the value

**class** owlapy.class\_expression.restriction.OWLQuantifiedObjectRestriction(

*filler: owlapy.class\_expression.class\_expression.OWLClassExpression*)

Bases: *OWLQuantifiedRestriction*[owlapy.class\_expression.class\_expression.OWLClassExpression], *OWLObjectRestriction*

Represents a quantified object restriction.

```
__slots__ = ()
```

**get\_filler()** → *owlapy.class\_expression.class\_expression.OWLClassExpression*

Gets the filler for this restriction. In the case of an object restriction this will be an individual, in the case of a data restriction this will be a constant (data value). For quantified restriction this will be a class expression or a data range.

**Returns**

the value

```
class owlapy.class_expression.restriction.OWLObjectCardinalityRestriction(  
    cardinality: int, property: owlapy.owl_property.OWLObjectPropertyExpression,  
    filler: owlapy.class_expression.class_expression.OWLClassExpression)
```

Bases: *OWLCardinalityRestriction[owlapy.class\_expression.class\_expression.OWLClassExpression]*, *OWLQuantifiedObjectRestriction*

Represents Object Property Cardinality Restrictions in the OWL 2 specification.

```
__slots__ = ()
```

**get\_property()** → *owlapy.owl\_property.OWLObjectPropertyExpression*

**Returns**

Property being restricted.

```
__repr__()
```

Return repr(self).

```
__eq__(other)
```

Return self==value.

```
__hash__()
```

Return hash(self).

```
class owlapy.class_expression.restriction.OWLObjectMinCardinality(  
    cardinality: int, property: owlapy.owl_property.OWLObjectPropertyExpression,  
    filler: owlapy.class_expression.class_expression.OWLClassExpression)
```

Bases: *OWLObjectCardinalityRestriction*

A minimum cardinality expression *ObjectMinCardinality*( n OPE CE ) consists of a nonnegative integer n, an object property expression OPE, and a class expression CE, and it contains all those individuals that are connected by OPE to at least n different individuals that are instances of CE. ([https://www.w3.org/TR/owl2-syntax/#Minimum\\_Cardinality](https://www.w3.org/TR/owl2-syntax/#Minimum_Cardinality))

```
__slots__ = ('_cardinality', '_filler', '_property')
```

```
type_index: Final = 3008
```

```
class owlapy.class_expression.restriction.OWLObjectMaxCardinality(  
    cardinality: int, property: owlapy.owl_property.OWLObjectPropertyExpression,  
    filler: owlapy.class_expression.class_expression.OWLClassExpression)
```

Bases: *OWLObjectCardinalityRestriction*

A maximum cardinality expression *ObjectMaxCardinality*( n OPE CE ) consists of a nonnegative integer n, an object property expression OPE, and a class expression CE, and it contains all those individuals that are connected by OPE

to at most n different individuals that are instances of CE. ([https://www.w3.org/TR/owl2-syntax/#Maximum\\_Cardinality](https://www.w3.org/TR/owl2-syntax/#Maximum_Cardinality))

```
__slots__ = ('_cardinality', '_filler', '_property')
```

**type\_index: Final = 3010**

```
class owlapy.class_expression.restriction.OwlObjectExactCardinality(  
    cardinality: int, property: owlapy.owl_property.OwlObjectPropertyExpression,  
    filler: owlapy.class_expression.class_expression.OwlClassExpression)
```

Bases: *OwlObjectCardinalityRestriction*

**An exact cardinality expression ObjectExactCardinality( n OPE CE ) consists of a nonnegative integer n, an object**

property expression OPE, and a class expression CE, and it contains all those individuals that are connected by to exactly n different individuals that are instances of CE.

([https://www.w3.org/TR/owl2-syntax/#Exact\\_Cardinality](https://www.w3.org/TR/owl2-syntax/#Exact_Cardinality))

```
__slots__ = ('_cardinality', '_filler', '_property')
```

**type\_index: Final = 3009**

```
as_intersection_of_min_max()  
    → owlapy.class_expression.nary_boolean_expression.OwlObjectIntersectionOf
```

Obtains an equivalent form that is a conjunction of a min cardinality and max cardinality restriction.

#### Returns

The semantically equivalent but structurally simpler form  $(= 1 R C) = \geq 1 R C$  and  $\leq 1 R C$ .

```
class owlapy.class_expression.restriction.OwlObjectSomeValuesFrom(  
    property: owlapy.owl_property.OwlObjectPropertyExpression,  
    filler: owlapy.class_expression.class_expression.OwlClassExpression)
```

Bases: *OwlQuantifiedObjectRestriction*

An existential class expression ObjectSomeValuesFrom( OPE CE ) consists of an object property expression OPE and a class expression CE, and it contains all those individuals that are connected by OPE to an individual that is an instance of CE.

```
__slots__ = ('_property', '_filler')
```

**type\_index: Final = 3005**

```
__repr__()  
    Return repr(self).
```

```
__eq__(other)  
    Return self==value.
```

```
__hash__()  
    Return hash(self).
```

```
get_property() → owlapy.owl_property.OwlObjectPropertyExpression
```

#### Returns

Property being restricted.

```
class owlapy.class_expression.restriction.OwlObjectAllValuesFrom(  
    property: owlapy.owl_property.OwlObjectPropertyExpression,  
    filler: owlapy.class_expression.class_expression.OwlClassExpression)
```

Bases: *OwlQuantifiedObjectRestriction*

A universal class expression ObjectAllValuesFrom( OPE CE ) consists of an object property expression OPE and a class expression CE, and it contains all those individuals that are connected by OPE only to individuals that are instances of CE. ([https://www.w3.org/TR/owl2-syntax/#Universal\\_Quantification](https://www.w3.org/TR/owl2-syntax/#Universal_Quantification))

```

__slots__ = ('_property', '_filler')

type_index: Final = 3006

__repr__ ()
    Return repr(self).

__eq__ (other)
    Return self==value.

__hash__ ()
    Return hash(self).

get_property () → owlapy.owl_property.OWLObjectPropertyExpression

    Returns
        Property being restricted.

```

**class** owlapy.class\_expression.restriction.OWLObjectHasSelf (
 *property: owlapy.owl\_property.OWLObjectPropertyExpression*)

Bases: *OWLObjectRestriction*

A self-restriction ObjectHasSelf( OPE ) consists of an object property expression OPE, and it contains all those individuals that are connected by OPE to themselves. (<https://www.w3.org/TR/owl2-syntax/#Self-Restriction>)

```

__slots__ = '_property'

type_index: Final = 3011

get_property () → owlapy.owl_property.OWLObjectPropertyExpression

    Returns
        Property being restricted.

__eq__ (other)
    Return self==value.

__hash__ ()
    Return hash(self).

__repr__ ()
    Return repr(self).

```

**class** owlapy.class\_expression.restriction.OWLObjectHasValue (
 *property: owlapy.owl\_property.OWLObjectPropertyExpression,*  
*individual: owlapy.owl\_individual.OWLIndividual*)

Bases: *OWLHasValueRestriction[owlapy.owl\_individual.OWLIndividual], OWLObjectRestriction*

A has-value class expression ObjectHasValue( OPE a ) consists of an object property expression OPE and an individual a, and it contains all those individuals that are connected by OPE to a. Each such class expression can be seen as a syntactic shortcut for the class expression ObjectSomeValuesFrom( OPE ObjectOneOf( a ) ). ([https://www.w3.org/TR/owl2-syntax/#Individual\\_Value\\_Restriction](https://www.w3.org/TR/owl2-syntax/#Individual_Value_Restriction))

```

__slots__ = ('_property', '_v')

type_index: Final = 3007

```



**get\_property** () → *owlapy.owl\_property.OWLObjectPropertyExpression*

**Returns**

Property being restricted.

**as\_some\_values\_from** () → *owlapy.class\_expression.class\_expression.OWLClassExpression*

A convenience method that obtains this restriction as an existential restriction with a nominal filler.

**Returns**

The existential equivalent of this value restriction.  $\text{simp}(\text{HasValue}(p\ a)) = \text{some}(p\ \{a\})$ .

**\_\_repr\_\_** ()

Return repr(self).

**class** owlapy.class\_expression.restriction.OWLObjectOneOf (

*values: owlapy.owl\_individual.OWLIndividual | Iterable[owlapy.owl\_individual.OWLIndividual]*)

Bases: *owlapy.class\_expression.class\_expression.OWLAnonymousClassExpression*,  
*owlapy.meta\_classes.HasOperands[owlapy.owl\_individual.OWLIndividual]*

An enumeration of individuals `ObjectOneOf( a1 ... an )` contains exactly the individuals  $a_i$  with  $1 \leq i \leq n$ . ([https://www.w3.org/TR/owl2-syntax/#Enumeration\\_of\\_Individuals](https://www.w3.org/TR/owl2-syntax/#Enumeration_of_Individuals))

**\_\_slots\_\_** = `'_values'`

**type\_index:** `Final = 3004`

**individuals** () → *Iterable[owlapy.owl\_individual.OWLIndividual]*

Gets the individuals that are in the oneOf. These individuals represent the exact instances (extension) of this class expression.

**Returns**

The individuals that are the values of this `{@code ObjectOneOf}` class expression.

**operands** () → *Iterable[owlapy.owl\_individual.OWLIndividual]*

Gets the operands - e.g., the individuals in a sameAs axiom, or the classes in an equivalent classes axiom.

**Returns**

The operands.

**as\_object\_union\_of** () → *owlapy.class\_expression.class\_expression.OWLClassExpression*

Simplifies this enumeration to a union of singleton nominals.

**Returns**

This enumeration in a more standard DL form.  $\text{simp}(\{a\}) = \{a\}$   $\text{simp}(\{a_0, \dots, \{a_n\}\}) = \text{unionOf}(\{a_0\}, \dots, \{a_n\})$

**\_\_hash\_\_** ()

Return hash(self).

**\_\_eq\_\_** (*other*)

Return self==value.

**\_\_repr\_\_** ()

Return repr(self).

**class** owlapy.class\_expression.restriction.OWLDataRestriction

Bases: *OWLRestriction*

Represents a Data Property Restriction.

```

__slots__ = ()

is_data_restriction() → bool
    Determines if this is a data restriction.

    Returns
        True if this is a data restriction.

```

```

class owlapy.class_expression.restriction.OWLQuantifiedDataRestriction(
    filler: owlapy.owl_data_ranges.OWLDataRange)
    Bases: OWLQuantifiedRestriction[owlapy.owl_data_ranges.OWLDataRange], OWL-
            DataRestriction
    Represents a quantified data restriction.

__slots__ = ()

get_filler() → owlapy.owl_data_ranges.OWLDataRange
    Gets the filler for this restriction. In the case of an object restriction this will be an individual, in the case of
    a data restriction this will be a constant (data value). For quantified restriction this will be a class expression
    or a data range.

    Returns
        the value

```

```

class owlapy.class_expression.restriction.OWLDataCardinalityRestriction(
    cardinality: int, property: owlapy.owl_property.OWLDataPropertyExpression,
    filler: owlapy.owl_data_ranges.OWLDataRange)
    Bases: OWLCardinalityRestriction[owlapy.owl_data_ranges.OWLDataRange],
            OWLQuantifiedDataRestriction, OWLDataRestriction
    Represents Data Property Cardinality Restrictions.

__slots__ = ()

get_property() → owlapy.owl_property.OWLDataPropertyExpression

    Returns
        Property being restricted.

__repr__()
    Return repr(self).

__eq__(other)
    Return self==value.

__hash__()
    Return hash(self).

```

```

class owlapy.class_expression.restriction.OWLDataMinCardinality(cardinality: int,
    property: owlapy.owl_property.OWLDataPropertyExpression,
    filler: owlapy.owl_data_ranges.OWLDataRange)
    Bases: OWLDataCardinalityRestriction
    A minimum cardinality expression DataMinCardinality( n DPE DR ) consists of a nonnegative integer n, a data
    property expression DPE, and a unary data range DR, and it contains all those individuals that are connected by
    DPE to at least n different literals in DR. (https://www.w3.org/TR/owl2-syntax/#Minimum\_Cardinality)

__slots__ = ('_cardinality', '_filler', '_property')

```

**type\_index: Final = 3015**

```
class owlapy.class_expression.restriction.OWLDataMaxCardinality(cardinality: int,  
    property: owlapy.owl_property.OWLDataPropertyExpression,  
    filler: owlapy.owl_data_ranges.OWLDataRange)
```

Bases: *OWLDataCardinalityRestriction*

A maximum cardinality expression *ObjectMaxCardinality( n OPE CE )* consists of a nonnegative integer *n*, an object property expression *OPE*, and a class expression *CE*, and it contains all those individuals that are connected by *OPE* to at most *n* different individuals that are instances of *CE*. ([https://www.w3.org/TR/owl2-syntax/#Maximum\\_Cardinality](https://www.w3.org/TR/owl2-syntax/#Maximum_Cardinality))

```
__slots__ = ('_cardinality', '_filler', '_property')
```

**type\_index: Final = 3017**

```
class owlapy.class_expression.restriction.OWLDataExactCardinality(  
    cardinality: int, property: owlapy.owl_property.OWLDataPropertyExpression,  
    filler: owlapy.owl_data_ranges.OWLDataRange)
```

Bases: *OWLDataCardinalityRestriction*

An exact cardinality expression *ObjectExactCardinality( n OPE CE )* consists of a nonnegative integer *n*, an object property expression *OPE*, and a class expression *CE*, and it contains all those individuals that are connected

by *OPE* to exactly *n* different individuals that are instances of *CE* ([https://www.w3.org/TR/owl2-syntax/#Exact\\_Cardinality](https://www.w3.org/TR/owl2-syntax/#Exact_Cardinality))

```
__slots__ = ('_cardinality', '_filler', '_property')
```

**type\_index: Final = 3016**

```
as_intersection_of_min_max()  
    → owlapy.class_expression.nary_boolean_expression.OWLObjectIntersectionOf
```

Obtains an equivalent form that is a conjunction of a min cardinality and max cardinality restriction.

#### Returns

The semantically equivalent but structurally simpler form  $(= 1 \text{ R D}) = \geq 1 \text{ R D}$  and  $\leq 1 \text{ R D}$ .

```
class owlapy.class_expression.restriction.OWLDataSomeValuesFrom(  
    property: owlapy.owl_property.OWLDataPropertyExpression,  
    filler: owlapy.owl_data_ranges.OWLDataRange)
```

Bases: *OWLQuantifiedDataRestriction*

An existential class expression *DataSomeValuesFrom( DPE<sub>1</sub> ... DPE<sub>n</sub> DR )* consists of *n* data property expressions *DPE<sub>i</sub>*,  $1 \leq i \leq n$ , and a data range *DR* whose arity must be *n*. Such a class expression contains all those individuals that are connected by *DPE<sub>i</sub>* to literals *lt<sub>i</sub>*,  $1 \leq i \leq n$ , such that the tuple  $( lt_1, \dots, lt_n )$  is in *DR*. A class expression of the form *DataSomeValuesFrom( DPE DR )* can be seen as a syntactic shortcut for the class expression *DataMinCardinality( 1 DPE DR )*. ([https://www.w3.org/TR/owl2-syntax/#Existential\\_Quantification\\_2](https://www.w3.org/TR/owl2-syntax/#Existential_Quantification_2))

```
__slots__ = '_property'
```

**type\_index: Final = 3012**

```
__repr__()  
    Return repr(self).
```

```
__eq__(other)  
    Return self==value.
```

**\_\_hash\_\_** ()

Return hash(self).

**get\_property** () → *owlapy.owl\_property.OWLDataPropertyExpression*

**Returns**

Property being restricted.

```
class owlapy.class_expression.restriction.OWLDataAllValuesFrom (
    property: owlapy.owl_property.OWLDataPropertyExpression,
    filler: owlapy.owl_data_ranges.OWLDataRange)
```

Bases: *OWLQuantifiedDataRestriction*

A universal class expression `DataAllValuesFrom( DPE1 ... DPEn DR )` consists of *n* data property expressions `DPEi`,  $1 \leq i \leq n$ , and a data range `DR` whose arity must be *n*. Such a class expression contains all those individuals that

**are connected by DPE<sub>i</sub> only to literals *lt<sub>i</sub>*,  $1 \leq i \leq n$ , such that each tuple ( *lt<sub>1</sub>* , ..., *lt<sub>n</sub>* ) is in DR.**

**A class**

expression of the form `DataAllValuesFrom( DPE DR )` can be seen as a syntactic shortcut for the class expression `DataMaxCardinality( 0 DPE DataComplementOf( DR ) )`. ([https://www.w3.org/TR/owl2-syntax/#Universal\\_Quantification\\_2](https://www.w3.org/TR/owl2-syntax/#Universal_Quantification_2))

**\_\_slots\_\_** = **'\_property'**

**type\_index:** **Final** = 3013

**\_\_repr\_\_** ()

Return repr(self).

**\_\_eq\_\_** (*other*)

Return self==value.

**\_\_hash\_\_** ()

Return hash(self).

**get\_property** () → *owlapy.owl\_property.OWLDataPropertyExpression*

**Returns**

Property being restricted.

```
class owlapy.class_expression.restriction.OWLDataHasValue (
    property: owlapy.owl_property.OWLDataPropertyExpression,
    value: owlapy.owl_literal.OWLLiteral)
```

Bases: *OWLHasValueRestriction[owlapy.owl\_literal.OWLLiteral]*, *OWLDataRestriction*

A has-value class expression `DataHasValue( DPE lt )` consists of a data property expression `DPE` and a literal `lt`, and it contains all those individuals that are connected by `DPE` to `lt`. Each such class expression can be seen as a syntactic shortcut for the class expression `DataSomeValuesFrom( DPE DataOneOf( lt ) )`. ([https://www.w3.org/TR/owl2-syntax/#Literal\\_Value\\_Restriction](https://www.w3.org/TR/owl2-syntax/#Literal_Value_Restriction))

**\_\_slots\_\_** = **'\_property'**

**type\_index:** **Final** = 3014

**\_\_repr\_\_** ()

Return repr(self).

```

__eq__(other)
    Return self==value.

__hash__()
    Return hash(self).

as_some_values_from() → owlapy.class_expression.class_expression.OWLClassExpression
    A convenience method that obtains this restriction as an existential restriction with a nominal filler.

    Returns
        The existential equivalent of this value restriction.  $\text{simp}(\text{HasValue}(p\ a)) = \text{some}(p\ \{a\})$ .

get_property() → owlapy.owl_property.OWLDataPropertyExpression

    Returns
        Property being restricted.

```

**class** owlapy.class\_expression.restriction.OWLObjectOneOf (
 values: owlapy.owl\_literal.OWLLiteral | Iterable[owlapy.owl\_literal.OWLLiteral])

Bases: owlapy.owl\_data\_ranges.OWLDataRange, owlapy.meta\_classes.HasOperands[owlapy.owl\_literal.OWLLiteral]

An enumeration of literals DataOneOf(  $l_{t1} \dots l_{tn}$  ) contains exactly the explicitly specified literals  $l_{ti}$  with  $1 \leq i \leq n$ . The resulting data range has arity one. ([https://www.w3.org/TR/owl2-syntax/#Enumeration\\_of\\_Literals](https://www.w3.org/TR/owl2-syntax/#Enumeration_of_Literals))

**type\_index:** Final = 4003

**values**() → Iterable[owlapy.owl\_literal.OWLLiteral]

Gets the values that are in the oneOf.

**Returns**

The values of this {`@code DataOneOf`} class expression.

**operands**() → Iterable[owlapy.owl\_literal.OWLLiteral]

Gets the operands - e.g., the individuals in a sameAs axiom, or the classes in an equivalent classes axiom.

**Returns**

The operands.

```

__hash__()
    Return hash(self).

__eq__(other)
    Return self==value.

__repr__()
    Return repr(self).

```

**class** owlapy.class\_expression.restriction.OWLDatatypeRestriction (
 type\_: owlapy.owl\_datatype.OWLDatatype,
 facet\_restrictions: OWLFacetRestriction | Iterable[OWLFacetRestriction])

Bases: owlapy.owl\_data\_ranges.OWLDataRange

A datatype restriction DatatypeRestriction( DT F1  $l_{t1} \dots F_n l_{tn}$  ) consists of a unary datatype DT and  $n$  pairs (  $F_i$  ,  $l_{ti}$  ). The resulting data range is unary and is obtained by restricting the value space of DT according to the semantics of all (  $F_i$  ,  $l_{ti}$  ) (multiple pairs are interpreted conjunctively), where  $l_{ti}$  are the data values of the literals  $l_{ti}$ . ([https://www.w3.org/TR/owl2-syntax/#Datatype\\_Restrictions](https://www.w3.org/TR/owl2-syntax/#Datatype_Restrictions))

```

__slots__ = ('_type', '_facet_restrictions')

```

```

type_index: Final = 4006

get_datatype () → owlapy.owl_datatype.OWLDatatype

get_facet_restrictions () → Sequence[OWLFacetRestriction]

__eq__ (other)
    Return self==value.

__hash__ ()
    Return hash(self).

__repr__ ()
    Return repr(self).

class owlapy.class_expression.restriction.OWLFacetRestriction (
    facet: owlapy.vocab.OWLFacet, literal: Literals)
    Bases: owlapy.owl_object.OWLObject
    A facet restriction is used to restrict a particular datatype.

    __slots__ = ('_facet', '_literal')

    type_index: Final = 4007

    get_facet () → owlapy.vocab.OWLFacet

    get_facet_value () → owlapy.owl_literal.OWLLiteral

    __eq__ (other)
        Return self==value.

    __hash__ ()
        Return hash(self).

    __repr__ ()
        Return repr(self).

```

## Package Contents

### Classes

<i>OWLClassExpression</i>	OWL Class expressions represent sets of individuals by formally specifying conditions on the individuals' properties;
<i>OWLAnonymousClassExpression</i>	A Class Expression which is not a named Class.
<i>OWLBooleanClassExpression</i>	Represent an anonymous boolean class expression.
<i>OWLObjectComplementOf</i>	Represents an ObjectComplementOf class expression in the OWL 2 Specification.
<i>OWLClass</i>	An OWL 2 named Class. Classes can be understood as sets of individuals.
<i>OWLNaryBooleanClassExpression</i>	OWLNaryBooleanClassExpression.
<i>OWLObjectUnionOf</i>	A union class expression ObjectUnionOf( CE1 ... CEn ) contains all individuals that are instances

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<i>OWLObjectIntersectionOf</i>	An intersection class expression <i>ObjectIntersectionOf</i> ( CE1 ... CEn ) contains all individuals that are instances
<i>OWLRestriction</i>	Represents an Object Property Restriction or Data Property Restriction in the OWL 2 specification.
<i>OWLQuantifiedRestriction</i>	Represents a quantified restriction.
<i>OWLQuantifiedObjectRestriction</i>	Represents a quantified object restriction.
<i>OWLObjectRestriction</i>	Represents an Object Property Restriction in the OWL 2 specification.
<i>OWLHasValueRestriction</i>	Represent a HasValue restriction in the OWL 2
<i>OWLDataRestriction</i>	Represents a Data Property Restriction.
<i>OWLCardinalityRestriction</i>	Base interface for owl min and max cardinality restriction.
<i>OWLObjectCardinalityRestriction</i>	Represents Object Property Cardinality Restrictions in the OWL 2 specification.
<i>OWLObjectHasSelf</i>	A self-restriction <i>ObjectHasSelf</i> ( OPE ) consists of an object property expression OPE,
<i>OWLDataOneOf</i>	An enumeration of literals <i>DataOneOf</i> ( lt1 ... ltn ) contains exactly the explicitly specified literals lti with
<i>OWLQuantifiedDataRestriction</i>	Represents a quantified data restriction.
<i>OWLDataCardinalityRestriction</i>	Represents Data Property Cardinality Restrictions.
<i>OWLObjectSomeValuesFrom</i>	An existential class expression <i>ObjectSomeValuesFrom</i> ( OPE CE ) consists of an object property expression OPE and
<i>OWLObjectAllValuesFrom</i>	A universal class expression <i>ObjectAllValuesFrom</i> ( OPE CE ) consists of an object property expression OPE and a
<i>OWLObjectHasValue</i>	A has-value class expression <i>ObjectHasValue</i> ( OPE a ) consists of an object property expression OPE and an
<i>OWLDatatypeRestriction</i>	A datatype restriction <i>DatatypeRestriction</i> ( DT F1 lt1 ... Fn ltn ) consists of a unary datatype DT and n pairs
<i>OWLFacet</i>	Enumerations for OWL facets.
<i>OWLFacetRestriction</i>	A facet restriction is used to restrict a particular datatype.
<i>OWLObjectMinCardinality</i>	A minimum cardinality expression <i>ObjectMinCardinality</i> ( n OPE CE ) consists of a nonnegative integer n, an object
<i>OWLObjectMaxCardinality</i>	A maximum cardinality expression <i>ObjectMaxCardinality</i> ( n OPE CE ) consists of a nonnegative integer n, an object
<i>OWLObjectExactCardinality</i>	An exact cardinality expression <i>ObjectExactCardinality</i> ( n OPE CE ) consists of a nonnegative integer n, an object
<i>OWLDataSomeValuesFrom</i>	An existential class expression <i>DataSomeValuesFrom</i> ( DPE1 ... DPEn DR ) consists of n data property expressions
<i>OWLDataAllValuesFrom</i>	A universal class expression <i>DataAllValuesFrom</i> ( DPE1 ... DPEn DR ) consists of n data property expressions DPEi,
<i>OWLDataHasValue</i>	A has-value class expression <i>DataHasValue</i> ( DPE lt ) consists of a data property expression DPE and a literal lt,
<i>OWLDataMinCardinality</i>	A minimum cardinality expression <i>DataMinCardinality</i> ( n DPE DR ) consists of a nonnegative integer n, a data
<i>OWLDataMaxCardinality</i>	A maximum cardinality expression <i>ObjectMaxCardinality</i> ( n OPE CE ) consists of a nonnegative integer n, an object

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<i>OWLObjectExactCardinality</i>	An exact cardinality expression <i>ObjectExactCardinality</i> ( <i>n</i> OPE CE ) consists of a nonnegative integer <i>n</i> , an
<i>OWLObjectOneOf</i>	An enumeration of individuals <i>ObjectOneOf</i> ( <i>a</i> <sub>1</sub> ... <i>a</i> <sub><i>n</i></sub> ) contains exactly the individuals <i>a</i> <sub><i>i</i></sub> with $1 \leq i \leq n$ .
<i>OWLRDFVocabulary</i>	Enumerations for OWL/RDF vocabulary.

## Attributes

<i>OWLThing</i>
<i>OWLNothing</i>

**class** owlapy.class\_expression.OWLClassExpression

Bases: *owlapy.owl\_data\_ranges.OWLPropertyRange*

OWL Class expressions represent sets of individuals by formally specifying conditions on the individuals' properties; individuals satisfying these conditions are said to be instances of the respective class expressions. In the structural specification of OWL 2, class expressions are represented by *ClassExpression*. ([https://www.w3.org/TR/owl2-syntax/#Class\\_Expressions](https://www.w3.org/TR/owl2-syntax/#Class_Expressions))

**\_\_slots\_\_** = ()

**abstract is\_owl\_thing** () → bool

Determines if this expression is the built in class owl:Thing. This method does not determine if the class is equivalent to owl:Thing.

**Returns**

Thing.

**Return type**

True if this expression is owl

**abstract is\_owl\_nothing** () → bool

Determines if this expression is the built in class owl:Nothing. This method does not determine if the class is equivalent to owl:Nothing.

**abstract get\_object\_complement\_of** () → *OWLObjectComplementOf*

Gets the object complement of this class expression.

**Returns**

A class expression that is the complement of this class expression.

**abstract get\_nnf** () → *OWLClassExpression*

Gets the negation normal form of the complement of this expression.

**Returns**

A expression that represents the NNF of the complement of this expression.

**class** owlapy.class\_expression.OWLAnonymousClassExpression

Bases: *OWLClassExpression*

A Class Expression which is not a named Class.



**is\_owl\_nothing** () → bool

Determines if this expression is the built in class owl:Nothing. This method does not determine if the class is equivalent to owl:Nothing.

**is\_owl\_thing** () → bool

Determines if this expression is the built in class owl:Thing. This method does not determine if the class is equivalent to owl:Thing.

**Returns**

Thing.

**Return type**

True if this expression is owl

**get\_object\_complement\_of** () → *OWLObjectComplementOf*

Gets the object complement of this class expression.

**Returns**

A class expression that is the complement of this class expression.

**get\_nnf** () → *OWLClassExpression*

Gets the negation normal form of the complement of this expression.

**Returns**

A expression that represents the NNF of the complement of this expression.

**class** owlapy.class\_expression.OWLBooleanClassExpression

Bases: *OWLAnonymousClassExpression*

Represent an anonymous boolean class expression.

**\_\_slots\_\_** = ()

**class** owlapy.class\_expression.OWLObjectComplementOf (op: *OWLClassExpression*)

Bases: *OWLBooleanClassExpression*, *owlapy.meta\_classes.HasOperands[OWLClassExpression]*

Represents an ObjectComplementOf class expression in the OWL 2 Specification.

**\_\_slots\_\_** = '\_operand'

**type\_index**: Final = 3003

**get\_operand** () → *OWLClassExpression*

**Returns**

The wrapped expression.

**operands** () → Iterable[*OWLClassExpression*]

Gets the operands - e.g., the individuals in a sameAs axiom, or the classes in an equivalent classes axiom.

**Returns**

The operands.

**\_\_repr\_\_** ()

Return repr(self).

**\_\_eq\_\_** (other)

Return self==value.

```

__hash__()
    Return hash(self).

class owlapy.class_expression.OWLClass(iri: owlapy.iri.IRI | str)
    Bases: owlapy.class_expression.class_expression.OWLClassExpression, owlapy.owl_object.OWLEntity

    An OWL 2 named Class. Classes can be understood as sets of individuals. (https://www.w3.org/TR/owl2-syntax/#Classes)

    property iri: owlapy.iri.IRI
        Gets the IRI of this object.

        Returns
            The IRI of this object.

    property str
        Gets the string representation of this object

        Returns
            The IRI as string

    property reminder: str
        The reminder of the IRI

    __slots__ = ('_iri', '_is_nothing', '_is_thing')

    type_index: Final = 1001

    is_owl_thing() → bool
        Determines if this expression is the built in class owl:Thing. This method does not determine if the class is
        equivalent to owl:Thing.

        Returns
            Thing.

        Return type
            True if this expression is owl

    is_owl_nothing() → bool
        Determines if this expression is the built in class owl:Nothing. This method does not determine if the class
        is equivalent to owl:Nothing.

    get_object_complement_of()
        → owlapy.class_expression.class_expression.OWLObjectComplementOf
        Gets the object complement of this class expression.

        Returns
            A class expression that is the complement of this class expression.

    get_nnf() → OWLClass
        Gets the negation normal form of the complement of this expression.

        Returns
            A expression that represents the NNF of the complement of this expression.

class owlapy.class_expression.OWLNaryBooleanClassExpression(
    operands: Iterable[owlapy.class_expression.class_expression.OWLClassExpression])
    Bases: owlapy.class_expression.class_expression.OWLBooleanClassExpression,

```

```
owlapy.meta_classes.HasOperands[owlapy.class_expression.class_expression.  
OWLClassExpression]
```

OWLNaryBooleanClassExpression.

```
__slots__ = ()
```

```
operands() → Iterable[owlapy.class_expression.class_expression.OWLClassExpression]
```

Gets the operands - e.g., the individuals in a sameAs axiom, or the classes in an equivalent classes axiom.

**Returns**

The operands.

```
__repr__()
```

Return repr(self).

```
__eq__(other)
```

Return self==value.

```
__hash__()
```

Return hash(self).

```
class owlapy.class_expression.OWLObjectUnionOf(  
    operands: Iterable[owlapy.class_expression.class_expression.OWLClassExpression])
```

Bases: *OWLNaryBooleanClassExpression*

A union class expression `ObjectUnionOf( CE1 ... CEn )` contains all individuals that are instances of at least one class expression `CEi` for  $1 \leq i \leq n$ . ([https://www.w3.org/TR/owl2-syntax/#Union\\_of\\_Class\\_Expressions](https://www.w3.org/TR/owl2-syntax/#Union_of_Class_Expressions))

```
__slots__ = '_operands'
```

```
type_index: Final = 3002
```

```
class owlapy.class_expression.OWLObjectIntersectionOf(  
    operands: Iterable[owlapy.class_expression.class_expression.OWLClassExpression])
```

Bases: *OWLNaryBooleanClassExpression*

An intersection class expression `ObjectIntersectionOf( CE1 ... CEn )` contains all individuals that are instances of all class expressions `CEi` for  $1 \leq i \leq n$ . ([https://www.w3.org/TR/owl2-syntax/#Intersection\\_of\\_Class\\_Expressions](https://www.w3.org/TR/owl2-syntax/#Intersection_of_Class_Expressions))

```
__slots__ = '_operands'
```

```
type_index: Final = 3001
```

```
class owlapy.class_expression.OWLRestriction
```

Bases: *owlapy.class\_expression.class\_expression.OWLAnonymousClassExpression*

Represents an Object Property Restriction or Data Property Restriction in the OWL 2 specification.

```
__slots__ = ()
```

```
abstract get_property() → owlapy.owl_property.OWLPropertyExpression
```

**Returns**

Property being restricted.

```
is_data_restriction() → bool
```

Determines if this is a data restriction.

**Returns**

True if this is a data restriction.

**is\_object\_restriction()** → bool

Determines if this is an object restriction.

**Returns**

True if this is an object restriction.

**class** owlapy.class\_expression.OWLQuantifiedRestriction

Bases: Generic[\_T], *OWLRestriction*, owlapy.meta\_classes.HasFiller[\_T]

Represents a quantified restriction.

**Parameters**

**\_T** – value type

**\_\_slots\_\_** = ()

**class** owlapy.class\_expression.OWLQuantifiedObjectRestriction(  
    *filler: owlapy.class\_expression.class\_expression.OWLClassExpression*)

Bases: *OWLQuantifiedRestriction*[owlapy.class\_expression.class\_expression.OWLClassExpression], *OWLObjectRestriction*

Represents a quantified object restriction.

**\_\_slots\_\_** = ()

**get\_filler()** → *owlapy.class\_expression.class\_expression.OWLClassExpression*

Gets the filler for this restriction. In the case of an object restriction this will be an individual, in the case of a data restriction this will be a constant (data value). For quantified restriction this will be a class expression or a data range.

**Returns**

the value

**class** owlapy.class\_expression.OWLObjectRestriction

Bases: *OWLRestriction*

Represents an Object Property Restriction in the OWL 2 specification.

**\_\_slots\_\_** = ()

**is\_object\_restriction()** → bool

Determines if this is an object restriction.

**Returns**

True if this is an object restriction.

**abstract get\_property()** → *owlapy.owl\_property.OWLObjectPropertyExpression*

**Returns**

Property being restricted.

**class** owlapy.class\_expression.OWLHasValueRestriction(*value: \_T*)

Bases: Generic[\_T], *OWLRestriction*, owlapy.meta\_classes.HasFiller[\_T]

Represent a HasValue restriction in the OWL 2

**Parameters**

**\_T** – The value type.

**\_\_slots\_\_** = ()

**\_\_eq\_\_** (*other*)

Return self==value.

**\_\_hash\_\_** ()

Return hash(self).

**get\_filler** () → *\_T*

Gets the filler for this restriction. In the case of an object restriction this will be an individual, in the case of a data restriction this will be a constant (data value). For quantified restriction this will be a class expression or a data range.

**Returns**

the value

**class** owlapy.class\_expression.**OWLDataRestriction**

Bases: *OWLRestriction*

Represents a Data Property Restriction.

**\_\_slots\_\_** = ()

**is\_data\_restriction** () → bool

Determines if this is a data restriction.

**Returns**

True if this is a data restriction.

**class** owlapy.class\_expression.**OWLCardinalityRestriction** (*cardinality: int, filler: \_F*)

Bases: *Generic[\_F]*, *OWLQuantifiedRestriction[\_F]*, *owlapy.meta\_classes.HasCardinality*

Base interface for owl min and max cardinality restriction.

**Parameters**

*\_F* – Type of filler.

**\_\_slots\_\_** = ()

**get\_cardinality** () → int

Gets the cardinality of a restriction.

**Returns**

The cardinality. A non-negative integer.

**get\_filler** () → *\_F*

Gets the filler for this restriction. In the case of an object restriction this will be an individual, in the case of a data restriction this will be a constant (data value). For quantified restriction this will be a class expression or a data range.

**Returns**

the value

**class** owlapy.class\_expression.**OWLObjectCardinalityRestriction** (*cardinality: int, property: owlapy.owl\_property.OWLObjectPropertyExpression, filler: owlapy.class\_expression.class\_expression.OWLClassExpression*)

Bases: *OWLCardinalityRestriction[owlapy.class\_expression.class\_expression.OWLClassExpression]*, *OWLQuantifiedObjectRestriction*

Represents Object Property Cardinality Restrictions in the OWL 2 specification.

```

__slots__ = ()

get_property() → owlapy.owl_property.OWLObjectPropertyExpression

    Returns
        Property being restricted.

__repr__()
    Return repr(self).

__eq__(other)
    Return self==value.

__hash__()
    Return hash(self).

class owlapy.class_expression.OWLObjectHasSelf(
    property: owlapy.owl_property.OWLObjectPropertyExpression)
Bases: OWLObjectRestriction

A self-restriction ObjectHasSelf( OPE ) consists of an object property expression OPE, and it contains all those
individuals that are connected by OPE to themselves. (https://www.w3.org/TR/owl2-syntax/#Self-Restriction)

__slots__ = '_property'

type_index: Final = 3011

get_property() → owlapy.owl_property.OWLObjectPropertyExpression

    Returns
        Property being restricted.

__eq__(other)
    Return self==value.

__hash__()
    Return hash(self).

__repr__()
    Return repr(self).

class owlapy.class_expression.OWLDataOneOf(
    values: owlapy.owl_literal.OWLLiteral | Iterable[owlapy.owl_literal.OWLLiteral])
Bases: owlapy.owl_data_ranges.OWLDataRange, owlapy.meta_classes.
HasOperands[owlapy.owl_literal.OWLLiteral]

An enumeration of literals DataOneOf( lt1 ... ltn ) contains exactly the explicitly specified literals lti with  $1 \leq i \leq n$ . The resulting data range has arity one. (https://www.w3.org/TR/owl2-syntax/#Enumeration\_of\_Literals)

type_index: Final = 4003

values() → Iterable[owlapy.owl_literal.OWLLiteral]
    Gets the values that are in the oneOf.

    Returns
        The values of this {@code DataOneOf} class expression.

```

**operands** () → Iterable[*owlapy.owl\_literal.OWLLiteral*]

Gets the operands - e.g., the individuals in a sameAs axiom, or the classes in an equivalent classes axiom.

**Returns**

The operands.

**\_\_hash\_\_** ()

Return hash(self).

**\_\_eq\_\_** (other)

Return self==value.

**\_\_repr\_\_** ()

Return repr(self).

**class** owlapy.class\_expression.OWLQuantifiedDataRestriction (  
    filler: *owlapy.owl\_data\_ranges.OWLDataRange*)

Bases: *OWLQuantifiedRestriction*[*owlapy.owl\_data\_ranges.OWLDataRange*], *OWLDataRestriction*

Represents a quantified data restriction.

**\_\_slots\_\_** = ()

**get\_filler** () → *owlapy.owl\_data\_ranges.OWLDataRange*

Gets the filler for this restriction. In the case of an object restriction this will be an individual, in the case of a data restriction this will be a constant (data value). For quantified restriction this will be a class expression or a data range.

**Returns**

the value

**class** owlapy.class\_expression.OWLDataCardinalityRestriction (*cardinality: int*,  
    *property: owlapy.owl\_property.OWLDataPropertyExpression*,  
    filler: *owlapy.owl\_data\_ranges.OWLDataRange*)

Bases: *OWLCardinalityRestriction*[*owlapy.owl\_data\_ranges.OWLDataRange*], *OWLQuantifiedDataRestriction*, *OWLDataRestriction*

Represents Data Property Cardinality Restrictions.

**\_\_slots\_\_** = ()

**get\_property** () → *owlapy.owl\_property.OWLDataPropertyExpression*

**Returns**

Property being restricted.

**\_\_repr\_\_** ()

Return repr(self).

**\_\_eq\_\_** (other)

Return self==value.

**\_\_hash\_\_** ()

Return hash(self).

**class** owlapy.class\_expression.OWLObjectSomeValuesFrom (  
    *property: owlapy.owl\_property.OWLObjectPropertyExpression*,  
    filler: *owlapy.class\_expression.class\_expression.OWLClassExpression*)

Bases: *OWLQuantifiedObjectRestriction*

An existential class expression `ObjectSomeValuesFrom( OPE CE )` consists of an object property expression OPE and a class expression CE, and it contains all those individuals that are connected by OPE to an individual that is an instance of CE.

```
__slots__ = ('_property', '_filler')
```

```
type_index: Final = 3005
```

```
__repr__()
```

Return repr(self).

```
__eq__(other)
```

Return self==value.

```
__hash__()
```

Return hash(self).

```
get_property() → owlapy.owl_property.OWLObjectPropertyExpression
```

#### Returns

Property being restricted.

```
class owlapy.class_expression.OWLObjectAllValuesFrom(  
    property: owlapy.owl_property.OWLObjectPropertyExpression,  
    filler: owlapy.class_expression.class_expression.OWLClassExpression)
```

Bases: *OWLQuantifiedObjectRestriction*

A universal class expression `ObjectAllValuesFrom( OPE CE )` consists of an object property expression OPE and a class expression CE, and it contains all those individuals that are connected by OPE only to individuals that are instances of CE. ([https://www.w3.org/TR/owl2-syntax/#Universal\\_Quantification](https://www.w3.org/TR/owl2-syntax/#Universal_Quantification))

```
__slots__ = ('_property', '_filler')
```

```
type_index: Final = 3006
```

```
__repr__()
```

Return repr(self).

```
__eq__(other)
```

Return self==value.

```
__hash__()
```

Return hash(self).

```
get_property() → owlapy.owl_property.OWLObjectPropertyExpression
```

#### Returns

Property being restricted.

```
class owlapy.class_expression.OWLObjectHasValue(  
    property: owlapy.owl_property.OWLObjectPropertyExpression,  
    individual: owlapy.owl_individual.OWLIndividual)
```

Bases: *OWLHasValueRestriction[owlapy.owl\_individual.OWLIndividual]*, *OWLObjectRestriction*

A has-value class expression `ObjectHasValue( OPE a )` consists of an object property expression OPE and an individual a, and it contains all those individuals that are connected by OPE to a. Each such class expression



can be seen as a syntactic shortcut for the class expression `ObjectSomeValuesFrom( OPE ObjectOneOf( a ) )`.  
([https://www.w3.org/TR/owl2-syntax/#Individual\\_Value\\_Restriction](https://www.w3.org/TR/owl2-syntax/#Individual_Value_Restriction))

```
__slots__ = ('_property', '_v')
```

```
type_index: Final = 3007
```

```
get_property() → owlapy.owl_property.OWLObjectPropertyExpression
```

#### Returns

Property being restricted.

```
as_some_values_from() → owlapy.class_expression.class_expression.OWLClassExpression
```

A convenience method that obtains this restriction as an existential restriction with a nominal filler.

#### Returns

The existential equivalent of this value restriction.  $\text{simp}(\text{HasValue}(p\ a)) = \text{some}(p\ \{a\})$ .

```
__repr__()
```

Return repr(self).

```
class owlapy.class_expression.OWLDatatypeRestriction(  
    type_: owlapy.owl_datatype.OWLDatatype,  
    facet_restrictions: OWLFacetRestriction | Iterable[OWLFacetRestriction])
```

Bases: `owlapy.owl_data_ranges.OWLDataRange`

A datatype restriction `DatatypeRestriction( DT F1 l1 ... Fn ltn )` consists of a unary datatype `DT` and `n` pairs `( Fi , lti )`. The resulting data range is unary and is obtained by restricting the value space of `DT` according to the semantics of all `( Fi , vi )` (multiple pairs are interpreted conjunctively), where `vi` are the data values of the literals `lti`. ([https://www.w3.org/TR/owl2-syntax/#Datatype\\_Restrictions](https://www.w3.org/TR/owl2-syntax/#Datatype_Restrictions))

```
__slots__ = ('_type', '_facet_restrictions')
```

```
type_index: Final = 4006
```

```
get_datatype() → owlapy.owl_datatype.OWLDatatype
```

```
get_facet_restrictions() → Sequence[OWLFacetRestriction]
```

```
__eq__(other)
```

Return self==value.

```
__hash__()
```

Return hash(self).

```
__repr__()
```

Return repr(self).

```
class owlapy.class_expression.OWLFacet(remainder: str, symbolic_form: str,  
    operator: Callable[[_X, _X], bool])
```

Bases: `_Vocabulary, enum.Enum`

Enumerations for OWL facets.

```
property symbolic_form
```

```
property operator
```

```
MIN_INCLUSIVE: Final = ('minInclusive', '>=')
```

```

MIN_EXCLUSIVE: Final = ('minExclusive', '>')
MAX_INCLUSIVE: Final = ('maxInclusive', '<=')
MAX_EXCLUSIVE: Final = ('maxExclusive', '<')
LENGTH: Final = ('length', 'length')
MIN_LENGTH: Final = ('minLength', 'minLength')
MAX_LENGTH: Final = ('maxLength', 'maxLength')
PATTERN: Final = ('pattern', 'pattern')
TOTAL_DIGITS: Final = ('totalDigits', 'totalDigits')
FRACTION_DIGITS: Final = ('fractionDigits', 'fractionDigits')

static from_str(name: str) → OWLFacet

class owlapy.class_expression.OWLFacetRestriction(facet: owlapy.vocab.OWLFacet,
    literal: Literals)
    Bases: owlapy.owl_object.OWLObject
    A facet restriction is used to restrict a particular datatype.
    __slots__ = ('_facet', '_literal')
    type_index: Final = 4007
    get_facet() → owlapy.vocab.OWLFacet
    get_facet_value() → owlapy.owl_literal.OWLLiteral
    __eq__(other)
        Return self==value.
    __hash__()
        Return hash(self).
    __repr__()
        Return repr(self).

class owlapy.class_expression.OWLObjectMinCardinality(cardinality: int,
    property: owlapy.owl_property.OWLObjectPropertyExpression,
    filler: owlapy.class_expression.class_expression.OWLClassExpression)
    Bases: OWLObjectCardinalityRestriction
    A minimum cardinality expression ObjectMinCardinality( n OPE CE ) consists of a nonnegative integer n, an object
    property expression OPE, and a class expression CE, and it contains all those individuals that are connected by
    OPE to at least n different individuals that are instances of CE. (https://www.w3.org/TR/owl2-syntax/#Minimum\_Cardinality)
    __slots__ = ('_cardinality', '_filler', '_property')
    type_index: Final = 3008

```

```
class owlapy.class_expression.OwlObjectMaxCardinality (cardinality: int,
    property: owlapy.owl_property.OwlObjectPropertyExpression,
    filler: owlapy.class_expression.class_expression.OwlClassExpression)
```

Bases: *OwlObjectCardinalityRestriction*

A maximum cardinality expression `ObjectMaxCardinality( n OPE CE )` consists of a nonnegative integer `n`, an object property expression `OPE`, and a class expression `CE`, and it contains all those individuals that are connected by `OPE`

to at most `n` different individuals that are instances of `CE`. ([https://www.w3.org/TR/owl2-syntax/#Maximum\\_Cardinality](https://www.w3.org/TR/owl2-syntax/#Maximum_Cardinality))

```
__slots__ = ('_cardinality', '_filler', '_property')
```

```
type_index: Final = 3010
```

```
class owlapy.class_expression.OwlObjectExactCardinality (cardinality: int,
    property: owlapy.owl_property.OwlObjectPropertyExpression,
    filler: owlapy.class_expression.class_expression.OwlClassExpression)
```

Bases: *OwlObjectCardinalityRestriction*

An exact cardinality expression `ObjectExactCardinality( n OPE CE )` consists of a nonnegative integer `n`, an object

property expression `OPE`, and a class expression `CE`, and it contains all those individuals that are connected by to exactly `n` different individuals that are instances of `CE`.

([https://www.w3.org/TR/owl2-syntax/#Exact\\_Cardinality](https://www.w3.org/TR/owl2-syntax/#Exact_Cardinality))

```
__slots__ = ('_cardinality', '_filler', '_property')
```

```
type_index: Final = 3009
```

```
as_intersection_of_min_max()
```

→ *owlapy.class\_expression.nary\_boolean\_expression.OwlObjectIntersectionOf*

Obtains an equivalent form that is a conjunction of a min cardinality and max cardinality restriction.

#### Returns

The semantically equivalent but structurally simpler form  $(= 1 \text{ R } C) = \geq 1 \text{ R } C \text{ and } \leq 1 \text{ R } C$ .

```
class owlapy.class_expression.OwlDataSomeValuesFrom (
    property: owlapy.owl_property.OwlDataPropertyExpression,
    filler: owlapy.owl_data_ranges.OwlDataRange)
```

Bases: *OwlQuantifiedDataRestriction*

An existential class expression `DataSomeValuesFrom( DPE1 ... DPEn DR )` consists of `n` data property expressions `DPEi`,  $1 \leq i \leq n$ , and a data range `DR` whose arity must be `n`. Such a class expression contains all those individuals that are connected by `DPEi` to literals `lti`,  $1 \leq i \leq n$ , such that the tuple  $( lt_1, \dots, lt_n )$  is in `DR`. A class expression of the form `DataSomeValuesFrom( DPE DR )` can be seen as a syntactic shortcut for the class expression `DataMinCardinality( 1 DPE DR )`. ([https://www.w3.org/TR/owl2-syntax/#Existential\\_Quantification\\_2](https://www.w3.org/TR/owl2-syntax/#Existential_Quantification_2))

```
__slots__ = '_property'
```

```
type_index: Final = 3012
```

```
__repr__()
```

Return `repr(self)`.

```
__eq__(other)
```

Return `self==value`.

**\_\_hash\_\_** ()

Return hash(self).

**get\_property** () → *owlapy.owl\_property.OWLDataPropertyExpression*

**Returns**

Property being restricted.

```
class owlapy.class_expression.OWLDataAllValuesFrom(  
    property: owlapy.owl_property.OWLDataPropertyExpression,  
    filler: owlapy.owl_data_ranges.OWLDataRange)
```

Bases: *OWLQuantifiedDataRestriction*

A universal class expression `DataAllValuesFrom( DPE1 ... DPEn DR )` consists of  $n$  data property expressions `DPEi`,  $1 \leq i \leq n$ , and a data range `DR` whose arity must be  $n$ . Such a class expression contains all those individuals that

**are connected by DPE<sub>i</sub> only to literals `lti`,  $1 \leq i \leq n$ , such that each tuple `( lt1 , ..., ltn )` is in `DR`.**

**A class**

expression of the form `DataAllValuesFrom( DPE DR )` can be seen as a syntactic shortcut for the class expression `DataMaxCardinality( 0 DPE DataComplementOf( DR ) )`. ([https://www.w3.org/TR/owl2-syntax/#Universal\\_Quantification\\_2](https://www.w3.org/TR/owl2-syntax/#Universal_Quantification_2))

**\_\_slots\_\_** = `'_property'`

**type\_index:** `Final = 3013`

**\_\_repr\_\_** ()

Return repr(self).

**\_\_eq\_\_** (*other*)

Return self==value.

**\_\_hash\_\_** ()

Return hash(self).

**get\_property** () → *owlapy.owl\_property.OWLDataPropertyExpression*

**Returns**

Property being restricted.

```
class owlapy.class_expression.OWLDataHasValue(  
    property: owlapy.owl_property.OWLDataPropertyExpression,  
    value: owlapy.owl_literal.OWLLiteral)
```

Bases: *OWLHasValueRestriction[owlapy.owl\_literal.OWLLiteral], OWLDataRestriction*

A has-value class expression `DataHasValue( DPE lt )` consists of a data property expression `DPE` and a literal `lt`, and it contains all those individuals that are connected by `DPE` to `lt`. Each such class expression can be seen as a syntactic shortcut for the class expression `DataSomeValuesFrom( DPE DataOneOf( lt ) )`. ([https://www.w3.org/TR/owl2-syntax/#Literal\\_Value\\_Restriction](https://www.w3.org/TR/owl2-syntax/#Literal_Value_Restriction))

**\_\_slots\_\_** = `'_property'`

**type\_index:** `Final = 3014`

**\_\_repr\_\_** ()

Return repr(self).

```

__eq__(other)
    Return self==value.

__hash__()
    Return hash(self).

as_some_values_from() → owlapy.class_expression.class_expression.OWLClassExpression
    A convenience method that obtains this restriction as an existential restriction with a nominal filler.

    Returns
        The existential equivalent of this value restriction.  $\text{simp}(\text{HasValue}(p\ a)) = \text{some}(p\ \{a\})$ .

get_property() → owlapy.owl_property.OWLDataPropertyExpression

    Returns
        Property being restricted.

```

**class** owlapy.class\_expression.OWLDataMinCardinality(cardinality: int,  
property: owlapy.owl\_property.OWLDataPropertyExpression,  
filler: owlapy.owl\_data\_ranges.OWLDataRange)

Bases: OWLDataCardinalityRestriction

A minimum cardinality expression DataMinCardinality( n DPE DR ) consists of a nonnegative integer n, a data property expression DPE, and a unary data range DR, and it contains all those individuals that are connected by DPE to at least n different literals in DR. ([https://www.w3.org/TR/owl2-syntax/#Minimum\\_Cardinality](https://www.w3.org/TR/owl2-syntax/#Minimum_Cardinality))

```

__slots__ = ('_cardinality', '_filler', '_property')

type_index: Final = 3015

```

**class** owlapy.class\_expression.OWLDataMaxCardinality(cardinality: int,  
property: owlapy.owl\_property.OWLDataPropertyExpression,  
filler: owlapy.owl\_data\_ranges.OWLDataRange)

Bases: OWLDataCardinalityRestriction

A maximum cardinality expression ObjectMaxCardinality( n OPE CE ) consists of a nonnegative integer n, an object property expression OPE, and a class expression CE, and it contains all those individuals that are connected by OPE to at most n different individuals that are instances of CE. ([https://www.w3.org/TR/owl2-syntax/#Maximum\\_Cardinality](https://www.w3.org/TR/owl2-syntax/#Maximum_Cardinality))

```

__slots__ = ('_cardinality', '_filler', '_property')

type_index: Final = 3017

```

**class** owlapy.class\_expression.OWLDataExactCardinality(cardinality: int,  
property: owlapy.owl\_property.OWLDataPropertyExpression,  
filler: owlapy.owl\_data\_ranges.OWLDataRange)

Bases: OWLDataCardinalityRestriction

An exact cardinality expression ObjectExactCardinality( n OPE CE ) consists of a nonnegative integer n, an object property expression OPE, and a class expression CE, and it contains all those individuals that are connected

by OPE to exactly n different individuals that are instances of CE ([https://www.w3.org/TR/owl2-syntax/#Exact\\_Cardinality](https://www.w3.org/TR/owl2-syntax/#Exact_Cardinality))

```

__slots__ = ('_cardinality', '_filler', '_property')

type_index: Final = 3016

```

**as\_intersection\_of\_min\_max()**

→ *owlapy.class\_expression.nary\_boolean\_expression.OWLObjectIntersectionOf*

Obtains an equivalent form that is a conjunction of a min cardinality and max cardinality restriction.

**Returns**

The semantically equivalent but structurally simpler form ( $= 1 \text{ R D}$ )  $= \geq 1 \text{ R D}$  and  $\leq 1 \text{ R D}$ .

**class** owlapy.class\_expression.OWLObjectOneOf (

*values: owlapy.owl\_individual.OWLIndividual | Iterable[owlapy.owl\_individual.OWLIndividual]*)

Bases: *owlapy.class\_expression.class\_expression.OWLAnonymousClassExpression*,  
*owlapy.meta\_classes.HasOperands[owlapy.owl\_individual.OWLIndividual]*

An enumeration of individuals *ObjectOneOf*( $a_1 \dots a_n$ ) contains exactly the individuals  $a_i$  with  $1 \leq i \leq n$ . ([https://www.w3.org/TR/owl2-syntax/#Enumeration\\_of\\_Individuals](https://www.w3.org/TR/owl2-syntax/#Enumeration_of_Individuals))

**\_\_slots\_\_** = **'\_values'**

**type\_index:** **Final** = 3004

**individuals()** → *Iterable[owlapy.owl\_individual.OWLIndividual]*

Gets the individuals that are in the *oneOf*. These individuals represent the exact instances (extension) of this class expression.

**Returns**

The individuals that are the values of this {`@code` *ObjectOneOf*} class expression.

**operands()** → *Iterable[owlapy.owl\_individual.OWLIndividual]*

Gets the operands - e.g., the individuals in a *sameAs* axiom, or the classes in an equivalent classes axiom.

**Returns**

The operands.

**as\_object\_union\_of()** → *owlapy.class\_expression.class\_expression.OWLClassExpression*

Simplifies this enumeration to a union of singleton nominals.

**Returns**

This enumeration in a more standard DL form.  $\text{simp}(\{a\}) = \{a\}$   $\text{simp}(\{a_0, \dots, \{a_n\}\}) = \text{unionOf}(\{a_0\}, \dots, \{a_n\})$

**\_\_hash\_\_()**

Return *hash(self)*.

**\_\_eq\_\_** (*other*)

Return *self==value*.

**\_\_repr\_\_()**

Return *repr(self)*.

**class** owlapy.class\_expression.OWL~~R~~DFVocabulary (

*namespace: owlapy.namespaces.Namespaces, remainder: str*)

Bases: *\_Vocabulary*, *enum.Enum*

Enumerations for OWL/RDF vocabulary.

**OWL\_THING** = ()

**OWL\_NOthing** = ()

**OWL\_CLASS** = ()

```

    OWL_NAMED_INDIVIDUAL = ()

    OWL_TOP_OBJECT_PROPERTY = ()

    OWL_BOTTOM_OBJECT_PROPERTY = ()

    OWL_TOP_DATA_PROPERTY = ()

    OWL_BOTTOM_DATA_PROPERTY = ()

    RDFS_LITERAL = ()

owlapy.class_expression.OWLThing: Final

owlapy.class_expression.OWLNothing: Final

```

## owlapy.entities

Entities are the fundamental building blocks of OWL 2 ontologies, and they define the vocabulary — the named terms — of an ontology. In logic, the set of entities is usually said to constitute the signature of an ontology.

Classes, datatypes, object properties, data properties, annotation properties, and named individuals are entities, and they are all uniquely identified by an IR.

## 3.2 Submodules

### owlapy.converter

Format converter.

### Module Contents

#### Classes

<i>VariablesMapping</i>	Helper class for owl-to-sparql conversion.
<i>Owl2SparqlConverter</i>	Convert owl (owlapy model class expressions) to SPARQL.

#### Functions

<i>peek(x)</i>	Peek the last element of an array.
<i>owl_expression_to_sparql(→ str)</i>	Convert an OWL Class Expression ( <a href="https://www.w3.org/TR/owl2-syntax/#Class_Expressions">https://www.w3.org/TR/owl2-syntax/#Class_Expressions</a> ) into a SPARQL query

## Attributes

---

*converter*

---

`owlapy.converter.peek(x)`

Peek the last element of an array.

### Returns

The last element `arr[-1]`.

**class** `owlapy.converter.VariablesMapping`

Helper class for owl-to-sparql conversion.

`__slots__ = ('class_cnt', 'prop_cnt', 'ind_cnt', 'dict')`

`get_variable(e: owlapy.owl_object.OWLEntity) → str`

`new_individual_variable() → str`

`new_property_variable() → str`

`__contains__(item: owlapy.owl_object.OWLEntity) → bool`

`__getitem__(item: owlapy.owl_object.OWLEntity) → str`

**class** `owlapy.converter.Owl2SparqlConverter`

Convert owl (owlapy model class expressions) to SPARQL.

`property modal_depth`

`property current_variable`

`__slots__ = ('ce', 'sparql', 'variables', 'parent', 'parent_var', 'properties', 'variable_entities', 'cnt', ...)`

`ce: owlapy.class_expression.OWLClassExpression`

`sparql: List[str]`

`variables: List[str]`

`parent: List[owlapy.class_expression.OWLClassExpression]`

`parent_var: List[str]`

`variable_entities: Set[owlapy.owl_object.OWLEntity]`

`properties: Dict[int, List[owlapy.owl_object.OWLEntity]]`

`mapping: VariablesMapping`

`grouping_vars: Dict[owlapy.class_expression.OWLClassExpression, Set[str]]`

`having_conditions: Dict[owlapy.class_expression.OWLClassExpression, Set[str]]`



**cnt:** int

**for\_all\_de\_morgan:** bool

**named\_individuals:** bool

**convert** (*root\_variable: str, ce: owlapy.class\_expression.OWLClassExpression,*  
*for\_all\_de\_morgan: bool = True, named\_individuals: bool = False*)

Used to convert owl class expression to SPARQL syntax.

#### Parameters

- **root\_variable** (*str*) – Root variable name that will be used in SPARQL query.
- **ce** (*OWLClassExpression*) – The owl class expression to convert.
- **named\_individuals** (*bool*) – If ‘True’ return only entities that are instances of owl:NamedIndividual.

#### Returns

The SPARQL query.

#### Return type

list[str]

**abstract\_render** (*e*)

**stack\_variable** (*var*)

**stack\_parent** (*parent: owlapy.class\_expression.OWLClassExpression*)

**abstract\_process** (*ce: owlapy.class\_expression.OWLClassExpression*)

**forAll** (*ce: owlapy.class\_expression.OWLObjectAllValuesFrom*)

**forAllDeMorgan** (*ce: owlapy.class\_expression.OWLObjectAllValuesFrom*)

**new\_count\_var** () → str

**append\_triple** (*subject, predicate, object\_*)

**append** (*frag*)

**triple** (*subject, predicate, object\_*)

**as\_query** (*root\_variable: str, ce: owlapy.class\_expression.OWLClassExpression,*  
*for\_all\_de\_morgan: bool = True, count: bool = False,*  
*values: Iterable[owlapy.owl\_individual.OWLNamedIndividual] | None = None,*  
*named\_individuals: bool = False*) → str

owlapy.converter.**converter**

owlapy.converter.**owl\_expression\_to\_sparql** (  
*expression: owlapy.class\_expression.OWLClassExpression = None, root\_variable: str = '?x',*  
*values: Iterable[owlapy.owl\_individual.OWLNamedIndividual] | None = None,*  
*for\_all\_de\_morgan: bool = True, named\_individuals: bool = False*) → str

Convert an OWL Class Expression ([https://www.w3.org/TR/owl2-syntax/#Class\\_Expressions](https://www.w3.org/TR/owl2-syntax/#Class_Expressions)) into a SPARQL query root variable: the variable that will be projected expression: the class expression to be transformed to a SPARQL query

values: positive or negative examples from a class expression problem. Unclear for\_all\_de\_morgan: if set to True, the SPARQL mapping will use the mapping containing the nested FILTER NOT EXISTS patterns for the universal

quantifier  $(\neg(\exists r.\neg C))$ , instead of the counting query named `individuals`: if set to `True`, the generated SPARQL query will return only entities that are instances of `owl:NamedIndividual`

## `owlapy.iri`

OWL IRI

## Module Contents

### Classes

<i>IRI</i>	An IRI, consisting of a namespace and a remainder.
------------	--

```
class owlapy.iri.IRI (namespace: str | owlapy.namespaces.Namespaces, remainder: str)
    Bases:      owlapy.owl_annotation.OWLAnnotationSubject,  owlapy.owl_annotation.
                OWLAnnotationValue
    An IRI, consisting of a namespace and a remainder.
    property str: str
        Returns: The string that specifies the IRI.
    property reminder: str
        Returns: The string corresponding to the reminder of the IRI.
    __slots__ = ('_namespace', '_remainder', '__weakref__')
    type_index: Final = 0
    static create (namespace: owlapy.namespaces.Namespaces, remainder: str) → IRI
    static create (namespace: str, remainder: str) → IRI
    static create (string: str) → IRI
    __repr__ ()
        Return repr(self).
    __eq__ (other)
        Return self==value.
    __hash__ ()
        Return hash(self).
    is_nothing ()
        Determines if this IRI is equal to the IRI that owl:Nothing is named with.
        Returns
            True if this IRI is equal to <http://www.w3.org/2002/07/owl#Nothing> and otherwise False.
    is_thing ()
        Determines if this IRI is equal to the IRI that owl:Thing is named with.
        Returns
            True if this IRI is equal to <http://www.w3.org/2002/07/owl#Thing> and otherwise False.
```

**is\_reserved\_vocabulary** () → bool

Determines if this IRI is in the reserved vocabulary. An IRI is in the reserved vocabulary if it starts with <http://www.w3.org/1999/02/22-rdf-syntax-ns#> or <http://www.w3.org/2000/01/rdf-schema#> or <http://www.w3.org/2001/XMLSchema#> or <http://www.w3.org/2002/07/owl#>.

**Returns**

True if the IRI is in the reserved vocabulary, otherwise False.

**as\_iri** () → *IRI*

**Returns**

if the value is an IRI, return it. Return None otherwise.

**as\_str** () → str

CD: Should be deprecated. :returns: The string that specifies the IRI.

**get\_short\_form** () → str

Gets the short form.

**Returns**

A string that represents the short form.

**get\_namespace** () → str

**Returns**

The namespace as string.

**get\_remainder** () → str

**Returns**

The remainder (coincident with NCName usually) for this IRI.

## owlapy.meta\_classes

Meta classes for OWL objects.

## Module Contents

### Classes

<i>HasIRI</i>	Simple class to access the IRI.
<i>HasOperands</i>	An interface to objects that have a collection of operands.
<i>HasFiller</i>	An interface to objects that have a filler.
<i>HasCardinality</i>	An interface to objects that have a cardinality.

**class** owlapy.meta\_classes.**HasIRI**

Simple class to access the IRI.

**abstract property** iri: *IRI*

Gets the IRI of this object.

**Returns**

The IRI of this object.

```

abstract property str: str
    Gets the string representation of this object

    Returns
        The IRI as string

__slots__ = ()

class owlapy.meta_classes.HasOperands
    Bases: Generic[_T]

    An interface to objects that have a collection of operands.

    Parameters
        _T – Operand type.

__slots__ = ()

abstract operands() → Iterable[_T]
    Gets the operands - e.g., the individuals in a sameAs axiom, or the classes in an equivalent classes axiom.

    Returns
        The operands.

class owlapy.meta_classes.HasFiller
    Bases: Generic[_T]

    An interface to objects that have a filler.

    Parameters
        _T – Filler type.

__slots__ = ()

abstract get_filler() → _T
    Gets the filler for this restriction. In the case of an object restriction this will be an individual, in the case of
    a data restriction this will be a constant (data value). For quantified restriction this will be a class expression
    or a data range.

    Returns
        the value

class owlapy.meta_classes.HasCardinality
    An interface to objects that have a cardinality.

__slots__ = ()

abstract get_cardinality() → int
    Gets the cardinality of a restriction.

    Returns
        The cardinality. A non-negative integer.

```

## owlapy.namespaces

Namespaces.

## Module Contents

### Classes

<i>Namespaces</i>	Namespaces provide a simple method for qualifying element and attribute names used in Extensible Markup
-------------------	---

### Attributes

<i>OWL</i>
<i>RDFS</i>
<i>RDF</i>
<i>XSD</i>

**class** owlapy.namespaces.**Namespaces** (*prefix: str, ns: str*)

Namespaces provide a simple method for qualifying element and attribute names used in Extensible Markup Language documents by associating them with namespaces identified by URI references

**property** ns: str

**property** prefix: str

**\_\_slots\_\_** = ('\_prefix', '\_ns')

**\_\_repr\_\_**()

Return repr(self).

**\_\_hash\_\_**()

Return hash(self).

**\_\_eq\_\_**(*other*)

Return self==value.

owlapy.namespaces.**OWL**: **Final**

owlapy.namespaces.**RDFS**: **Final**

owlapy.namespaces.**RDF**: **Final**

owlapy.namespaces.**XSD**: **Final**

`owlapy.owl_annotation`

OWL Annotations

## Module Contents

### Classes

<i>OWLAnnotationObject</i>	A marker interface for the values (objects) of annotations.
<i>OWLAnnotationSubject</i>	A marker interface for annotation subjects, which can either be IRIs or anonymous individuals
<i>OWLAnnotationValue</i>	A marker interface for annotation values, which can either be an IRI (URI), Literal or Anonymous Individual.

**class** `owlapy.owl_annotation.OWLAnnotationObject`

Bases: *owlapy.owl\_object.OWLObject*

A marker interface for the values (objects) of annotations.

**\_\_slots\_\_** = ()

**as\_iri** () → *IRI* | None

**Returns**

if the value is an IRI, return it. Return None otherwise.

**as\_anonymous\_individual** ()

**Returns**

if the value is an anonymous, return it. Return None otherwise.

**class** `owlapy.owl_annotation.OWLAnnotationSubject`

Bases: *OWLAnnotationObject*

A marker interface for annotation subjects, which can either be IRIs or anonymous individuals

**\_\_slots\_\_** = ()

**class** `owlapy.owl_annotation.OWLAnnotationValue`

Bases: *OWLAnnotationObject*

A marker interface for annotation values, which can either be an IRI (URI), Literal or Anonymous Individual.

**\_\_slots\_\_** = ()

**is\_literal** () → bool

**Returns**

true if the annotation value is a literal

**as\_literal** () → *OWLLiteral* | None

**Returns**

if the value is a literal, returns it. Return None otherwise

## Module Contents

### Classes

<i>OWLAxiom</i>	Represents Axioms in the OWL 2 Specification.
<i>OWLLogicalAxiom</i>	A base interface of all axioms that affect the logical meaning of an ontology. This excludes declaration
<i>OWLPropertyAxiom</i>	The base interface for property axioms.
<i>OWLObjectPropertyAxiom</i>	The base interface for object property axioms.
<i>OWLDataPropertyAxiom</i>	The base interface for data property axioms.
<i>OWLIndividualAxiom</i>	The base interface for individual axioms.
<i>OWLClassAxiom</i>	The base interface for class axioms.
<i>OWLDeclarationAxiom</i>	Represents a Declaration axiom in the OWL 2 Specification. A declaration axiom declares an entity in an ontology.
<i>OWLDatatypeDefinitionAxiom</i>	A datatype definition <i>DatatypeDefinition</i> ( DT DR ) defines a new datatype DT as being semantically
<i>OWLHasKeyAxiom</i>	A key axiom <i>HasKey</i> ( CE ( OPE1 ... OPEm ) ( DPE1 ... DPEn ) ) states that each
<i>OWLNaryAxiom</i>	Represents an axiom that contains two or more operands that could also be represented with multiple pairwise
<i>OWLNaryClassAxiom</i>	Represents an axiom that contains two or more operands that could also be represented with
<i>OWLEquivalentClassesAxiom</i>	An equivalent classes axiom <i>EquivalentClasses</i> ( CE1 ... CEn ) states that all of the class expressions CEi,
<i>OWLDisjointClassesAxiom</i>	A disjoint classes axiom <i>DisjointClasses</i> ( CE1 ... CEn ) states that all of the class expressions CEi, $1 \leq i \leq n$ ,
<i>OWLNaryIndividualAxiom</i>	Represents an axiom that contains two or more operands that could also be represented with
<i>OWLDifferentIndividualsAxiom</i>	An individual inequality axiom <i>DifferentIndividuals</i> ( a1 ... an ) states that all of the individuals ai,
<i>OWLSameIndividualAxiom</i>	An individual equality axiom <i>SameIndividual</i> ( a1 ... an ) states that all of the individuals ai, $1 \leq i \leq n$ ,
<i>OWLNaryPropertyAxiom</i>	Represents an axiom that contains two or more operands that could also be represented with
<i>OWLEquivalentObjectPropertiesAxiom</i>	An equivalent object properties axiom <i>EquivalentObjectProperties</i> ( OPE1 ... OPEn ) states that all of the object
<i>OWLDisjointObjectPropertiesAxiom</i>	A disjoint object properties axiom <i>DisjointObjectProperties</i> ( OPE1 ... OPEn ) states that all of the object
<i>OWLInverseObjectPropertiesAxiom</i>	An inverse object properties axiom <i>InverseObjectProperties</i> ( OPE1 OPE2 ) states that the object property
<i>OWLEquivalentDataPropertiesAxiom</i>	An equivalent data properties axiom <i>EquivalentDataProperties</i> ( DPE1 ... DPEn ) states that all the data property
<i>OWLDisjointDataPropertiesAxiom</i>	A disjoint data properties axiom <i>DisjointDataProperties</i> ( DPE1 ... DPEn ) states that all of the data property
<i>OWLSubClassOfAxiom</i>	A subclass axiom <i>SubClassOf</i> ( CE1 CE2 ) states that the class expression CE1 is a subclass of the class

continues on next page

Table 2 – continued from previous page

<i>OWLDisjointUnionAxiom</i>	A disjoint union axiom <code>DisjointUnion( C CE1 ... CEn )</code> states that a class <i>C</i> is a disjoint union of the class
<i>OWLClassAssertionAxiom</i>	A class assertion <code>ClassAssertion( CE a )</code> states that the individual <i>a</i> is an instance of the class expression <i>CE</i> .
<i>OWLAnnotationProperty</i>	Represents an <code>AnnotationProperty</code> in the OWL 2 specification.
<i>OWLAnnotation</i>	Annotations are used in the various types of annotation axioms, which bind annotations to their subjects
<i>OWLAnnotationAxiom</i>	A super interface for annotation axioms.
<i>OWLAnnotationAssertionAxiom</i>	An annotation assertion <code>AnnotationAssertion( AP as av )</code> states that the annotation subject <i>as</i> — an IRI or an
<i>OWLSubAnnotationPropertyOfAxiom</i>	An annotation subproperty axiom <code>SubAnnotationPropertyOf( AP1 AP2 )</code> states that the annotation property <i>AP1</i> is
<i>OWLAnnotationPropertyDomainAxiom</i>	An annotation property domain axiom <code>AnnotationPropertyDomain( AP U )</code> states that the domain of the annotation
<i>OWLAnnotationPropertyRangeAxiom</i>	An annotation property range axiom <code>AnnotationPropertyRange( AP U )</code>
<i>OWLSubPropertyAxiom</i>	Base interface for object and data sub-property axioms.
<i>OWLSubObjectPropertyOfAxiom</i>	Object subproperty axioms are analogous to subclass axioms, and they come in two forms.
<i>OWLSubDataPropertyOfAxiom</i>	A data subproperty axiom <code>SubDataPropertyOf( DPE1 DPE2 )</code> states that the data property expression <i>DPE1</i> is a
<i>OWLPropertyAssertionAxiom</i>	Base class for Property Assertion axioms.
<i>OWLObjectPropertyAssertionAxiom</i>	A positive object property assertion <code>ObjectPropertyAssertion( OPE a1 a2 )</code> states that the individual <i>a1</i> is
<i>OWLNegativeObjectPropertyAssertionAxiom</i>	A negative object property assertion <code>NegativeObjectPropertyAssertion( OPE a1 a2 )</code> states that the individual <i>a1</i>
<i>OWLDataPropertyAssertionAxiom</i>	A positive data property assertion <code>DataPropertyAssertion( DPE a lt )</code> states that the individual <i>a</i> is connected
<i>OWLNegativeDataPropertyAssertionAxiom</i>	A negative data property assertion <code>NegativeDataPropertyAssertion( DPE a lt )</code> states that the individual <i>a</i> is not
<i>OWLUnaryPropertyAxiom</i>	Base class for Unary property axiom.
<i>OWLObjectPropertyCharacteristicAxiom</i>	Base interface for functional object property axiom.
<i>OWLFunctionalObjectPropertyAxiom</i>	An object property functionality axiom <code>FunctionalObjectProperty( OPE )</code> states that
<i>OWLASymmetricObjectPropertyAxiom</i>	An object property asymmetry axiom <code>AsymmetricObjectProperty( OPE )</code> states that
<i>OWLInverseFunctionalObjectPropertyAxiom</i>	An object property inverse functionality axiom <code>InverseFunctionalObjectProperty( OPE )</code>
<i>OWLIrreflexiveObjectPropertyAxiom</i>	An object property irreflexivity axiom <code>IrreflexiveObjectProperty( OPE )</code> states that the
<i>OWLReflexiveObjectPropertyAxiom</i>	An object property reflexivity axiom <code>ReflexiveObjectProperty( OPE )</code> states that the
<i>OWLSymmetricObjectPropertyAxiom</i>	An object property symmetry axiom <code>SymmetricObjectProperty( OPE )</code> states that

continues on next page



Table 2 – continued from previous page

<i>OWLTransitiveObjectPropertyAxiom</i>	An object property transitivity axiom TransitiveObjectProperty( OPE ) states that the
<i>OWLDataPropertyCharacteristicAxiom</i>	Base interface for Functional data property axiom.
<i>OWLFunctionalDataPropertyAxiom</i>	A data property functionality axiom FunctionalDataProperty( DPE ) states that
<i>OWLPropertyDomainAxiom</i>	Base class for Property Domain axioms.
<i>OWLPropertyRangeAxiom</i>	Base class for Property Range axioms.
<i>OWLObjectPropertyDomainAxiom</i>	An object property domain axiom ObjectPropertyDomain( OPE CE ) states that the domain of the
<i>OWLDataPropertyDomainAxiom</i>	A data property domain axiom DataPropertyDomain( DPE CE ) states that the domain of the
<i>OWLObjectPropertyRangeAxiom</i>	An object property range axiom ObjectPropertyRange( OPE CE ) states that the range of the object property
<i>OWLDataPropertyRangeAxiom</i>	A data property range axiom DataPropertyRange( DPE DR ) states that the range of the data property

```
class owlapy.owl_axiom.OWLAXiom (annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *owlapy.owl\_object.OWLObject*

Represents Axioms in the OWL 2 Specification.

An OWL ontology contains a set of axioms. These axioms can be annotation axioms, declaration axioms, imports axioms or logical axioms.

```
__slots__ = '_annotations'
```

```
annotations () → List[OWLAnnotation] | None
```

```
is_annotated () → bool
```

```
is_logical_axiom () → bool
```

```
is_annotation_axiom () → bool
```

```
class owlapy.owl_axiom.OWLLogicalAxiom (
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLAxiom*

A base interface of all axioms that affect the logical meaning of an ontology. This excludes declaration axioms (including imports declarations) and annotation axioms.

```
__slots__ = ()
```

```
is_logical_axiom () → bool
```

```
class owlapy.owl_axiom.OWLPropertyAxiom (
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLLogicalAxiom*

The base interface for property axioms.

```
__slots__ = ()
```

```
class owlapy.owl_axiom.OWLObjectPropertyAxiom (
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLPropertyAxiom*

The base interface for object property axioms.

```

__slots__ = ()

class owlapy.owl_axiom.OWLDataPropertyAxiom(
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLPropertyAxiom
    The base interface for data property axioms.

__slots__ = ()

class owlapy.owl_axiom.OWLIndividualAxiom(
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLLogicalAxiom
    The base interface for individual axioms.

__slots__ = ()

class owlapy.owl_axiom.OWLClassAxiom(annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLLogicalAxiom
    The base interface for class axioms.

__slots__ = ()

class owlapy.owl_axiom.OWLDeclarationAxiom(entity: owlapy.owl_object.OWLEntity,
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLAxiom
    Represents a Declaration axiom in the OWL 2 Specification. A declaration axiom declares an entity in an ontology.
    It doesn't affect the logical meaning of the ontology.

__slots__ = '_entity'

get_entity() → owlapy.owl_object.OWLEntity

__eq__(other)
    Return self==value.

__hash__()
    Return hash(self).

__repr__()
    Return repr(self).

class owlapy.owl_axiom.OWLDatatypeDefinitionAxiom(
    datatype: owlapy.owl_datatype.OWLDatatype, datarange: owlapy.owl_datatype.OWLDataRange,
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLLogicalAxiom
    A datatype definition DatatypeDefinition( DT DR ) defines a new datatype DT as being semantically equivalent to
    the data range DR; the latter must be a unary data range. This axiom allows one to use the defined datatype DT as
    a synonym for DR — that is, in any expression in the ontology containing such an axiom, DT can be replaced with
    DR without affecting the meaning of the ontology.
    (https://www.w3.org/TR/owl2-syntax/#Datatype\_Definitions)

__slots__ = ('_datatype', '_datarange')

get_datatype() → owlapy.owl_datatype.OWLDatatype

```

**get\_datarange** () → owlapy.owl\_datatype.OWLDataRange

**\_\_eq\_\_** (other)

Return self==value.

**\_\_hash\_\_** ()

Return hash(self).

**\_\_repr\_\_** ()

Return repr(self).

```
class owlapy.owl_axiom.OWLHasKeyAxiom (  
    class_expression: owlapy.class_expression.OWLClassExpression,  
    property_expressions: List[owlapy.owl_property.OWLPropertyExpression],  
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLLogicalAxiom*, *owlapy.meta\_classes.HasOperands[owlapy.owl\_property.OWLPropertyExpression]*

A key axiom `HasKey( CE ( OPE1 ... OPEm ) ( DPE1 ... DPEn ) )` states that each (named) instance of the class expression CE is uniquely identified by the object property expressions OPEi and/or the data property expressions DPEj — that is, no two distinct (named) instances of CE can coincide on the values of all object property expressions OPEi and all data property expressions DPEj. In each such axiom in an OWL ontology, m or n (or both) must be larger than zero. A key axiom of the form `HasKey( owl:Thing ( OPE ) ( ) )` is similar to the axiom `InverseFunctionalObjectProperty( OPE )`, the main differences being that the former axiom is applicable only to individuals that are explicitly named in an ontology, while the latter axiom is also applicable to anonymous individuals and individuals whose existence is implied by existential quantification.

(<https://www.w3.org/TR/owl2-syntax/#Keys>)

**\_\_slots\_\_** = ('\_class\_expression', '\_property\_expressions')

**get\_class\_expression** () → owlapy.class\_expression.OWLClassExpression

**get\_property\_expressions** () → List[owlapy.owl\_property.OWLPropertyExpression]

**operands** () → Iterable[owlapy.owl\_property.OWLPropertyExpression]

Gets the operands - e.g., the individuals in a sameAs axiom, or the classes in an equivalent classes axiom.

#### Returns

The operands.

**\_\_eq\_\_** (other)

Return self==value.

**\_\_hash\_\_** ()

Return hash(self).

**\_\_repr\_\_** ()

Return repr(self).

```
class owlapy.owl_axiom.OWLNaryAxiom (annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *Generic[\_C]*, *OWLAxiom*

Represents an axiom that contains two or more operands that could also be represented with multiple pairwise axioms.

#### Parameters

**\_C** – Class of contained objects.

```

__slots__ = ()

abstract as_pairwise_axioms () → Iterable[OWLNaryAxiom[_C]]

class owlapy.owl_axiom.OWLNaryClassAxiom (
    class_expressions: List[owlapy.class_expression.OWLClassExpression],
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLClassAxiom, OWLNaryAxiom[owlapy.class_expression.OWLClassExpression]

    Represents an axiom that contains two or more operands that could also be represented with multiple pairwise
    axioms.

    __slots__ = '_class_expressions'

    class_expressions () → Iterable[owlapy.class_expression.OWLClassExpression]
        Gets all of the top level class expressions that appear in this axiom.

        Returns
            Sorted stream of class expressions that appear in the axiom.

    as_pairwise_axioms () → Iterable[OWLNaryClassAxiom]
        Gets this axiom as a set of pairwise axioms; if the axiom contains only two operands, the axiom itself is
        returned unchanged, including its annotations.

        Returns
            This axiom as a set of pairwise axioms.

    __eq__ (other)
        Return self==value.

    __hash__ ()
        Return hash(self).

    __repr__ ()
        Return repr(self).

class owlapy.owl_axiom.OWLEquivalentClassesAxiom (
    class_expressions: List[owlapy.class_expression.OWLClassExpression],
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLNaryClassAxiom

    An equivalent classes axiom EquivalentClasses( CE1 ... CEn ) states that all of the class expressions CEi, 1 ≤ i ≤
    n, are semantically equivalent to each other. This axiom allows one to use each CEi as a synonym for each CEj —
    that is, in any expression in the ontology containing such an axiom, CEi can be replaced with CEj without affecting
    the meaning of the ontology.

    (https://www.w3.org/TR/owl2-syntax/#Equivalent\_Classes)

    __slots__ = ()

    contains_named_equivalent_class () → bool

    contains_owl_nothing () → bool

    contains_owl_thing () → bool

    named_classes () → Iterable[owlapy.class_expression.OWLClass]

```

```
class owlapy.owl_axiom.OWLDisjointClassesAxiom(
    class_expressions: List[owlapy.class_expression.OWLClassExpression],
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLNaryClassAxiom*

A disjoint classes axiom `DisjointClasses( CE1 ... CEn )` states that all of the class expressions  $CE_i$ ,  $1 \leq i \leq n$ , are pairwise disjoint; that is, no individual can be at the same time an instance of both  $CE_i$  and  $CE_j$  for  $i \neq j$ .

([https://www.w3.org/TR/owl2-syntax/#Disjoint\\_Classes](https://www.w3.org/TR/owl2-syntax/#Disjoint_Classes))

```
__slots__ = ()
```

```
class owlapy.owl_axiom.OWLNaryIndividualAxiom(
    individuals: List[owlapy.owl_individual.OWLIndividual],
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLIndividualAxiom*, *OWLNaryAxiom*[*owlapy.owl\_individual.OWLIndividual*]

Represents an axiom that contains two or more operands that could also be represented with multiple pairwise individual axioms.

```
__slots__ = '_individuals'
```

```
individuals() → Iterable[owlapy.owl_individual.OWLIndividual]
```

Get the individuals.

#### Returns

Generator containing the individuals.

```
as_pairwise_axioms() → Iterable[OWLNaryIndividualAxiom]
```

```
__eq__(other)
```

Return `self==value`.

```
__hash__()
```

Return `hash(self)`.

```
__repr__()
```

Return `repr(self)`.

```
class owlapy.owl_axiom.OWLDifferentIndividualsAxiom(
    individuals: List[owlapy.owl_individual.OWLIndividual],
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLNaryIndividualAxiom*

An individual inequality axiom `DifferentIndividuals( a1 ... an )` states that all of the individuals  $ai$ ,  $1 \leq i \leq n$ , are different from each other; that is, no individuals  $ai$  and  $aj$  with  $i \neq j$  can be derived to be equal. This axiom can be used to axiomatize the unique name assumption — the assumption that all different individual names denote different individuals. ([https://www.w3.org/TR/owl2-syntax/#Individual\\_Inequality](https://www.w3.org/TR/owl2-syntax/#Individual_Inequality))

```
__slots__ = ()
```

```
class owlapy.owl_axiom.OWLSameIndividualAxiom(
    individuals: List[owlapy.owl_individual.OWLIndividual],
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLNaryIndividualAxiom*

An individual equality axiom `SameIndividual( a1 ... an )` states that all of the individuals  $ai$ ,  $1 \leq i \leq n$ , are equal to each other. This axiom allows one to use each  $ai$  as a synonym for each  $aj$  — that is, in any expression in the ontology containing such an axiom,  $ai$  can be replaced with  $aj$  without affecting the meaning of the ontology.

([https://www.w3.org/TR/owl2-syntax/#Individual\\_Equality](https://www.w3.org/TR/owl2-syntax/#Individual_Equality))

```

__slots__ = ()

class owlapy.owl_axiom.OWLNaryPropertyAxiom (properties: List[_P],
        annotations: Iterable[OWLAnnotation] | None = None)
    Bases: Generic[_P], OWLPropertyAxiom, OWLNaryAxiom[_P]

    Represents an axiom that contains two or more operands that could also be represented with multiple pairwise
    property axioms.

    __slots__ = '_properties'

    properties () → Iterable[_P]
        Get all the properties that appear in the axiom.

        Returns
            Generator containing the properties.

    as_pairwise_axioms () → Iterable[OWLNaryPropertyAxiom]

    __eq__ (other)
        Return self==value.

    __hash__ ()
        Return hash(self).

    __repr__ ()
        Return repr(self).

class owlapy.owl_axiom.OWLEquivalentObjectPropertiesAxiom (
    properties: List[owlapy.owl_property.OWLObjectPropertyExpression],
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLNaryPropertyAxiom[owlapy.owl_property.OWLObjectPropertyExpression],
    OWLObjectPropertyAxiom

    An equivalent object properties axiom EquivalentObjectProperties( OPE1 ... OPEn ) states that all of the object
    property expressions OPEi, 1 ≤ i ≤ n, are semantically equivalent to each other. This axiom allows one to use each
    OPEi as a synonym for each OPEj — that is, in any expression in the ontology containing such an axiom, OPEi
    can be replaced with OPEj without affecting the meaning of the ontology.

    (https://www.w3.org/TR/owl2-syntax/#Equivalent\_Object\_Properties)

    __slots__ = ()

class owlapy.owl_axiom.OWLDisjointObjectPropertiesAxiom (
    properties: List[owlapy.owl_property.OWLObjectPropertyExpression],
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLNaryPropertyAxiom[owlapy.owl_property.OWLObjectPropertyExpression],
    OWLObjectPropertyAxiom

    A disjoint object properties axiom DisjointObjectProperties( OPE1 ... OPEn ) states that all of the object property
    expressions OPEi, 1 ≤ i ≤ n, are pairwise disjoint; that is, no individual x can be connected to an individual y by
    both OPEi and OPEj for i ≠ j.

    (https://www.w3.org/TR/owl2-syntax/#Disjoint\_Object\_Properties)

    __slots__ = ()

class owlapy.owl_axiom.OWLInverseObjectPropertiesAxiom (
    first: owlapy.owl_property.OWLObjectPropertyExpression,
    second: owlapy.owl_property.OWLObjectPropertyExpression,
    annotations: Iterable[OWLAnnotation] | None = None)

```

Bases: *OWLNaryPropertyAxiom*[*owlapy.owl\_property.OWLObjectPropertyExpression*],  
*OWLObjectPropertyAxiom*

An inverse object properties axiom *InverseObjectProperties*( OPE1 OPE2 ) states that the object property expression OPE1 is an inverse of the object property expression OPE2. Thus, if an individual x is connected by OPE1 to an individual y, then y is also connected by OPE2 to x, and vice versa.

([https://www.w3.org/TR/owl2-syntax/#Inverse\\_Object\\_Properties\\_2](https://www.w3.org/TR/owl2-syntax/#Inverse_Object_Properties_2))

```
__slots__ = ('_first', '_second')
```

```
get_first_property() → owlapy.owl_property.OWLObjectPropertyExpression
```

```
get_second_property() → owlapy.owl_property.OWLObjectPropertyExpression
```

```
__repr__()
```

Return repr(self).

```
class owlapy.owl_axiom.OWLEquivalentDataPropertiesAxiom(
    properties: List[owlapy.owl_property.OWLDataPropertyExpression],
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLNaryPropertyAxiom*[*owlapy.owl\_property.OWLDataPropertyExpression*],  
*OWLDataPropertyAxiom*

An equivalent data properties axiom *EquivalentDataProperties*( DPE1 ... DPE<sub>n</sub> ) states that all the data property expressions DPE<sub>i</sub>, 1 ≤ i ≤ n, are semantically equivalent to each other. This axiom allows one to use each DPE<sub>i</sub> as a synonym for each DPE<sub>j</sub> — that is, in any expression in the ontology containing such an axiom, DPE<sub>i</sub> can be replaced with DPE<sub>j</sub> without affecting the meaning of the ontology.

([https://www.w3.org/TR/owl2-syntax/#Equivalent\\_Data\\_Properties](https://www.w3.org/TR/owl2-syntax/#Equivalent_Data_Properties))

```
__slots__ = ()
```

```
class owlapy.owl_axiom.OWLDisjointDataPropertiesAxiom(
    properties: List[owlapy.owl_property.OWLDataPropertyExpression],
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLNaryPropertyAxiom*[*owlapy.owl\_property.OWLDataPropertyExpression*],  
*OWLDataPropertyAxiom*

A disjoint data properties axiom *DisjointDataProperties*( DPE1 ... DPE<sub>n</sub> ) states that all of the data property expressions DPE<sub>i</sub>, 1 ≤ i ≤ n, are pairwise disjoint; that is, no individual x can be connected to a literal y by both

DPE<sub>i</sub> and DPE<sub>j</sub> for i ≠ j.

([https://www.w3.org/TR/owl2-syntax/#Disjoint\\_Data\\_Properties](https://www.w3.org/TR/owl2-syntax/#Disjoint_Data_Properties))

```
__slots__ = ()
```

```
class owlapy.owl_axiom.OWLSubClassOfAxiom(
    sub_class: owlapy.class_expression.OWLClassExpression,
    super_class: owlapy.class_expression.OWLClassExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLClassAxiom*

A subclass axiom *SubClassOf*( CE1 CE2 ) states that the class expression CE1 is a subclass of the class expression CE2. Roughly speaking, this states that CE1 is more specific than CE2. Subclass axioms are a fundamental type of axioms in OWL 2 and can be used to construct a class hierarchy. Other kinds of class expression axiom can be seen as syntactic shortcuts for one or more subclass axioms.

([https://www.w3.org/TR/owl2-syntax/#Subclass\\_Axioms](https://www.w3.org/TR/owl2-syntax/#Subclass_Axioms))

```

__slots__ = ('_sub_class', '_super_class')

get_sub_class() → owlapy.class_expression.OWLClassExpression

get_super_class() → owlapy.class_expression.OWLClassExpression

__eq__(other)
    Return self==value.

__hash__()
    Return hash(self).

__repr__()
    Return repr(self).

class owlapy.owl_axiom.OWLDisjointUnionAxiom(cls_: owlapy.class_expression.OWLClass,
        class_expressions: List[owlapy.class_expression.OWLClassExpression],
        annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLClassAxiom

    A disjoint union axiom DisjointUnion( C CE1 ... CEn ) states that a class C is a disjoint union of the class expressions CEi, 1 ≤ i ≤ n, all of which are pairwise disjoint. Such axioms are sometimes referred to as covering axioms, as they state that the extensions of all CEi exactly cover the extension of C. Thus, each instance of C is an instance of exactly one CEi, and each instance of CEi is an instance of C.

    (https://www.w3.org/TR/owl2-syntax/#Disjoint\_Union\_of\_Class\_Expressions)

__slots__ = ('_cls', '_class_expressions')

get_owl_class() → owlapy.class_expression.OWLClass

get_class_expressions() → Iterable[owlapy.class_expression.OWLClassExpression]

get_owl_equivalent_classes_axiom() → OWLEquivalentClassesAxiom

get_owl_disjoint_classes_axiom() → OWLDisjointClassesAxiom

__eq__(other)
    Return self==value.

__hash__()
    Return hash(self).

__repr__()
    Return repr(self).

class owlapy.owl_axiom.OWLClassAssertionAxiom(
    individual: owlapy.owl_individual.OWLIndividual,
    class_expression: owlapy.class_expression.OWLClassExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLIndividualAxiom

    A class assertion ClassAssertion( CE a ) states that the individual a is an instance of the class expression CE.

    (https://www.w3.org/TR/owl2-syntax/#Class\_Assertions)

__slots__ = ('_individual', '_class_expression')

get_individual() → owlapy.owl_individual.OWLIndividual

```



```

get_class_expression () → owlapy.class_expression.OWLClassExpression

__eq__ (other)
    Return self==value.

__hash__ ()
    Return hash(self).

__repr__ ()
    Return repr(self).

class owlapy.owl_axiom.OWLAnnotationProperty (iri: owlapy.iri.IRI | str)
    Bases: owlapy.owl_property.OWLProperty
    Represents an AnnotationProperty in the OWL 2 specification.

    property iri: owlapy.iri.IRI
        Gets the IRI of this object.

        Returns
            The IRI of this object.

    property str: str
        Gets the string representation of this object

        Returns
            The IRI as string

    __slots__ = '_iri'

class owlapy.owl_axiom.OWLAnnotation (property: OWLAnnotationProperty,
    value: owlapy.owl_annotation.OWLAnnotationValue)
    Bases: owlapy.owl_object.OWLObject

    Annotations are used in the various types of annotation axioms, which bind annotations to their subjects (i.e. axioms
    or declarations).

    __slots__ = ('_property', '_value')

    get_property () → OWLAnnotationProperty
        Gets the property that this annotation acts along.

        Returns
            The annotation property.

    get_value () → owlapy.owl_annotation.OWLAnnotationValue
        Gets the annotation value. The type of value will depend upon the type of the annotation e.g. whether the
        annotation is an OWLLiteral, an IRI or an OWLAnonymousIndividual.

        Returns
            The annotation value.

    __eq__ (other)
        Return self==value.

    __hash__ ()
        Return hash(self).

    __repr__ ()
        Return repr(self).

```

```

class owlapy.owl_axiom.OWLAnnotationAxiom(
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLAxiom
    A super interface for annotation axioms.
    __slots__ = ()
    is_annotation_axiom() → bool

class owlapy.owl_axiom.OWLAnnotationAssertionAxiom(
    subject: owlapy.owl_annotation.OWLAnnotationSubject, annotation: OWLAnnotation)
    Bases: OWLAnnotationAxiom
    An annotation assertion AnnotationAssertion( AP as av ) states that the annotation subject as — an IRI or an
    anonymous individual — is annotated with the annotation property AP and the annotation value av.
    (https://www.w3.org/TR/owl2-syntax/#Annotation\_Assertion)
    __slots__ = ('_subject', '_annotation')
    get_subject() → owlapy.owl_annotation.OWLAnnotationSubject
        Gets the subject of this object.
        Returns
            The subject.
    get_property() → OWLAnnotationProperty
        Gets the property.
        Returns
            The property.
    get_value() → owlapy.owl_annotation.OWLAnnotationValue
        Gets the annotation value. This is either an IRI, an OWLAnonymousIndividual or an OWLLiteral.
        Returns
            The annotation value.
    __eq__(other)
        Return self==value.
    __hash__()
        Return hash(self).
    __repr__()
        Return repr(self).

class owlapy.owl_axiom.OWLSubAnnotationPropertyOfAxiom(
    sub_property: OWLAnnotationProperty, super_property: OWLAnnotationProperty,
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLAnnotationAxiom
    An annotation subproperty axiom SubAnnotationPropertyOf( AP1 AP2 ) states that the annotation property AP1
    is a subproperty of the annotation property AP2.
    (https://www.w3.org/TR/owl2-syntax/#Annotation\_Subproperties)
    __slots__ = ('_sub_property', '_super_property')
    get_sub_property() → OWLAnnotationProperty

```

**get\_super\_property** () → *OWLAnnotationProperty*

**\_\_eq\_\_** (other)

Return self==value.

**\_\_hash\_\_** ()

Return hash(self).

**\_\_repr\_\_** ()

Return repr(self).

```
class owlapy.owl_axiom.OWLAnnotationPropertyDomainAxiom(  
    property_: OWLAnnotationProperty, domain: owlapy.iri.IRI,  
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLAnnotationAxiom*

An annotation property domain axiom *AnnotationPropertyDomain*( AP U ) states that the domain of the annotation property AP is the IRI U.

([https://www.w3.org/TR/owl2-syntax/#Annotation\\_Property\\_Domain](https://www.w3.org/TR/owl2-syntax/#Annotation_Property_Domain))

**\_\_slots\_\_** = ('\_property', '\_domain')

**get\_property** () → *OWLAnnotationProperty*

**get\_domain** () → *owlapy.iri.IRI*

**\_\_eq\_\_** (other)

Return self==value.

**\_\_hash\_\_** ()

Return hash(self).

**\_\_repr\_\_** ()

Return repr(self).

```
class owlapy.owl_axiom.OWLAnnotationPropertyRangeAxiom(  
    property_: OWLAnnotationProperty, range_: owlapy.iri.IRI,  
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLAnnotationAxiom*

An annotation property range axiom *AnnotationPropertyRange*( AP U ) states that the range of the annotation property AP is the IRI U.

([https://www.w3.org/TR/owl2-syntax/#Annotation\\_Property\\_Range](https://www.w3.org/TR/owl2-syntax/#Annotation_Property_Range))

**\_\_slots\_\_** = ('\_property', '\_range')

**get\_property** () → *OWLAnnotationProperty*

**get\_range** () → *owlapy.iri.IRI*

**\_\_eq\_\_** (other)

Return self==value.

**\_\_hash\_\_** ()

Return hash(self).

**\_\_repr\_\_** ()

Return repr(self).

```

class owlapy.owl_axiom.OWLSubPropertyAxiom (sub_property: _P, super_property: _P,
      annotations: Iterable[OWLAnnotation] | None = None)
    Bases: Generic[_P], OWLPropertyAxiom
    Base interface for object and data sub-property axioms.

    __slots__ = ('_sub_property', '_super_property')

    get_sub_property() → _P

    get_super_property() → _P

    __eq__(other)
        Return self==value.

    __hash__()
        Return hash(self).

    __repr__()
        Return repr(self).

class owlapy.owl_axiom.OWLSubObjectPropertyOfAxiom (
    sub_property: owlapy.owl_property.OWLObjectPropertyExpression,
    super_property: owlapy.owl_property.OWLObjectPropertyExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLSubPropertyAxiom[owlapy.owl_property.OWLObjectPropertyExpression],
            OWLObjectPropertyAxiom

    Object subproperty axioms are analogous to subclass axioms, and they come in two forms. The basic form is
    SubObjectPropertyOf( OPE1 OPE2 ). This axiom states that the object property expression OPE1 is a subproperty
    of the object property expression OPE2 — that is, if an individual x is connected by OPE1 to an individual y, then
    x is also connected by OPE2 to y. The more complex form is SubObjectPropertyOf( ObjectPropertyChain( OPE1
    ... OPEn ) OPE ) but ObjectPropertyChain is not represented in owlapy yet.

    (https://www.w3.org/TR/owl2-syntax/#Object\_Subproperties)

    __slots__ = ()

class owlapy.owl_axiom.OWLSubDataPropertyOfAxiom (
    sub_property: owlapy.owl_property.OWLDataPropertyExpression,
    super_property: owlapy.owl_property.OWLDataPropertyExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLSubPropertyAxiom[owlapy.owl_property.OWLDataPropertyExpression],
            OWLDataPropertyAxiom

    A data subproperty axiom SubDataPropertyOf( DPE1 DPE2 ) states that the data property expression DPE1 is a
    subproperty of the data property expression DPE2 — that is, if an individual x is connected by DPE1 to a literal y,
    then x is connected by DPE2 to y as well.

    (https://www.w3.org/TR/owl2-syntax/#Data\_Subproperties)

    __slots__ = ()

class owlapy.owl_axiom.OWLPropertyAssertionAxiom (
    subject: owlapy.owl_individual.OWLIndividual, property_: _P, object_: _C,
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: Generic[_P, _C], OWLIndividualAxiom

    Base class for Property Assertion axioms.

```

```

__slots__ = ('_subject', '_property', '_object')

get_subject() → owlapy.owl_individual.OWLIndividual

get_property() → _P

get_object() → _C

__eq__(other)
    Return self==value.

__hash__()
    Return hash(self).

__repr__()
    Return repr(self).

```

**class** owlapy.owl\_axiom.OWLObjectPropertyAssertionAxiom(  
*subject: owlapy.owl\_individual.OWLIndividual,*  
*property\_: owlapy.owl\_property.OWLObjectPropertyExpression,*  
*object\_: owlapy.owl\_individual.OWLIndividual,*  
*annotations: Iterable[OWLAnnotation] | None = None*)  
Bases: OWLPropertyAssertionAxiom[owlapy.owl\_property.OWLObjectPropertyExpression,  
owlapy.owl\_individual.OWLIndividual]

A positive object property assertion ObjectPropertyAssertion( OPE a1 a2 ) states that the individual a1 is connected by the object property expression OPE to the individual a2.

([https://www.w3.org/TR/owl2-syntax/#Positive\\_Object\\_Property\\_Assertions](https://www.w3.org/TR/owl2-syntax/#Positive_Object_Property_Assertions))

```

__slots__ = ()

```

**class** owlapy.owl\_axiom.OWLNegativeObjectPropertyAssertionAxiom(  
*subject: owlapy.owl\_individual.OWLIndividual,*  
*property\_: owlapy.owl\_property.OWLObjectPropertyExpression,*  
*object\_: owlapy.owl\_individual.OWLIndividual,*  
*annotations: Iterable[OWLAnnotation] | None = None*)  
Bases: OWLPropertyAssertionAxiom[owlapy.owl\_property.OWLObjectPropertyExpression,  
owlapy.owl\_individual.OWLIndividual]

A negative object property assertion NegativeObjectPropertyAssertion( OPE a1 a2 ) states that the individual a1 is not connected by the object property expression OPE to the individual a2.

([https://www.w3.org/TR/owl2-syntax/#Negative\\_Object\\_Property\\_Assertions](https://www.w3.org/TR/owl2-syntax/#Negative_Object_Property_Assertions))

```

__slots__ = ()

```

**class** owlapy.owl\_axiom.OWLDataPropertyAssertionAxiom(  
*subject: owlapy.owl\_individual.OWLIndividual,*  
*property\_: owlapy.owl\_property.OWLDataPropertyExpression,*  
*object\_: owlapy.owl\_literal.OWLLiteral, annotations: Iterable[OWLAnnotation] | None = None*)  
Bases: OWLPropertyAssertionAxiom[owlapy.owl\_property.OWLDataPropertyExpression,  
owlapy.owl\_literal.OWLLiteral]

A positive data property assertion DataPropertyAssertion( DPE a lt ) states that the individual a is connected by the data property expression DPE to the literal lt.

([https://www.w3.org/TR/owl2-syntax/#Positive\\_Data\\_Property\\_Assertions](https://www.w3.org/TR/owl2-syntax/#Positive_Data_Property_Assertions))

```

__slots__ = ()

class owlapy.owl_axiom.OWLNegativeDataPropertyAssertionAxiom(
    subject: owlapy.owl_individual.OWLIndividual,
    property_: owlapy.owl_property.OWLDataPropertyExpression,
    object_: owlapy.owl_literal.OWLLiteral, annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLPropertyAssertionAxiom[owlapy.owl_property.OWLDataPropertyExpression,
    owlapy.owl_literal.OWLLiteral]

    A negative data property assertion NegativeDataPropertyAssertion( DPE a lt ) states that the individual a is not
    connected by the data property expression DPE to the literal lt.

    (https://www.w3.org/TR/owl2-syntax/#Negative\_Data\_Property\_Assertions)

__slots__ = ()

class owlapy.owl_axiom.OWLUnaryPropertyAxiom(property_: _P,
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: Generic[_P], OWLPropertyAxiom

    Base class for Unary property axiom.

__slots__ = '_property'

get_property() → _P

class owlapy.owl_axiom.OWLObjectPropertyCharacteristicAxiom(
    property_: owlapy.owl_property.OWLObjectPropertyExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLUnaryPropertyAxiom[owlapy.owl_property.OWLObjectPropertyExpression],
    OWLObjectPropertyAxiom

    Base interface for functional object property axiom.

__slots__ = ()

__eq__(other)
    Return self==value.

__hash__()
    Return hash(self).

__repr__()
    Return repr(self).

class owlapy.owl_axiom.OWLFunctionalObjectPropertyAxiom(
    property_: owlapy.owl_property.OWLObjectPropertyExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLObjectPropertyCharacteristicAxiom

    An object property functionality axiom FunctionalObjectProperty( OPE ) states that the object property expression
    OPE is functional — that is, for each individual x, there can be at most one distinct individual y such that x is
    connected by OPE to y.

    (https://www.w3.org/TR/owl2-syntax/#Functional\_Object\_Properties)

__slots__ = ()

```

```
class owlapy.owl_axiom.OWLAsymmetricObjectPropertyAxiom (
    property_: owlapy.owl_property.OWLObjectPropertyExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLObjectPropertyCharacteristicAxiom*

An object property asymmetry axiom *AsymmetricObjectProperty*( OPE ) states that the object property expression OPE is asymmetric — that is, if an individual x is connected by OPE to an individual y, then y cannot be connected by OPE to x.

([https://www.w3.org/TR/owl2-syntax/#Symmetric\\_Object\\_Properties](https://www.w3.org/TR/owl2-syntax/#Symmetric_Object_Properties))

```
__slots__ = ()
```

```
class owlapy.owl_axiom.OWLInverseFunctionalObjectPropertyAxiom (
    property_: owlapy.owl_property.OWLObjectPropertyExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLObjectPropertyCharacteristicAxiom*

An object property inverse functionality axiom *InverseFunctionalObjectProperty*( OPE ) states that the object property expression OPE is inverse-functional — that is, for each individual x, there can be at most one individual y such that y is connected by OPE with x.

([https://www.w3.org/TR/owl2-syntax/#Inverse-Functional\\_Object\\_Properties](https://www.w3.org/TR/owl2-syntax/#Inverse-Functional_Object_Properties))

```
__slots__ = ()
```

```
class owlapy.owl_axiom.OWLIrreflexiveObjectPropertyAxiom (
    property_: owlapy.owl_property.OWLObjectPropertyExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLObjectPropertyCharacteristicAxiom*

An object property irreflexivity axiom *IrreflexiveObjectProperty*( OPE ) states that the object property expression OPE is irreflexive — that is, no individual is connected by OPE to itself.

([https://www.w3.org/TR/owl2-syntax/#Irreflexive\\_Object\\_Properties](https://www.w3.org/TR/owl2-syntax/#Irreflexive_Object_Properties))

```
__slots__ = ()
```

```
class owlapy.owl_axiom.OWLReflexiveObjectPropertyAxiom (
    property_: owlapy.owl_property.OWLObjectPropertyExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLObjectPropertyCharacteristicAxiom*

An object property reflexivity axiom *ReflexiveObjectProperty*( OPE ) states that the object property expression OPE is reflexive — that is, each individual is connected by OPE to itself. Each such axiom can be seen as a syntactic shortcut for the following axiom: *SubClassOf*( owl:Thing *ObjectHasSelf*( OPE ) )

([https://www.w3.org/TR/owl2-syntax/#Reflexive\\_Object\\_Properties](https://www.w3.org/TR/owl2-syntax/#Reflexive_Object_Properties))

```
__slots__ = ()
```

```
class owlapy.owl_axiom.OWLSymmetricObjectPropertyAxiom (
    property_: owlapy.owl_property.OWLObjectPropertyExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *OWLObjectPropertyCharacteristicAxiom*

An object property symmetry axiom *SymmetricObjectProperty*( OPE ) states that the object property expression OPE is symmetric — that is, if an individual x is connected by OPE to an individual y, then y is also connected by OPE to x. Each such axiom can be seen as a syntactic shortcut for the following axiom:

```

SubObjectPropertyOf( OPE ObjectInverseOf( OPE ) )

(https://www.w3.org/TR/owl2-syntax/#Symmetric\_Object\_Properties)

__slots__ = ()

class owlapy.owl_axiom.OWLTransitiveObjectPropertyAxiom(
    property_: owlapy.owl_property.OWLObjectPropertyExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
Bases: OWLObjectPropertyCharacteristicAxiom

An object property transitivity axiom TransitiveObjectProperty( OPE ) states that the object property expression OPE is transitive — that is, if an individual x is connected by OPE to an individual y that is connected by OPE to an individual z, then x is also connected by OPE to z. Each such axiom can be seen as a syntactic shortcut for the following axiom: SubObjectPropertyOf( ObjectPropertyChain( OPE OPE ) OPE )

(https://www.w3.org/TR/owl2-syntax/#Transitive\_Object\_Properties)

__slots__ = ()

class owlapy.owl_axiom.OWLDataPropertyCharacteristicAxiom(
    property_: owlapy.owl_property.OWLDataPropertyExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
Bases: OWLUnaryPropertyAxiom[owlapy.owl_property.OWLDataPropertyExpression], OWLDataPropertyAxiom

Base interface for Functional data property axiom.

__slots__ = ()

__eq__(other)
    Return self==value.

__hash__()
    Return hash(self).

__repr__()
    Return repr(self).

class owlapy.owl_axiom.OWLFunctionalDataPropertyAxiom(
    property_: owlapy.owl_property.OWLDataPropertyExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
Bases: OWLDataPropertyCharacteristicAxiom

A data property functionality axiom FunctionalDataProperty( DPE ) states that the data property expression DPE is functional — that is, for each individual x, there can be at most one distinct literal y such that x is connected by DPE with y. Each such axiom can be seen as a syntactic shortcut for the following axiom: SubClassOf( owl:Thing DataMaxCardinality( 1 DPE ) )

(https://www.w3.org/TR/owl2-syntax/#Transitive\_Object\_Properties)

__slots__ = ()

class owlapy.owl_axiom.OWLPropertyDomainAxiom(property_: _P,
    domain: owlapy.class_expression.OWLClassExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
Bases: Generic[_P], OWLUnaryPropertyAxiom[_P]

Base class for Property Domain axioms.

```



```

__slots__ = '_domain'

get_domain() → owlapy.class_expression.OWLClassExpression

__eq__(other)
    Return self==value.

__hash__()
    Return hash(self).

__repr__()
    Return repr(self).

class owlapy.owl_axiom.OWLPropertyRangeAxiom(property_: _P, range_: _R,
        annotations: Iterable[OWLAnnotation] | None = None)
    Bases: Generic[_P, _R], OWLUnaryPropertyAxiom[_P]
    Base class for Property Range axioms.

__slots__ = '_range'

get_range() → _R

__eq__(other)
    Return self==value.

__hash__()
    Return hash(self).

__repr__()
    Return repr(self).

class owlapy.owl_axiom.OWLObjectPropertyDomainAxiom(
    property_: owlapy.owl_property.OWLObjectPropertyExpression,
    domain: owlapy.class_expression.OWLClassExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLPropertyDomainAxiom[owlapy.owl_property.OWLObjectPropertyExpression]

    An object property domain axiom ObjectPropertyDomain( OPE CE ) states that the domain of the object property
    expression OPE is the class expression CE — that is, if an individual x is connected by OPE with some other
    individual, then x is an instance of CE. Each such axiom can be seen as a syntactic shortcut for the following
    axiom: SubClassOf( ObjectSomeValuesFrom( OPE owl:Thing ) CE )

    (https://www.w3.org/TR/owl2-syntax/#Object\_Property\_Domain)

__slots__ = ()

class owlapy.owl_axiom.OWLDataPropertyDomainAxiom(
    property_: owlapy.owl_property.OWLDataPropertyExpression,
    domain: owlapy.class_expression.OWLClassExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLPropertyDomainAxiom[owlapy.owl_property.OWLDataPropertyExpression]

    A data property domain axiom DataPropertyDomain( DPE CE ) states that the domain of the data property ex-
    pression DPE is the class expression CE — that is, if an individual x is connected by DPE with some literal, then
    x is an instance of CE. Each such axiom can be seen as a syntactic shortcut for the following axiom: SubClassOf(
    DataSomeValuesFrom( DPE rdfs:Literal ) CE )

    (https://www.w3.org/TR/owl2-syntax/#Data\_Property\_Domain)

```

```
__slots__ = ()
```

```
class owlapy.owl_axiom.OWLObjectPropertyRangeAxiom(  
    property_: owlapy.owl_property.OWLObjectPropertyExpression,  
    range_: owlapy.class_expression.OWLClassExpression,  
    annotations: Iterable[OWLAnnotation] | None = None)
```

```
Bases: OWLPropertyRangeAxiom[owlapy.owl_property.OWLObjectPropertyExpression,  
owlapy.class_expression.OWLClassExpression]
```

An object property range axiom `ObjectPropertyRange( OPE CE )` states that the range of the object property expression `OPE` is the class expression `CE` — that is, if some individual is connected by `OPE` with an individual `x`, then `x` is an instance of `CE`. Each such axiom can be seen as a syntactic shortcut for the following axiom: `SubClassOf( owl:Thing ObjectAllValuesFrom( OPE CE ) )`

([https://www.w3.org/TR/owl2-syntax/#Object\\_Property\\_Range](https://www.w3.org/TR/owl2-syntax/#Object_Property_Range))

```
__slots__ = ()
```

```
class owlapy.owl_axiom.OWLDataPropertyRangeAxiom(  
    property_: owlapy.owl_property.OWLDataPropertyExpression,  
    range_: owlapy.owl_datatype.OWLDataRange,  
    annotations: Iterable[OWLAnnotation] | None = None)
```

```
Bases: OWLPropertyRangeAxiom[owlapy.owl_property.OWLDataPropertyExpression,  
owlapy.owl_datatype.OWLDataRange]
```

A data property range axiom `DataPropertyRange( DPE DR )` states that the range of the data property expression `DPE` is the data range `DR` — that is, if some individual is connected by `DPE` with a literal `x`, then `x` is in `DR`. The arity of `DR` must be one. Each such axiom can be seen as a syntactic shortcut for the following axiom: `SubClassOf( owl:Thing DataAllValuesFrom( DPE DR ) )`

([https://www.w3.org/TR/owl2-syntax/#Data\\_Property\\_Range](https://www.w3.org/TR/owl2-syntax/#Data_Property_Range))

```
__slots__ = ()
```

## owlapy.owl\_data\_ranges

### OWL Data Ranges

[https://www.w3.org/TR/owl2-syntax/#Data\\_Ranges](https://www.w3.org/TR/owl2-syntax/#Data_Ranges)

`DataRange := Datatype | DataIntersectionOf | DataUnionOf | DataComplementOf | DataOneOf | DatatypeRestriction`

## Module Contents

### Classes

<i>OWLPropertyRange</i>	OWL Objects that can be the ranges of properties.
<i>OWLDataRange</i>	Represents a <code>DataRange</code> in the OWL 2 Specification.
<i>OWLNaryDataRange</i>	<code>OWLNaryDataRange</code> .
<i>OWLDataIntersectionOf</i>	An intersection data range <code>DataIntersectionOf( DR1 ... DRn )</code> contains all tuples of literals that are contained
<i>OWLDataUnionOf</i>	A union data range <code>DataUnionOf( DR1 ... DRn )</code> contains all tuples of literals that are contained in the at least
<i>OWLDataComplementOf</i>	A complement data range <code>DataComplementOf( DR )</code> contains all tuples of literals that are not contained in the

```

class owlapy.owl_data_ranges.OWLPropertyRange
    Bases: owlapy.owl_object.OWLObject
    OWL Objects that can be the ranges of properties.

class owlapy.owl_data_ranges.OWLDataRange
    Bases: OWLPropertyRange
    Represents a DataRange in the OWL 2 Specification.

class owlapy.owl_data_ranges.OWLNaryDataRange (operands: Iterable[OWLDataRange])
    Bases: OWLDataRange, owlapy.meta_classes.HasOperands[OWLDataRange]
    OWLNaryDataRange.
    __slots__ = ()
    operands () → Iterable[OWLDataRange]
        Gets the operands - e.g., the individuals in a sameAs axiom, or the classes in an equivalent classes axiom.
        Returns
            The operands.
    __repr__ ()
        Return repr(self).
    __eq__ (other)
        Return self==value.
    __hash__ ()
        Return hash(self).

class owlapy.owl_data_ranges.OWLDataIntersectionOf (
    operands: Iterable[OWLDataRange])
    Bases: OWLNaryDataRange
    An intersection data range DataIntersectionOf( DR1 ... DRn ) contains all tuples of literals that are contained in
    each data range DRi for  $1 \leq i \leq n$ . All data ranges DRi must be of the same arity, and the resulting data range is
    of that arity as well.
    (https://www.w3.org/TR/owl2-syntax/#Intersection\_of\_Data\_Ranges)
    __slots__ = '_operands'
    type_index: Final = 4004

class owlapy.owl_data_ranges.OWLDataUnionOf (operands: Iterable[OWLDataRange])
    Bases: OWLNaryDataRange
    A union data range DataUnionOf( DR1 ... DRn ) contains all tuples of literals that are contained in the at least one
    data range DRi for  $1 \leq i \leq n$ . All data ranges DRi must be of the same arity, and the resulting data range is of that
    arity as well.
    (https://www.w3.org/TR/owl2-syntax/#Union\_of\_Data\_Ranges)
    __slots__ = '_operands'
    type_index: Final = 4005

```

**class** owlapy.owl\_data\_ranges.OWLDataComplementOf (*data\_range: OWLDataRange*)

Bases: *OWLDataRange*

A complement data range DataComplementOf( DR ) contains all tuples of literals that are not contained in the data range DR. The resulting data range has the arity equal to the arity of DR.

([https://www.w3.org/TR/owl2-syntax/#Complement\\_of\\_Data\\_Ranges](https://www.w3.org/TR/owl2-syntax/#Complement_of_Data_Ranges))

**type\_index:** Final = 4002

**get\_data\_range** () → *OWLDataRange*

**Returns**

The wrapped data range.

**\_\_repr\_\_** ()

Return repr(self).

**\_\_eq\_\_** (*other*)

Return self==value.

**\_\_hash\_\_** ()

Return hash(self).

owlapy.owl\_datatype

OWL Datatype

## Module Contents

### Classes

---

*OWLDatatype*

Datatypes are entities that refer to sets of data values.  
Thus, datatypes are analogous to classes,

---

**class** owlapy.owl\_datatype.OWLDatatype (*iri: owlapy.iri.IRI | owlapy.meta\_classes.HasIRI*)

Bases: *owlapy.owl\_object.OWLEntity*, *owlapy.owl\_data\_ranges.OWLDataRange*

Datatypes are entities that refer to sets of data values. Thus, datatypes are analogous to classes, the main difference being that the former contain data values such as strings and numbers, rather than individuals. Datatypes are a kind of data range, which allows them to be used in restrictions. Each data range is associated with an arity; for datatypes, the arity is always one. The built-in datatype `rdfs:Literal` denotes any set of data values that contains the union of the value spaces of all datatypes.

(<https://www.w3.org/TR/owl2-syntax/#Datatypes>)

**property iri:** *owlapy.iri.IRI*

Gets the IRI of this object.

**Returns**

The IRI of this object.

```

property str: str
    Gets the string representation of this object

    Returns
        The IRI as string

__slots__ = '_iri'

type_index: Final = 4001

```

## owlapy.owl\_hierarchy

Classes representing hierarchy in OWL.

## Module Contents

### Classes

<i>AbstractHierarchy</i>	Representation of an abstract hierarchy which can be used for classes or properties.
<i>ClassHierarchy</i>	Representation of a class hierarchy.
<i>ObjectPropertyHierarchy</i>	Representation of an objet property hierarchy.
<i>DatatypePropertyHierarchy</i>	Representation of a data property hierarchy.

```

class owlapy.owl_hierarchy.AbstractHierarchy (factory: Type[_S],
        hierarchy_down: Iterable[Tuple[_S, Iterable[_S]]])

```

```

class owlapy.owl_hierarchy.AbstractHierarchy (factory: Type[_S],
        reasoner: owlapy.owl_reasoner.OWLReasoner)

```

Bases: Generic[\_S]

Representation of an abstract hierarchy which can be used for classes or properties.

#### Parameters

- **hierarchy\_down** – A downwards hierarchy given as a mapping of Entities to sub-entities.
- **reasoner** – Alternatively, a reasoner whose root\_ontology is queried for entities.

```

__slots__ = ('_Type', '_ent_set', '_parents_map', '_parents_map_trans',
        '_children_map', ...)

```

```

abstract classmethod get_top_entity() → _S

```

The most general entity in this hierarchy, which contains all the entities.

```

abstract classmethod get_bottom_entity() → _S

```

The most specific entity in this hierarchy, which contains none of the entities.

```

static restrict (hierarchy: _U, *, remove: Iterable[_S] = None, allow: Iterable[_S] = None) → _U

```

Restrict a given hierarchy to a set of allowed/removed entities.

#### Parameters

- **hierarchy** – An existing Entity hierarchy to restrict.
- **remove** – Set of entities which should be ignored.

- **allow** – Set of entities which should be used.

#### Returns

The restricted hierarchy.

**restrict\_and\_copy** (\*, remove: Iterable[\_S] = None, allow: Iterable[\_S] = None) → \_U

Restrict this hierarchy.

See restrict for more info.

**parents** (entity: \_S, direct: bool = True) → Iterable[\_S]

Parents of an entity.

#### Parameters

- **entity** – Entity for which to query parent entities.
- **direct** – False to return transitive parents.

#### Returns

Super-entities.

**is\_parent\_of** (a: \_S, b: \_S) → bool

if A is a parent of B.

---

**Note:** A is always a parent of A.

---

**is\_child\_of** (a: \_S, b: \_S) → bool

If A is a child of B.

---

**Note:** A is always a child of A.

---

**children** (entity: \_S, direct: bool = True) → Iterable[\_S]

Children of an entity.

#### Parameters

- **entity** – Entity for which to query child entities.
- **direct** – False to return transitive children.

#### Returns

Sub-entities.

**siblings** (entity: \_S) → Iterable[\_S]

**items** () → Iterable[\_S]

**roots** (of: \_S | None = None) → Iterable[\_S]

**leaves** (of: \_S | None = None) → Iterable[\_S]

**\_\_contains\_\_** (item: \_S) → bool

**\_\_len\_\_** ()

```
class owlapy.owl_hierarchy.ClassHierarchy (
    hierarchy_down: Iterable[Tuple[owlapy.class_expression.OWLClass, Iterable[owlapy.class_expression.OWLClass]])
```

```
class owlapy.owl_hierarchy.ClassHierarchy (reasoner: owlapy.owl_reasoner.OWLReasoner)
    Bases: AbstractHierarchy[owlapy.class_expression.OWLClass]
```

Representation of a class hierarchy.

#### Parameters

- **hierarchy\_down** – A downwards hierarchy given as a mapping of Class to sub-classes.
- **reasoner** – Alternatively, a reasoner whose root\_ontology is queried for classes and sub-classes.

```
classmethod get_top_entity () → owlapy.class_expression.OWLClass
```

The most general entity in this hierarchy, which contains all the entities.

```
classmethod get_bottom_entity () → owlapy.class_expression.OWLClass
```

The most specific entity in this hierarchy, which contains none of the entities.

```
sub_classes (entity: owlapy.class_expression.OWLClass, direct: bool = True)
    → Iterable[owlapy.class_expression.OWLClass]
```

```
super_classes (entity: owlapy.class_expression.OWLClass, direct: bool = True)
    → Iterable[owlapy.class_expression.OWLClass]
```

```
is_subclass_of (subclass: owlapy.class_expression.OWLClass,
    superclass: owlapy.class_expression.OWLClass) → bool
```

```
class owlapy.owl_hierarchy.ObjectPropertyHierarchy (
    hierarchy_down: Iterable[Tuple[owlapy.owl_property.OWLObjectProperty, Iterable[owlapy.owl_property.OWLObjectProperty]
```

```
class owlapy.owl_hierarchy.ObjectPropertyHierarchy (
    reasoner: owlapy.owl_reasoner.OWLReasoner)
```

```
Bases: AbstractHierarchy[owlapy.owl_property.OWLObjectProperty]
```

Representation of an object property hierarchy.

```
classmethod get_top_entity () → owlapy.owl_property.OWLObjectProperty
```

The most general entity in this hierarchy, which contains all the entities.

```
classmethod get_bottom_entity () → owlapy.owl_property.OWLObjectProperty
```

The most specific entity in this hierarchy, which contains none of the entities.

```
sub_object_properties (entity: owlapy.owl_property.OWLObjectProperty, direct: bool = True)
    → Iterable[owlapy.owl_property.OWLObjectProperty]
```

```
super_object_properties (entity: owlapy.owl_property.OWLObjectProperty, direct: bool = True)
    → Iterable[owlapy.owl_property.OWLObjectProperty]
```

```
more_general_roles (role: owlapy.owl_property.OWLObjectProperty, direct: bool = True)
    → Iterable[owlapy.owl_property.OWLObjectProperty]
```

```
more_special_roles (role: owlapy.owl_property.OWLObjectProperty, direct: bool = True)
    → Iterable[owlapy.owl_property.OWLObjectProperty]
```

```
is_sub_property_of (sub_property: owlapy.owl_property.OWLObjectProperty,
    super_property: owlapy.owl_property.OWLObjectProperty) → bool
```

```
most_general_roles () → Iterable[owlapy.owl_property.OWLObjectProperty]
```

```

most_special_roles () → Iterable[owlapy.owl_property.OWLObjectProperty]

class owlapy.owl_hierarchy.DatatypePropertyHierarchy (
    hierarchy_down: Iterable[Tuple[owlapy.owl_property.OWLDataProperty, Iterable[owlapy.owl_property.OWLDataProperty]]]

class owlapy.owl_hierarchy.DatatypePropertyHierarchy (
    reasoner: owlapy.owl_reasoner.OWLReasoner)
    Bases: AbstractHierarchy[owlapy.owl_property.OWLDataProperty]
    Representation of a data property hierarchy.

    classmethod get_top_entity () → owlapy.owl_property.OWLDataProperty
        The most general entity in this hierarchy, which contains all the entities.

    classmethod get_bottom_entity () → owlapy.owl_property.OWLDataProperty
        The most specific entity in this hierarchy, which contains none of the entities.

    sub_data_properties (entity: owlapy.owl_property.OWLDataProperty, direct: bool = True)

    super_data_properties (entity: owlapy.owl_property.OWLDataProperty, direct: bool = True)

    more_general_roles (role: owlapy.owl_property.OWLDataProperty, direct: bool = True)
        → Iterable[owlapy.owl_property.OWLDataProperty]

    more_special_roles (role: owlapy.owl_property.OWLDataProperty, direct: bool = True)
        → Iterable[owlapy.owl_property.OWLDataProperty]

    is_sub_property_of (sub_property: owlapy.owl_property.OWLDataProperty,
        super_property: owlapy.owl_property.OWLDataProperty) → bool

    most_general_roles () → Iterable[owlapy.owl_property.OWLDataProperty]

    most_special_roles () → Iterable[owlapy.owl_property.OWLDataProperty]

```

## owlapy.owl\_individual

OWL Individuals

## Module Contents

### Classes

<i>OWLIndividual</i>	Represents a named or anonymous individual.
<i>OWLNamedIndividual</i>	Named individuals are identified using an IRI. Since they are given an IRI, named individuals are entities.

```

class owlapy.owl_individual.OWLIndividual
    Bases: owlapy.owl_object.OWLObject
    Represents a named or anonymous individual.

    __slots__ = ()

```



**class** owlapy.owl\_individual.OWLNamedIndividual (*iri: owlapy.iri.IRI | str*)

Bases: *OWLIndividual, owlapy.owl\_object.OWLEntity*

Named individuals are identified using an IRI. Since they are given an IRI, named individuals are entities. IRIs from the reserved vocabulary must not be used to identify named individuals in an OWL 2 DL ontology.

([https://www.w3.org/TR/owl2-syntax/#Named\\_Individuals](https://www.w3.org/TR/owl2-syntax/#Named_Individuals))

**property iri:** *owlapy.iri.IRI*

Gets the IRI of this object.

**Returns**

The IRI of this object.

**property str**

Gets the string representation of this object

**Returns**

The IRI as string

**\_\_slots\_\_** = *'\_iri'*

**type\_index:** *Final* = 1005

**owlapy.owl\_literal**

OWL Literals

## Module Contents

### Classes

<i>OWLLiteral</i>	Literals represent data values such as particular strings or integers. They are analogous to typed RDF
-------------------	--

## Attributes

<i>Literals</i>
<i>OWLTopObjectProperty</i>
<i>OWLBottomObjectProperty</i>
<i>OWLTopDataProperty</i>
<i>OWLBottomDataProperty</i>
<i>DoubleOWLDatatype</i>
<i>IntegerOWLDatatype</i>
<i>BooleanOWLDatatype</i>
<i>StringOWLDatatype</i>
<i>DateOWLDatatype</i>
<i>DateTimeOWLDatatype</i>
<i>DurationOWLDatatype</i>
<i>TopOWLDatatype</i>
<i>NUMERIC_DATATYPES</i>
<i>TIME_DATATYPES</i>

`owlapy.owl_literal.Literals`

**class** `owlapy.owl_literal.OWLLiteral`

Bases: `owlapy.owl_annotation.OWLAnnotationValue`

Literals represent data values such as particular strings or integers. They are analogous to typed RDF literals and can also be understood as individuals denoting data values. Each literal consists of a lexical form, which is a string, and a datatype.

(<https://www.w3.org/TR/owl2-syntax/#Literals>)

**\_\_slots\_\_** = ()

**type\_index**: Final = 4008

**get\_literal**() → str

Gets the lexical value of this literal. Note that the language tag is not included.

### Returns

The lexical value of this literal.

**is\_boolean()** → bool

Whether this literal is typed as boolean.

**parse\_boolean()** → bool

Parses the lexical value of this literal into a bool. The lexical value of this literal should be in the lexical space of the boolean datatype ("<http://www.w3.org/2001/XMLSchema#boolean>").

**Returns**

A bool value that is represented by this literal.

**is\_double()** → bool

Whether this literal is typed as double.

**parse\_double()** → float

Parses the lexical value of this literal into a double. The lexical value of this literal should be in the lexical space of the double datatype ("<http://www.w3.org/2001/XMLSchema#double>").

**Returns**

A double value that is represented by this literal.

**is\_integer()** → bool

Whether this literal is typed as integer.

**parse\_integer()** → int

Parses the lexical value of this literal into an integer. The lexical value of this literal should be in the lexical space of the integer datatype ("<http://www.w3.org/2001/XMLSchema#integer>").

**Returns**

An integer value that is represented by this literal.

**is\_string()** → bool

Whether this literal is typed as string.

**parse\_string()** → str

Parses the lexical value of this literal into a string. The lexical value of this literal should be in the lexical space of the string datatype ("<http://www.w3.org/2001/XMLSchema#string>").

**Returns**

A string value that is represented by this literal.

**is\_date()** → bool

Whether this literal is typed as date.

**parse\_date()** → datetime.date

Parses the lexical value of this literal into a date. The lexical value of this literal should be in the lexical space of the date datatype ("<http://www.w3.org/2001/XMLSchema#date>").

**Returns**

A date value that is represented by this literal.

**is\_datetime()** → bool

Whether this literal is typed as dateTime.

**parse\_datetime()** → datetime.datetime

Parses the lexical value of this literal into a datetime. The lexical value of this literal should be in the lexical space of the dateTime datatype ("<http://www.w3.org/2001/XMLSchema#dateTime>").

**Returns**

A datetime value that is represented by this literal.

**is\_duration** () → bool

Whether this literal is typed as duration.

**parse\_duration** () → pandas.Timedelta

Parses the lexical value of this literal into a Timedelta. The lexical value of this literal should be in the lexical space of the duration datatype ("<http://www.w3.org/2001/XMLSchema#duration>").

**Returns**

A Timedelta value that is represented by this literal.

**is\_literal** () → bool

**Returns**

true if the annotation value is a literal

**as\_literal** () → *OWLLiteral*

**Returns**

if the value is a literal, returns it. Return None otherwise

**to\_python** () → Literals

**abstract get\_datatype** () → *owlapy.owl\_datatype.OWLDatatype*

Gets the OWLDatatype which types this literal.

**Returns**

The OWLDatatype that types this literal.

`owlapy.owl_literal.OWLTopObjectProperty: Final`

`owlapy.owl_literal.OWLBottomObjectProperty: Final`

`owlapy.owl_literal.OWLTopDataProperty: Final`

`owlapy.owl_literal.OWLBottomDataProperty: Final`

`owlapy.owl_literal.DoubleOWLDatatype: Final`

`owlapy.owl_literal.IntegerOWLDatatype: Final`

`owlapy.owl_literal.BooleanOWLDatatype: Final`

`owlapy.owl_literal.StringOWLDatatype: Final`

`owlapy.owl_literal.DateOWLDatatype: Final`

`owlapy.owl_literal.DateTimeOWLDatatype: Final`

`owlapy.owl_literal.DurationOWLDatatype: Final`

`owlapy.owl_literal.TopOWLDatatype: Final`

`owlapy.owl_literal.NUMERIC_DATATYPES:`  
`Final[Set[owlapy.owl_datatype.OWLDatatype]]`

`owlapy.owl_literal.TIME_DATATYPES: Final[Set[owlapy.owl_datatype.OWLDatatype]]`

`owlapy.owl_object`

OWL Base classes

## Module Contents

### Classes

<i>OWLObject</i>	Base interface for OWL objects
<i>OWLObjectRenderer</i>	Abstract class with a render method to render an OWL Object into a string.
<i>OWLObjectParser</i>	Abstract class with a parse method to parse a string to an OWL Object.
<i>OWLNamedObject</i>	Represents a named object for example, class, property, ontology etc. - i.e. anything that has an
<i>OWLEntity</i>	Represents Entities in the OWL 2 Specification.

```
class owlapy.owl_object.OWLObject
```

Base interface for OWL objects

```
__slots__ = ()
```

```
abstract __eq__(other)
```

Return self==value.

```
abstract __hash__()
```

Return hash(self).

```
abstract __repr__()
```

Return repr(self).

```
is_anonymous() → bool
```

```
class owlapy.owl_object.OWLObjectRenderer
```

Abstract class with a render method to render an OWL Object into a string.

```
abstract set_short_form_provider(short_form_provider) → None
```

Configure a short form provider that shortens the OWL objects during rendering.

**Parameters**

**short\_form\_provider** – Short form provider.

```
abstract render(o: OWLObject) → str
```

Render OWL Object to string.

**Parameters**

**o** – OWL Object.

**Returns**

String rendition of OWL object.

```
class owlapy.owl_object.OWLObjectParser
```

Abstract class with a parse method to parse a string to an OWL Object.

**abstract parse\_expression** (*expression\_str: str*) → *OWLObject*

Parse a string to an OWL Object.

**Parameters**

**expression\_str** (*str*) – Expression string.

**Returns**

The OWL Object which is represented by the string.

**class** owlapy.owl\_object.**OWLNamedObject**

Bases: *OWLObject*, *owlapy.meta\_classes.HasIRI*

Represents a named object for example, class, property, ontology etc. - i.e. anything that has an IRI as its name.

**\_\_slots\_\_** = ()

**\_\_eq\_\_** (*other*)

Return self==value.

**\_\_lt\_\_** (*other*)

Return self<value.

**\_\_hash\_\_** ()

Return hash(self).

**\_\_repr\_\_** ()

Return repr(self).

**class** owlapy.owl\_object.**OWLEntity**

Bases: *OWLNamedObject*

Represents Entities in the OWL 2 Specification.

**\_\_slots\_\_** = ()

**to\_string\_id** () → str

**is\_anonymous** () → bool

**owlapy.owl\_ontology**

OWL Ontology

## Module Contents

### Classes

<i>OWLOntologyID</i>	An object that identifies an ontology. Since OWL 2, ontologies do not have to have an ontology IRI, or if they
<i>OWLOntology</i>	Represents an OWL 2 Ontology in the OWL 2 specification.

```
class owlapy.owl_ontology.OWLOntologyID (ontology_iri: owlapy.iri.IRI | None = None,
version_iri: owlapy.iri.IRI | None = None)
```

An object that identifies an ontology. Since OWL 2, ontologies do not have to have an ontology IRI, or if they have an ontology IRI then they can optionally also have a version IRI. Instances of this OWLOntologyID class bundle identifying information of an ontology together. If an ontology doesn't have an ontology IRI then we say that it is "anonymous".

```
__slots__ = ('_ontology_iri', '_version_iri')
```

```
get_ontology_iri () → owlapy.iri.IRI | None
```

Gets the ontology IRI.

#### Returns

Ontology IRI. If the ontology is anonymous, it will return None.

```
get_version_iri () → owlapy.iri.IRI | None
```

Gets the version IRI.

#### Returns

Version IRI or None.

```
get_default_document_iri () → owlapy.iri.IRI | None
```

Gets the IRI which is used as a default for the document that contain a representation of an ontology with this ID. This will be the version IRI if there is an ontology IRI and version IRI, else it will be the ontology IRI if there is an ontology IRI but no version IRI, else it will be None if there is no ontology IRI. See Ontology Documents in the OWL 2 Structural Specification.

#### Returns

the IRI that can be used as a default for an ontology document, or None.

```
is_anonymous () → bool
```

```
__repr__ ()
```

Return repr(self).

```
__eq__ (other)
```

Return self==value.

```
class owlapy.owl_ontology.OWLOntology
```

Bases: *owlapy.owl\_object.OWLObject*

Represents an OWL 2 Ontology in the OWL 2 specification.

An OWLOntology consists of a possibly empty set of OWLAxioms and a possibly empty set of OWLAnnotations. An ontology can have an ontology IRI which can be used to identify the ontology. If it has an ontology IRI then it may also have an ontology version IRI. Since OWL 2, an ontology need not have an ontology IRI. (See the OWL 2 Structural Specification).

An ontology cannot be modified directly. Changes must be applied via its OWLOntologyManager.

```
__slots__ = ()
```

```
type_index: Final = 1
```

```
abstract classes_in_signature () → Iterable[owlapy.class_expression.OWLClass]
```

Gets the classes in the signature of this object.

#### Returns

Classes in the signature of this object.

**abstract data\_properties\_in\_signature ()**  
→ Iterable[*owlapy.owl\_property.OWLDataProperty*]

Get the data properties that are in the signature of this object.

**Returns**

Data properties that are in the signature of this object.

**abstract object\_properties\_in\_signature ()**  
→ Iterable[*owlapy.owl\_property.OWLObjectProperty*]

A convenience method that obtains the object properties that are in the signature of this object.

**Returns**

Object properties that are in the signature of this object.

**abstract individuals\_in\_signature ()**  
→ Iterable[*owlapy.owl\_individual.OWLNamedIndividual*]

A convenience method that obtains the individuals that are in the signature of this object.

**Returns**

Individuals that are in the signature of this object.

**abstract equivalent\_classes\_axioms (c: *owlapy.class\_expression.OWLClass*)**  
→ Iterable[*owlapy.owl\_axiom.OWLEquivalentClassesAxiom*]

Gets all of the equivalent axioms in this ontology that contain the specified class as an operand.

**Parameters**

**c** – The class for which the EquivalentClasses axioms should be retrieved.

**Returns**

EquivalentClasses axioms contained in this ontology.

**abstract general\_class\_axioms ()** → Iterable[*owlapy.owl\_axiom.OWLClassAxiom*]

**Get the general class axioms of this ontology. This includes SubClass axioms with a complex class expression**

as the sub class and EquivalentClass axioms and DisjointClass axioms with only complex class expressions.

**Returns**

General class axioms contained in this ontology.

**abstract data\_property\_domain\_axioms (property: *owlapy.owl\_property.OWLDataProperty*)**  
→ Iterable[*owlapy.owl\_axiom.OWLDataPropertyDomainAxiom*]

Gets the OWLDataPropertyDomainAxiom objects where the property is equal to the specified property.

**Parameters**

**property** – The property which is equal to the property of the retrieved axioms.

**Returns**

The axioms matching the search.

**abstract data\_property\_range\_axioms (property: *owlapy.owl\_property.OWLDataProperty*)**  
→ Iterable[*owlapy.owl\_axiom.OWLDataPropertyRangeAxiom*]

Gets the OWLDataPropertyRangeAxiom objects where the property is equal to the specified property.

**Parameters**

**property** – The property which is equal to the property of the retrieved axioms.

**Returns**

The axioms matching the search.



```
abstract object_property_domain_axioms (
    property: owlapy.owl_property.OWLObjectProperty)
    → Iterable[owlapy.owl_axiom.OWLObjectPropertyDomainAxiom]
```

Gets the OWLObjectPropertyDomainAxiom objects where the property is equal to the specified property.

**Parameters**

**property** – The property which is equal to the property of the retrieved axioms.

**Returns**

The axioms matching the search.

```
abstract object_property_range_axioms (
    property: owlapy.owl_property.OWLObjectProperty)
    → Iterable[owlapy.owl_axiom.OWLObjectPropertyRangeAxiom]
```

Gets the OWLObjectPropertyRangeAxiom objects where the property is equal to the specified property.

**Parameters**

**property** – The property which is equal to the property of the retrieved axioms.

**Returns**

The axioms matching the search.

```
abstract get_owl_ontology_manager () → _M
```

Gets the manager that manages this ontology.

```
abstract get_ontology_id () → OWLOntologyID
```

Gets the OWLOntologyID belonging to this object.

**Returns**

The OWLOntologyID.

```
is_anonymous () → bool
```

Check whether this ontology does contain an IRI or not.

`owlapy.owl_ontology_manager`

## Module Contents

### Classes

<i>OWLOntologyChange</i>	Represents an ontology change.
<i>OWLOntologyManager</i>	An OWLOntologyManager manages a set of ontologies. It is the main point for creating, loading and accessing
<i>OWLImportsDeclaration</i>	Represents an import statement in an ontology.
<i>AddImport</i>	Represents an ontology change where an import statement is added to an ontology.

```
class owlapy.owl_ontology_manager.OWLOntologyChange (
    ontology: owlapy.owl_ontology.OWLOntology)
```

Represents an ontology change.

```
__slots__ = ()
```

**get\_ontology** () → *owlapy.owl\_ontology.OWLOntology*

Gets the ontology that the change is/was applied to.

**Returns**

The ontology that the change is applicable to.

**class** *owlapy.owl\_ontology\_manager.OWLOntologyManager*

An OWLOntologyManager manages a set of ontologies. It is the main point for creating, loading and accessing ontologies.

**abstract create\_ontology** (*iri*: *owlapy.iri.IRI*) → *owlapy.owl\_ontology.OWLOntology*

Creates a new (empty) ontology that has the specified ontology IRI (and no version IRI).

**Parameters**

**iri** – The IRI of the ontology to be created.

**Returns**

The newly created ontology, or if an ontology with the specified IRI already exists then this existing ontology will be returned.

**abstract load\_ontology** (*iri*: *owlapy.iri.IRI*) → *owlapy.owl\_ontology.OWLOntology*

Loads an ontology that is assumed to have the specified ontology IRI as its IRI or version IRI. The ontology IRI will be mapped to an ontology document IRI.

**Parameters**

**iri** – The IRI that identifies the ontology. It is expected that the ontology will also have this IRI (although the OWL API should tolerate situations where this is not the case).

**Returns**

The OWLOntology representation of the ontology that was loaded.

**abstract apply\_change** (*change*: *OWLOntologyChange*)

A convenience method that applies just one change to an ontology. When this method is used through an OWLOntologyManager implementation, the instance used should be the one that the ontology returns through the `get_owl_ontology_manager()` call.

**Parameters**

**change** – The change to be applied.

**Raises**

**ChangeApplied.UNSUCCESSFULLY** – if the change was not applied successfully.

**abstract add\_axiom** (*ontology*: *owlapy.owl\_ontology.OWLOntology*,  
*axiom*: *owlapy.owl\_axiom.OWLXiom*)

A convenience method that adds a single axiom to an ontology.

**Parameters**

- **ontology** – The ontology to add the axiom to.
- **axiom** – The axiom to be added.

**abstract remove\_axiom** (*ontology*: *owlapy.owl\_ontology.OWLOntology*,  
*axiom*: *owlapy.owl\_axiom.OWLXiom*)

A convenience method that removes a single axiom from an ontology.

**Parameters**

- **ontology** – The ontology to remove the axiom from.
- **axiom** – The axiom to be removed.

**abstract save\_ontology** (*ontology: owlapy.owl\_ontology.OWL ontology*,  
*document\_iri: owlapy.iri.IRI*)

Saves the specified ontology, using the specified document IRI to determine where/how the ontology should be saved.

#### Parameters

- **ontology** – The ontology to be saved.
- **document\_iri** – The document IRI where the ontology should be saved to.

**class** owlapy.owl\_ontology\_manager.**OWLImportsDeclaration** (*import\_iri: owlapy.iri.IRI*)

Bases: *owlapy.meta\_classes.HasIRI*

Represents an import statement in an ontology.

**property iri:** *owlapy.iri.IRI*

Gets the import IRI.

#### Returns

The import IRI that points to the ontology to be imported. The imported ontology might have this IRI as its ontology IRI but this is not mandated. For example, an ontology with a non-resolvable ontology IRI can be deployed at a resolvable URL.

**property str:** **str**

Gets the string representation of this object

#### Returns

The IRI as string

**\_\_slots\_\_** = **'\_iri'**

**class** owlapy.owl\_ontology\_manager.**AddImport** (*ontology: owlapy.owl\_ontology.OWL ontology*,  
*import\_declaration: OWLImportsDeclaration*)

Bases: *OWL ontologyChange*

Represents an ontology change where an import statement is added to an ontology.

**\_\_slots\_\_** = (**'\_ont'**, **'\_declaration'**)

**get\_import\_declaration** () → *OWLImportsDeclaration*

Gets the import declaration that the change pertains to.

#### Returns

The import declaration.

**owlapy.owl\_property**

OWL Properties

## Module Contents

### Classes

<i>OWLPropertyExpression</i>	Represents a property or possibly the inverse of a property.
<i>OWLObjectPropertyExpression</i>	A high level interface to describe different types of object properties.
<i>OWLDataPropertyExpression</i>	A high level interface to describe different types of data properties.
<i>OWLProperty</i>	A base class for properties that aren't expression i.e. named properties. By definition, properties
<i>OWLObjectProperty</i>	Represents an Object Property in the OWL 2 Specification. Object properties connect pairs of individuals.
<i>OWLObjectInverseOf</i>	Represents the inverse of a property expression (Object-InverseOf). An inverse object property expression
<i>OWLDataProperty</i>	Represents a Data Property in the OWL 2 Specification. Data properties connect individuals with literals.

**class** owlapy.owl\_property.OWLPropertyExpression

Bases: *owlapy.owl\_object.OWLObject*

Represents a property or possibly the inverse of a property.

**\_\_slots\_\_** = ()

**is\_data\_property\_expression**() → bool

**Returns**

True if this is a data property.

**is\_object\_property\_expression**() → bool

**Returns**

True if this is an object property.

**is\_owl\_top\_object\_property**() → bool

Determines if this is the owl:topObjectProperty.

**Returns**

topObjectProperty.

**Return type**

True if this property is the owl

**is\_owl\_top\_data\_property**() → bool

Determines if this is the owl:topDataProperty.

**Returns**

topDataProperty.

**Return type**

True if this property is the owl

```
class owlapy.owl_property.OWLObjectPropertyExpression
```

Bases: *OWLPropertyExpression*

A high level interface to describe different types of object properties.

```
__slots__ = ()
```

```
abstract get_inverse_property() → OWLObjectPropertyExpression
```

Obtains the property that corresponds to the inverse of this property.

**Returns**

The inverse of this property. Note that this property will not necessarily be in the simplest form.

```
abstract get_named_property() → OWLObjectProperty
```

Get the named object property used in this property expression.

**Returns**

P if this expression is either inv(P) or P.

```
is_object_property_expression() → bool
```

**Returns**

True if this is an object property.

```
class owlapy.owl_property.OWLDataPropertyExpression
```

Bases: *OWLPropertyExpression*

A high level interface to describe different types of data properties.

```
__slots__ = ()
```

```
is_data_property_expression()
```

**Returns**

True if this is a data property.

```
class owlapy.owl_property.OWLProperty(iri: owlapy.iri.IRI | str)
```

Bases: *OWLPropertyExpression*, *owlapy.owl\_object.OWLEntity*

A base class for properties that aren't expression i.e. named properties. By definition, properties are either data properties or object properties.

```
property str: str
```

Gets the string representation of this object

**Returns**

The IRI as string

```
property iri: owlapy.iri.IRI
```

Gets the IRI of this object.

**Returns**

The IRI of this object.

```
__slots__ = '_iri'
```

```
class owlapy.owl_property.OWLObjectProperty(iri: owlapy.iri.IRI | str)
```

Bases: *OWLObjectPropertyExpression*, *OWLProperty*

Represents an Object Property in the OWL 2 Specification. Object properties connect pairs of individuals.

([https://www.w3.org/TR/owl2-syntax/#Object\\_Properties](https://www.w3.org/TR/owl2-syntax/#Object_Properties))

```

__slots__ = '_iri'

type_index: Final = 1002

get_named_property () → OWLObjectProperty
    Get the named object property used in this property expression.

    Returns
        P if this expression is either inv(P) or P.

get_inverse_property () → OWLObjectInverseOf
    Obtains the property that corresponds to the inverse of this property.

    Returns
        The inverse of this property. Note that this property will not necessarily be in the simplest form.

is_owl_top_object_property () → bool
    Determines if this is the owl:topObjectProperty.

    Returns
        topObjectProperty.

    Return type
        True if this property is the owl

```

**class** owlapy.owl\_property.OWLObjectInverseOf (property: *OWLObjectProperty*)

Bases: *OWLObjectPropertyExpression*

Represents the inverse of a property expression (ObjectInverseOf). An inverse object property expression ObjectInverseOf( P ) connects an individual I1 with I2 if and only if the object property P connects I2 with I1. This can be used to refer to the inverse of a property, without actually naming the property. For example, consider the property hasPart, the inverse property of hasPart (isPartOf) can be referred to using this interface inverseOf(hasPart), which can be used in restrictions e.g. inverseOf(hasPart) some Car refers to the set of things that are part of at least one car.

([https://www.w3.org/TR/owl2-syntax/#Inverse\\_Object\\_Properties](https://www.w3.org/TR/owl2-syntax/#Inverse_Object_Properties))

```

__slots__ = '_inverse_property'

type_index: Final = 1003

get_inverse () → OWLObjectProperty
    Gets the property expression that this is the inverse of.

    Returns
        The object property expression such that this object property expression is an inverse of it.

get_inverse_property () → OWLObjectProperty
    Obtains the property that corresponds to the inverse of this property.

    Returns
        The inverse of this property. Note that this property will not necessarily be in the simplest form.

get_named_property () → OWLObjectProperty
    Get the named object property used in this property expression.

    Returns
        P if this expression is either inv(P) or P.

__repr__ ()
    Return repr(self).

```

`__eq__ (other)`  
Return self==value.

`__hash__ ()`  
Return hash(self).

**class** owlapy.owl\_property.OWLDataProperty (iri: owlapy.iri.IRI | str)

Bases: OWLDataPropertyExpression, OWLProperty

Represents a Data Property in the OWL 2 Specification. Data properties connect individuals with literals. In some knowledge representation systems, functional data properties are called attributes.

([https://www.w3.org/TR/owl2-syntax/#Data\\_Properties](https://www.w3.org/TR/owl2-syntax/#Data_Properties))

`__slots__ = '_iri'`

`type_index: Final = 1004`

`is_owl_top_data_property ()` → bool  
Determines if this is the owl:topDataProperty.

**Returns**  
topDataProperty.

**Return type**  
True if this property is the owl

owlapy.owl\_reasoner

OWL Reasoner

## Module Contents

### Classes

*OWLReasoner*

An OWLReasoner reasons over a set of axioms (the set of reasoner axioms) that is based on the imports closure of

**class** owlapy.owl\_reasoner.OWLReasoner (ontology: owlapy.owl\_ontology.OWLOntology)

An OWLReasoner reasons over a set of axioms (the set of reasoner axioms) that is based on the imports closure of a particular ontology - the “root” ontology.

`__slots__ = ()`

**abstract data\_property\_domains** (pe: owlapy.owl\_property.OWLDataProperty, direct: bool = False) → Iterable[owlapy.class\_expression.OWLClassExpression]

**Gets the class expressions that are the direct or indirect domains of this property with respect to the imports closure of the root ontology.**

#### Parameters

- **pe** – The property expression whose domains are to be retrieved.

- **direct** – Specifies if the direct domains should be retrieved (True), or if all domains should be retrieved (False).

#### Returns

Let  $N = \text{equivalent\_classes}(\text{DataSomeValuesFrom}(\text{pe } \text{rdfs:Literal}))$ . If **direct** is True: then if  $N$  is not empty then the return value is  $N$ , else the return value is the result of  $\text{super\_classes}(\text{DataSomeValuesFrom}(\text{pe } \text{rdfs:Literal}), \text{true})$ . If **direct** is False: then the result of  $\text{super\_classes}(\text{DataSomeValuesFrom}(\text{pe } \text{rdfs:Literal}), \text{false})$  together with  $N$  if  $N$  is non-empty. (Note,  $\text{rdfs:Literal}$  is the top datatype).

**abstract object\_property\_domains** (*pe*: *owlapy.owl\_property.OWLObjectProperty*,  
*direct*: *bool = False*)  $\rightarrow \text{Iterable}[\text{owlapy.class\_expression.OWLClassExpression}]$

**Gets the class expressions that are the direct or indirect domains of this property with respect to the imports closure of the root ontology.**

#### Parameters

- **pe** – The property expression whose domains are to be retrieved.
- **direct** – Specifies if the direct domains should be retrieved (True), or if all domains should be retrieved (False).

#### Returns

Let  $N = \text{equivalent\_classes}(\text{ObjectSomeValuesFrom}(\text{pe } \text{owl:Thing}))$ . If **direct** is True: then if  $N$  is not empty then the return value is  $N$ , else the return value is the result of  $\text{super\_classes}(\text{ObjectSomeValuesFrom}(\text{pe } \text{owl:Thing}), \text{true})$ . If **direct** is False: then the result of  $\text{super\_classes}(\text{ObjectSomeValuesFrom}(\text{pe } \text{owl:Thing}), \text{false})$  together with  $N$  if  $N$  is non-empty.

**abstract object\_property\_ranges** (*pe*: *owlapy.owl\_property.OWLObjectProperty*,  
*direct*: *bool = False*)  $\rightarrow \text{Iterable}[\text{owlapy.class\_expression.OWLClassExpression}]$

**Gets the class expressions that are the direct or indirect ranges of this property with respect to the imports closure of the root ontology.**

#### Parameters

- **pe** – The property expression whose ranges are to be retrieved.
- **direct** – Specifies if the direct ranges should be retrieved (True), or if all ranges should be retrieved (False).

#### Returns

Let  $N = \text{equivalent\_classes}(\text{ObjectSomeValuesFrom}(\text{ObjectInverseOf}(\text{pe } \text{owl:Thing})))$ . If **direct** is True: then if  $N$  is not empty then the return value is  $N$ , else the return value is the result of  $\text{super\_classes}(\text{ObjectSomeValuesFrom}(\text{ObjectInverseOf}(\text{pe } \text{owl:Thing})), \text{true})$ . If **direct** is False: then the result of  $\text{super\_classes}(\text{ObjectSomeValuesFrom}(\text{ObjectInverseOf}(\text{pe } \text{owl:Thing})), \text{false})$  together with  $N$  if  $N$  is non-empty.

**abstract equivalent\_classes** (*ce*: *owlapy.class\_expression.OWLClassExpression*,  
*only\_named*: *bool = True*)  $\rightarrow \text{Iterable}[\text{owlapy.class\_expression.OWLClassExpression}]$

**Gets the class expressions that are equivalent to the specified class expression with respect to the set of reasoner axioms.**

#### Parameters

- **ce** – The class expression whose equivalent classes are to be retrieved.



- **only\_named** – Whether to only retrieve named equivalent classes or also complex class expressions.

#### Returns

All class expressions C where the root ontology imports closure entails `EquivalentClasses(ce C)`. If ce is not a class name (i.e. it is an anonymous class expression) and there are no such classes C then there will be no result. If ce is unsatisfiable with respect to the set of reasoner axioms then `owl:Nothing`, i.e. the bottom node, will be returned.

**abstract disjoint\_classes** (*ce: owlapy.class\_expression.OWLClassExpression*,  
*only\_named: bool = True*) → `Iterable[owlapy.class_expression.OWLClassExpression]`

Gets the class expressions that are disjoint with specified class expression with respect to the set of reasoner axioms.

#### Parameters

- **ce** – The class expression whose disjoint classes are to be retrieved.
- **only\_named** – Whether to only retrieve named disjoint classes or also complex class expressions.

#### Returns

All class expressions D where the set of reasoner axioms entails `EquivalentClasses(D ObjectComplementOf(ce))` or `StrictSubClassOf(D ObjectComplementOf(ce))`.

**abstract different\_individuals** (*ind: owlapy.owl\_individual.OWLNamedIndividual*)  
→ `Iterable[owlapy.owl_individual.OWLNamedIndividual]`

Gets the individuals that are different from the specified individual with respect to the set of reasoner axioms.

#### Parameters

**ind** – The individual whose different individuals are to be retrieved.

#### Returns

All individuals x where the set of reasoner axioms entails `DifferentIndividuals(ind x)`.

**abstract same\_individuals** (*ind: owlapy.owl\_individual.OWLNamedIndividual*)  
→ `Iterable[owlapy.owl_individual.OWLNamedIndividual]`

Gets the individuals that are the same as the specified individual with respect to the set of reasoner axioms.

#### Parameters

**ind** – The individual whose same individuals are to be retrieved.

#### Returns

All individuals x where the root ontology imports closure entails `SameIndividual(ind x)`.

**abstract equivalent\_object\_properties** (  
*op: owlapy.owl\_property.OWLObjectPropertyExpression*)  
→ `Iterable[owlapy.owl_property.OWLObjectPropertyExpression]`

Gets the simplified object properties that are equivalent to the specified object property with respect to the set of reasoner axioms.

#### Parameters

**op** – The object property whose equivalent object properties are to be retrieved.

#### Returns

All simplified object properties e where the root ontology imports closure entails `EquivalentObjectProperties(op e)`. If op is unsatisfiable with respect to the set of reasoner axioms then `owl:bottomDataProperty` will be returned.

**abstract equivalent\_data\_properties** (*dp: owlapy.owl\_property.OWLDataProperty*)  
→ Iterable[*owlapy.owl\_property.OWLDataProperty*]

Gets the data properties that are equivalent to the specified data property with respect to the set of reasoner axioms.

**Parameters**

**dp** – The data property whose equivalent data properties are to be retrieved.

**Returns**

All data properties *e* where the root ontology imports closure entails EquivalentDataProperties(*dp e*). If *dp* is unsatisfiable with respect to the set of reasoner axioms then *owl:bottomDataProperty* will be returned.

**abstract data\_property\_values** (*ind: owlapy.owl\_individual.OWLNamedIndividual*,  
*pe: owlapy.owl\_property.OWLDataProperty*, *direct: bool = True*)  
→ Iterable[*owlapy.owl\_literal.OWLLiteral*]

Gets the data property values for the specified individual and data property expression.

**Parameters**

- **ind** – The individual that is the subject of the data property values.
- **pe** – The data property expression whose values are to be retrieved for the specified individual.
- **direct** – Specifies if the direct values should be retrieved (True), or if all values should be retrieved (False), so that sub properties are taken into account.

**Returns**

A set of OWLLiterals containing literals such that for each literal *l* in the set, the set of reasoner axioms entails DataPropertyAssertion(*pe ind l*).

**abstract object\_property\_values** (*ind: owlapy.owl\_individual.OWLNamedIndividual*,  
*pe: owlapy.owl\_property.OWLObjectPropertyExpression*, *direct: bool = True*)  
→ Iterable[*owlapy.owl\_individual.OWLNamedIndividual*]

Gets the object property values for the specified individual and object property expression.

**Parameters**

- **ind** – The individual that is the subject of the object property values.
- **pe** – The object property expression whose values are to be retrieved for the specified individual.
- **direct** – Specifies if the direct values should be retrieved (True), or if all values should be retrieved (False), so that sub properties are taken into account.

**Returns**

The named individuals such that for each individual *j*, the set of reasoner axioms entails ObjectPropertyAssertion(*pe ind j*).

**abstract flush** () → None

Flushes any changes stored in the buffer, which causes the reasoner to take into consideration the changes the current root ontology specified by the changes.

**abstract instances** (*ce: owlapy.class\_expression.OWLClassExpression*, *direct: bool = False*)  
→ Iterable[*owlapy.owl\_individual.OWLNamedIndividual*]

Gets the individuals which are instances of the specified class expression.

**Parameters**

- **ce** – The class expression whose instances are to be retrieved.

- **direct** – Specifies if the direct instances should be retrieved (True), or if all instances should be retrieved (False).

#### Returns

If **direct** is True, each named individual *j* where the set of reasoner axioms entails `DirectClassAssertion(ce, j)`. If **direct** is False, each named individual *j* where the set of reasoner axioms entails `ClassAssertion(ce, j)`. If *ce* is unsatisfiable with respect to the set of reasoner axioms then nothing returned.

**abstract sub\_classes** (*ce*: *owlapy.class\_expression.OWLClassExpression*, *direct*: *bool = False*, *only\_named*: *bool = True*) → *Iterable[owlapy.class\_expression.OWLClassExpression]*

Gets the set of named classes that are the strict (potentially direct) subclasses of the specified class expression with respect to the reasoner axioms.

#### Parameters

- **ce** – The class expression whose strict (direct) subclasses are to be retrieved.
- **direct** – Specifies if the direct subclasses should be retrieved (True) or if the all subclasses (descendant) classes should be retrieved (False).
- **only\_named** – Whether to only retrieve named sub-classes or also complex class expressions.

#### Returns

If **direct** is True, each class *C* where reasoner axioms entails `DirectSubClassOf(C, ce)`. If **direct** is False, each class *C* where reasoner axioms entails `StrictSubClassOf(C, ce)`. If *ce* is equivalent to `owl:Nothing` then nothing will be returned.

**abstract disjoint\_object\_properties** (*op*: *owlapy.owl\_property.OWLObjectPropertyExpression*) → *Iterable[owlapy.owl\_property.OWLObjectPropertyExpression]*

Gets the simplified object properties that are disjoint with the specified object property with respect to the set of reasoner axioms.

#### Parameters

- **op** – The object property whose disjoint object properties are to be retrieved.

#### Returns

All simplified object properties *e* where the root ontology imports closure entails `EquivalentObjectProperties(e ObjectPropertyComplementOf(op))` or `StrictSubObjectPropertyOf(e ObjectPropertyComplementOf(op))`.

**abstract disjoint\_data\_properties** (*dp*: *owlapy.owl\_property.OWLDataProperty*) → *Iterable[owlapy.owl\_property.OWLDataProperty]*

Gets the data properties that are disjoint with the specified data property with respect to the set of reasoner axioms.

#### Parameters

- **dp** – The data property whose disjoint data properties are to be retrieved.

#### Returns

All data properties *e* where the root ontology imports closure entails `EquivalentDataProperties(e DataPropertyComplementOf(dp))` or `StrictSubDataPropertyOf(e DataPropertyComplementOf(dp))`.

**abstract sub\_data\_properties** (*dp*: *owlapy.owl\_property.OWLDataProperty*, *direct*: *bool = False*) → *Iterable[owlapy.owl\_property.OWLDataProperty]*

Gets the set of named data properties that are the strict (potentially direct) subproperties of the specified data property expression with respect to the imports closure of the root ontology.

### Parameters

- **dp** – The data property whose strict (direct) subproperties are to be retrieved.
- **direct** – Specifies if the direct subproperties should be retrieved (True) or if the all subproperties (descendants) should be retrieved (False).

### Returns

If direct is True, each property P where the set of reasoner axioms entails `DirectSubDataPropertyOf(P, pe)`. If direct is False, each property P where the set of reasoner axioms entails `StrictSubDataPropertyOf(P, pe)`. If pe is equivalent to `owl:bottomDataProperty` then nothing will be returned.

**abstract super\_data\_properties** (*dp: owlapy.owl\_property.OWLDataProperty*,  
*direct: bool = False*) → `Iterable[owlapy.owl_property.OWLDataProperty]`

Gets the stream of data properties that are the strict (potentially direct) super properties of the specified data property with respect to the imports closure of the root ontology.

### Parameters

- **dp** (*OWLDataProperty*) – The data property whose super properties are to be retrieved.
- **direct** (*bool*) – Specifies if the direct super properties should be retrieved (True) or if the all super properties (ancestors) should be retrieved (False).

### Returns

Iterable of super properties.

**abstract sub\_object\_properties** (*op: owlapy.owl\_property.OWLObjectPropertyExpression*,  
*direct: bool = False*) → `Iterable[owlapy.owl_property.OWLObjectPropertyExpression]`

Gets the stream of simplified object property expressions that are the strict (potentially direct) subproperties of the specified object property expression with respect to the imports closure of the root ontology.

### Parameters

- **op** – The object property expression whose strict (direct) subproperties are to be retrieved.
- **direct** – Specifies if the direct subproperties should be retrieved (True) or if the all subproperties (descendants) should be retrieved (False).

### Returns

If direct is True, simplified object property expressions, such that for each simplified object property expression, P, the set of reasoner axioms entails `DirectSubObjectPropertyOf(P, pe)`. If direct is False, simplified object property expressions, such that for each simplified object property expression, P, the set of reasoner axioms entails `StrictSubObjectPropertyOf(P, pe)`. If pe is equivalent to `owl:bottomObjectProperty` then nothing will be returned.

**abstract super\_object\_properties** (*op: owlapy.owl\_property.OWLObjectPropertyExpression*,  
*direct: bool = False*) → `Iterable[owlapy.owl_property.OWLObjectPropertyExpression]`

Gets the stream of object properties that are the strict (potentially direct) super properties of the specified object property with respect to the imports closure of the root ontology.

### Parameters

- **op** (*OWLObjectPropertyExpression*) – The object property expression whose super properties are to be retrieved.
- **direct** (*bool*) – Specifies if the direct super properties should be retrieved (True) or if the all super properties (ancestors) should be retrieved (False).

### Returns

Iterable of super properties.

**abstract types** (*ind*: *owlapy.owl\_individual.OWLNamedIndividual*, *direct*: *bool = False*)  
→ *Iterable[owlapy.class\_expression.OWLClass]*

Gets the named classes which are (potentially direct) types of the specified named individual.

#### Parameters

- **ind** – The individual whose types are to be retrieved.
- **direct** – Specifies if the direct types should be retrieved (True), or if all types should be retrieved (False).

#### Returns

If *direct* is True, each named class *C* where the set of reasoner axioms entails *DirectClassAssertion(C, ind)*. If *direct* is False, each named class *C* where the set of reasoner axioms entails *ClassAssertion(C, ind)*.

**abstract get\_root\_ontology** () → *owlapy.owl\_ontology.OWLontology*

Gets the “root” ontology that is loaded into this reasoner. The reasoner takes into account the axioms in this ontology and its import’s closure.

**abstract is\_isolated** ()

Return True if this reasoner is using an isolated ontology.

**abstract super\_classes** (*ce*: *owlapy.class\_expression.OWLClassExpression*, *direct*: *bool = False*,  
*only\_named*: *bool = True*) → *Iterable[owlapy.class\_expression.OWLClassExpression]*

Gets the stream of named classes that are the strict (potentially direct) super classes of the specified class expression with respect to the imports closure of the root ontology.

#### Parameters

- **ce** – The class expression whose strict (direct) super classes are to be retrieved.
- **direct** – Specifies if the direct super classes should be retrieved (True) or if the all super classes (ancestors) classes should be retrieved (False).
- **only\_named** – Whether to only retrieve named super classes or also complex class expressions.

#### Returns

If *direct* is True, each class *C* where the set of reasoner axioms entails *DirectSubClassOf(ce, C)*. If *direct* is False, each class *C* where set of reasoner axioms entails *StrictSubClassOf(ce, C)*. If *ce* is equivalent to *owl:Thing* then nothing will be returned.

## owlapy.parser

String to OWL parsers.

## Module Contents

### Classes

<i>ManchesterOWLSyntaxParser</i>	Manchester Syntax parser to parse strings to OWLClassExpressions.
<i>DLSyntaxParser</i>	Description Logic Syntax parser to parse strings to OWL-ClassExpressions.

## Functions

```
dl_to_owl_expression(dl_expression, namespace)
manchester_to_owl_expression(manchester_ex
...)
```

## Attributes

```
MANCHESTER_GRAMMAR
DL_GRAMMAR
DLparser
ManchesterParser
```

`owlapy.parser.MANCHESTER_GRAMMAR`

```
class owlapy.parser.ManchesterOWLSyntaxParser (
    namespace: str | owlapy.namespaces.Namespaces | None = None, grammar=None)
    Bases: parsimonious.nodes.NodeVisitor, owlapy.owl_object.OWLObjectParser
    Manchester Syntax parser to parse strings to OWLClassExpressions. Following: https://www.w3.org/TR/owl2-manchester-syntax.
    slots = ('ns', 'grammar')
    ns: str | owlapy.namespaces.Namespaces | None
    parse_expression (expression_str: str) → owlapy.class_expression.OWLClassExpression
        Parse a string to an OWL Object.
        Parameters
            expression_str (str) – Expression string.
        Returns
            The OWL Object which is represented by the string.
    visit_union (node, children) → owlapy.class_expression.OWLClassExpression
    visit_intersection (node, children) → owlapy.class_expression.OWLClassExpression
    visit_primary (node, children) → owlapy.class_expression.OWLClassExpression
    visit_some_only_res (node, children) → owlapy.class_expression.OWLQuantifiedObjectRestriction
    visit_cardinality_res (node, children)
        → owlapy.class_expression.OWLObjectCardinalityRestriction
    visit_value_res (node, children) → owlapy.class_expression.OWLObjectHasValue
```

**visit\_has\_self** (*node*, *children*) → *owlapy.class\_expression.OWLObjectHasSelf*  
**visit\_object\_property** (*node*, *children*) → *owlapy.owl\_property.OWLObjectPropertyExpression*  
**visit\_class\_expression** (*node*, *children*) → *owlapy.class\_expression.OWLClassExpression*  
**visit\_individual\_list** (*node*, *children*) → *owlapy.class\_expression.OWLObjectOneOf*  
**visit\_data\_primary** (*node*, *children*) → *owlapy.owl\_data\_ranges.OWLDataRange*  
**visit\_data\_some\_only\_res** (*node*, *children*)  
     → *owlapy.class\_expression.OWLQuantifiedDataRestriction*  
**visit\_data\_cardinality\_res** (*node*, *children*)  
     → *owlapy.class\_expression.OWLDataCardinalityRestriction*  
**visit\_data\_value\_res** (*node*, *children*) → *owlapy.class\_expression.OWLDataHasValue*  
**visit\_data\_union** (*node*, *children*) → *owlapy.owl\_data\_ranges.OWLDataRange*  
**visit\_data\_intersection** (*node*, *children*) → *owlapy.owl\_data\_ranges.OWLDataRange*  
**visit\_literal\_list** (*node*, *children*) → *owlapy.class\_expression.OWLDataOneOf*  
**visit\_data\_parentheses** (*node*, *children*) → *owlapy.owl\_data\_ranges.OWLDataRange*  
**visit\_datatype\_restriction** (*node*, *children*)  
     → *owlapy.class\_expression.OWLDatatypeRestriction*  
**visit\_facet\_restrictions** (*node*, *children*)  
     → *List[owlapy.class\_expression.OWLFacetRestriction]*  
**visit\_facet\_restriction** (*node*, *children*) → *owlapy.class\_expression.OWLFacetRestriction*  
**visit\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*  
**visit\_typed\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*  
**abstract visit\_string\_literal\_language** (*node*, *children*)  
**visit\_string\_literal\_no\_language** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*  
**visit\_quoted\_string** (*node*, *children*) → *str*  
**visit\_float\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*  
**visit\_decimal\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*  
**visit\_integer\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*  
**visit\_boolean\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*  
**visit\_datetime\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*  
**visit\_duration\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*  
**visit\_date\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*  
**visit\_non\_negative\_integer** (*node*, *children*) → *int*  
**visit\_datatype\_iri** (*node*, *children*) → *str*

**visit\_datatype** (*node*, *children*) → *owlapy.owl\_datatype.OWLDatatype*  
**visit\_facet** (*node*, *children*) → *owlapy.vocab.OWLFacet*  
**visit\_class\_iri** (*node*, *children*) → *owlapy.class\_expression.OWLClass*  
**visit\_individual\_iri** (*node*, *children*) → *owlapy.owl\_individual.OWLNamedIndividual*  
**visit\_object\_property\_iri** (*node*, *children*) → *owlapy.owl\_property.OWLObjectProperty*  
**visit\_data\_property\_iri** (*node*, *children*) → *owlapy.owl\_property.OWLDataProperty*  
**visit\_iri** (*node*, *children*) → *owlapy.iri.IRI*  
**visit\_full\_iri** (*node*, *children*) → *owlapy.iri.IRI*  
**abstract\_visit\_abbreviated\_iri** (*node*, *children*)  
**visit\_simple\_iri** (*node*, *children*) → *owlapy.iri.IRI*  
**visit\_parentheses** (*node*, *children*) → *owlapy.class\_expression.OWLClassExpression*  
**generic\_visit** (*node*, *children*)

Default visitor method

#### Parameters

- **node** – The node we’re visiting
- **visited\_children** – The results of visiting the children of that node, in a list

I’m not sure there’s an implementation of this that makes sense across all (or even most) use cases, so we leave it to subclasses to implement for now.

*owlapy.parser.DL\_GRAMMAR*

```

class owlapy.parser.DLSyntaxParser (
    namespace: str | owlapy.namespaces.Namespaces | None = None, grammar=None)
Bases: parsimonious.nodes.NodeVisitor, owlapy.owl_object.OWLObjectParser
Description Logic Syntax parser to parse strings to OWLClassExpressions.
slots = ('ns', 'grammar')

```

**ns:** str | *owlapy.namespaces.Namespaces* | None

**parse\_expression** (*expression\_str: str*) → *owlapy.class\_expression.OWLClassExpression*  
 Parse a string to an OWL Object.

#### Parameters

**expression\_str** (*str*) – Expression string.

#### Returns

The OWL Object which is represented by the string.

**visit\_union** (*node*, *children*) → *owlapy.class\_expression.OWLClassExpression*  
**visit\_intersection** (*node*, *children*) → *owlapy.class\_expression.OWLClassExpression*  
**visit\_primary** (*node*, *children*) → *owlapy.class\_expression.OWLClassExpression*  
**visit\_some\_only\_res** (*node*, *children*) → *owlapy.class\_expression.OWLQuantifiedObjectRestriction*



**visit\_cardinality\_res** (*node*, *children*)  
     → *owlapy.class\_expression.OWLObjectCardinalityRestriction*

**visit\_value\_res** (*node*, *children*) → *owlapy.class\_expression.OWLObjectHasValue*

**visit\_has\_self** (*node*, *children*) → *owlapy.class\_expression.OWLObjectHasSelf*

**visit\_object\_property** (*node*, *children*) → *owlapy.owl\_property.OWLObjectPropertyExpression*

**visit\_class\_expression** (*node*, *children*) → *owlapy.class\_expression.OWLClassExpression*

**visit\_individual\_list** (*node*, *children*) → *owlapy.class\_expression.OWLObjectOneOf*

**visit\_data\_primary** (*node*, *children*) → *owlapy.owl\_data\_ranges.OWLDataRange*

**visit\_data\_some\_only\_res** (*node*, *children*)  
     → *owlapy.class\_expression.OWLQuantifiedDataRestriction*

**visit\_data\_cardinality\_res** (*node*, *children*)  
     → *owlapy.class\_expression.OWLDataCardinalityRestriction*

**visit\_data\_value\_res** (*node*, *children*) → *owlapy.class\_expression.OWLDataHasValue*

**visit\_data\_union** (*node*, *children*) → *owlapy.owl\_data\_ranges.OWLDataRange*

**visit\_data\_intersection** (*node*, *children*) → *owlapy.owl\_data\_ranges.OWLDataRange*

**visit\_literal\_list** (*node*, *children*) → *owlapy.class\_expression.OWLDataOneOf*

**visit\_data\_parentheses** (*node*, *children*) → *owlapy.owl\_data\_ranges.OWLDataRange*

**visit\_datatype\_restriction** (*node*, *children*)  
     → *owlapy.class\_expression.OWLDatatypeRestriction*

**visit\_facet\_restrictions** (*node*, *children*)  
     → List[*owlapy.class\_expression.OWLFacetRestriction*]

**visit\_facet\_restriction** (*node*, *children*) → *owlapy.class\_expression.OWLFacetRestriction*

**visit\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*

**visit\_typed\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*

**abstract\_visit\_string\_literal\_language** (*node*, *children*)

**visit\_string\_literal\_no\_language** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*

**visit\_quoted\_string** (*node*, *children*) → str

**visit\_float\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*

**visit\_decimal\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*

**visit\_integer\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*

**visit\_boolean\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*

**visit\_datetime\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*

**visit\_duration\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*

**visit\_date\_literal** (*node*, *children*) → *owlapy.owl\_literal.OWLLiteral*  
**visit\_non\_negative\_integer** (*node*, *children*) → int  
**visit\_datatype\_iri** (*node*, *children*) → str  
**visit\_datatype** (*node*, *children*) → *owlapy.owl\_datatype.OWLDatatype*  
**visit\_facet** (*node*, *children*) → *owlapy.vocab.OWLFacet*  
**visit\_class\_iri** (*node*, *children*) → *owlapy.class\_expression.OWLClass*  
**visit\_individual\_iri** (*node*, *children*) → *owlapy.owl\_individual.OWLNamedIndividual*  
**visit\_object\_property\_iri** (*node*, *children*) → *owlapy.owl\_property.OWLObjectProperty*  
**visit\_data\_property\_iri** (*node*, *children*) → *owlapy.owl\_property.OWLDataProperty*  
**visit\_iri** (*node*, *children*) → *owlapy.iri.IRI*  
**visit\_full\_iri** (*node*, *children*) → *owlapy.iri.IRI*  
**abstract\_visit\_abbreviated\_iri** (*node*, *children*)  
**visit\_simple\_iri** (*node*, *children*) → *owlapy.iri.IRI*  
**visit\_parentheses** (*node*, *children*) → *owlapy.class\_expression.OWLClassExpression*  
**generic\_visit** (*node*, *children*)

Default visitor method

#### Parameters

- **node** – The node we’re visiting
- **visited\_children** – The results of visiting the children of that node, in a list

I’m not sure there’s an implementation of this that makes sense across all (or even most) use cases, so we leave it to subclasses to implement for now.

`owlapy.parser.DLparser`

`owlapy.parser.ManchesterParser`

`owlapy.parser.dl_to_owl_expression` (*dl\_expression*: str, *namespace*: str)

`owlapy.parser.manchester_to_owl_expression` (*manchester\_expression*: str, *namespace*: str)

#### `owlapy.providers`

OWL Datatype restriction constructors.

## Module Contents

### Functions

<code>owl_datatype_max_exclusive_restriction</code>	Create a max exclusive restriction.
<code>owl_datatype_min_exclusive_restriction</code>	Create a min exclusive restriction.
<code>owl_datatype_max_inclusive_restriction</code>	Create a max inclusive restriction.
<code>owl_datatype_min_inclusive_restriction</code>	Create a min inclusive restriction.
<code>owl_datatype_min_max_exclusive_restric</code>	Create a min-max exclusive restriction.
<code>owl_datatype_min_max_inclusive_restric</code>	Create a min-max inclusive restriction.

### Attributes

<code>Restriction_Literals</code>
-----------------------------------

`owlapy.providers.Restriction_Literals`

`owlapy.providers.owl_datatype_max_exclusive_restriction` (*max\_*: *Restriction\_Literals*)  
→ *owlapy.class\_expression.OWLDatatypeRestriction*

Create a max exclusive restriction.

`owlapy.providers.owl_datatype_min_exclusive_restriction` (*min\_*: *Restriction\_Literals*)  
→ *owlapy.class\_expression.OWLDatatypeRestriction*

Create a min exclusive restriction.

`owlapy.providers.owl_datatype_max_inclusive_restriction` (*max\_*: *Restriction\_Literals*)  
→ *owlapy.class\_expression.OWLDatatypeRestriction*

Create a max inclusive restriction.

`owlapy.providers.owl_datatype_min_inclusive_restriction` (*min\_*: *Restriction\_Literals*)  
→ *owlapy.class\_expression.OWLDatatypeRestriction*

Create a min inclusive restriction.

`owlapy.providers.owl_datatype_min_max_exclusive_restriction` (*min\_*: *Restriction\_Literals*, *max\_*: *Restriction\_Literals*)  
→ *owlapy.class\_expression.OWLDatatypeRestriction*

Create a min-max exclusive restriction.

`owlapy.providers.owl_datatype_min_max_inclusive_restriction` (*min\_*: *Restriction\_Literals*, *max\_*: *Restriction\_Literals*)  
→ *owlapy.class\_expression.OWLDatatypeRestriction*

Create a min-max inclusive restriction.

## owlapy.render

Renderers for different syntax.

## Module Contents

### Classes

<i>DLSyntaxObjectRenderer</i>	DL Syntax renderer for OWL Objects.
<i>ManchesterOWLSyntaxOWLObjectRenderer</i>	Manchester Syntax renderer for OWL Objects

### Functions

<i>owl_expression_to_dl</i> ( $\rightarrow$ str)
<i>owl_expression_to_manchester</i> ( $\rightarrow$ str)

### Attributes

<i>DLrenderer</i>
<i>ManchesterRenderer</i>

```
class owlapy.render.DLSyntaxObjectRenderer (  
    short_form_provider: Callable[[owlapy.owl_object.OWLEntity], str] = _simple_short_form_provider)
```

Bases: *owlapy.owl\_object.OWLObjectRenderer*

DL Syntax renderer for OWL Objects.

**\_\_slots\_\_** = '\_sfp'

**set\_short\_form\_provider** (short\_form\_provider: Callable[[owlapy.owl\_object.OWLEntity], str])  
→ None

Configure a short form provider that shortens the OWL objects during rendering.

#### Parameters

**short\_form\_provider** – Short form provider.

**render** (o: *owlapy.owl\_object.OWLObject*) → str

Render OWL Object to string.

#### Parameters

o – OWL Object.

#### Returns

String rendition of OWL object.

```
class owlapy.render.ManchesterOWLSyntaxOWLObjectRenderer (
    short_form_provider: Callable[[owlapy.owl_object.OWLEntity], str] = _simple_short_form_provider,
    no_render_thing=False)
```

Bases: *owlapy.owl\_object.OWLObjectRenderer*

Manchester Syntax renderer for OWL Objects

```
__slots__ = ('_sfp', '_no_render_thing')
```

```
set_short_form_provider (short_form_provider: Callable[[owlapy.owl_object.OWLEntity], str])
    → None
```

Configure a short form provider that shortens the OWL objects during rendering.

#### Parameters

**short\_form\_provider** – Short form provider.

```
render (o: owlapy.owl_object.OWLObject) → str
```

Render OWL Object to string.

#### Parameters

**o** – OWL Object.

#### Returns

String rendition of OWL object.

```
owlapy.render.DLrenderer
```

```
owlapy.render.ManchesterRenderer
```

```
owlapy.render.owl_expression_to_dl (o: owlapy.owl_object.OWLObject) → str
```

```
owlapy.render.owl_expression_to_manchester (o: owlapy.owl_object.OWLObject) → str
```

## owlapy.static\_funcs

Static functions for general purposes.

## Module Contents

### Functions

<code>move(*args)</code>	"Move" an imported class to the current module by setting the classes <code>__module__</code> attribute.
<code>download_external_files(ftp_link)</code>	

```
owlapy.static_funcs.move (*args)
```

“Move” an imported class to the current module by setting the classes `__module__` attribute.

This is useful for documentation purposes to hide internal packages in sphinx.

#### Parameters

**args** – List of classes to move.

```
owlapy.static_funcs.download_external_files (ftp_link: str)
```

## owlapy.utils

Owlapy utils.

## Module Contents

### Classes

<i>OWLClassExpressionLengthMetric</i>	Length calculation of OWLClassExpression
<i>EvaluatedDescriptionSet</i>	Abstract base class for generic types.
<i>ConceptOperandSorter</i>	
<i>OperandSetTransform</i>	
<i>HasIndex</i>	Interface for types with an index; this is used to group objects by type when sorting.
<i>OrderedOWLObject</i>	Holder of OWL Objects that can be used for Python sorted.
<i>NNF</i>	This class contains functions to transform a Class Expression into Negation Normal Form.
<i>TopLevelCNF</i>	This class contains functions to transform a class expression into Top-Level Conjunctive Normal Form.
<i>TopLevelDNF</i>	This class contains functions to transform a class expression into Top-Level Disjunctive Normal Form.
<i>LRUCache</i>	Constants shares by all lru cache instances.

### Functions

<i>get_expression_length</i> (→ int)	
<i>combine_nary_expressions</i> (...)	Shortens an OWLClassExpression or OWLDataRange by combining all nested nary expressions of the same type.
<i>iter_count</i> (→ int)	Count the number of elements in an iterable.
<i>as_index</i> (→ HasIndex)	Cast OWL Object to HasIndex.

### Attributes

<i>measurer</i>	
-----------------	--

```

class owlapy.utils.OWLClassExpressionLengthMetric(*, class_length: int,
    object_intersection_length: int, object_union_length: int, object_complement_length: int,
    object_some_values_length: int, object_all_values_length: int, object_has_value_length: int,
    object_cardinality_length: int, object_has_self_length: int, object_one_of_length: int,
    data_some_values_length: int, data_all_values_length: int, data_has_value_length: int,
    data_cardinality_length: int, object_property_length: int, object_inverse_length: int,
    data_property_length: int, datatype_length: int, data_one_of_length: int,
    data_complement_length: int, data_intersection_length: int, data_union_length: int)

```

Length calculation of OWLClassExpression

#### Parameters

- **class\_length** – Class: “C”
- **object\_intersection\_length** – Intersection:  $A \sqcap B$
- **object\_union\_length** – Union:  $A \sqcup B$
- **object\_complement\_length** – Complement:  $\neg C$
- **object\_some\_values\_length** – Obj. Some Values:  $\exists r.C$
- **object\_all\_values\_length** – Obj. All Values:  $\forall r.C$
- **object\_has\_value\_length** – Obj. Has Value:  $\exists r.\{I\}$
- **object\_cardinality\_length** – Obj. Cardinality restriction:  $\leq n r.C$
- **object\_has\_self\_length** – Obj. Self restriction:  $\exists r.\text{Self}$
- **object\_one\_of\_length** – Obj. One of:  $\exists r.\{X,Y,Z\}$
- **data\_some\_values\_length** – Data Some Values:  $\exists p.t$
- **data\_all\_values\_length** – Data All Values:  $\forall p.t$
- **data\_has\_value\_length** – Data Has Value:  $\exists p.\{V\}$
- **data\_cardinality\_length** – Data Cardinality restriction:  $\leq n r.t$
- **object\_property\_length** – Obj. Property:  $\exists r.C$
- **object\_inverse\_length** – Inverse property:  $\exists r^{-}.C$
- **data\_property\_length** – Data Property:  $\exists p.t$
- **datatype\_length** – Datatype:  $^{\wedge}\text{datatype}$
- **data\_one\_of\_length** – Data One of:  $\exists p.\{U,V,W\}$
- **data\_complement\_length** – Data Complement:  $\neg\text{datatype}$
- **data\_intersection\_length** – Data Intersection:  $\text{datatype} \sqcap \text{datatype}$
- **data\_union\_length** – Data Union:  $\text{datatype} \sqcup \text{datatype}$

```

__slots__ = ('class_length', 'object_intersection_length',
    'object_union_length', ...

```

```

class_length: int

```

```

object_intersection_length: int

```

```

object_union_length: int

```

```

object_complement_length: int

```

```

object_some_values_length: int
object_all_values_length: int
object_has_value_length: int
object_cardinality_length: int
object_has_self_length: int
object_one_of_length: int
data_some_values_length: int
data_all_values_length: int
data_has_value_length: int
data_cardinality_length: int
object_property_length: int
object_inverse_length: int
data_property_length: int
datatype_length: int
data_one_of_length: int
data_complement_length: int
data_intersection_length: int
data_union_length: int

static get_default () → OWLClassExpressionLengthMetric

abstract length(o: owlpy.owl_object.OWLObject) → int

```

owlapy.utils.measurer

owlapy.utils.get\_expression\_length(ce: owlpy.class\_expression.OWLClassExpression) → int

```

class owlpy.utils.EvaluatedDescriptionSet (ordering: Callable[[_N], _O],
      max_size: int = 10)

```

Bases: Generic[\_N, \_O]

Abstract base class for generic types.

A generic type is typically declared by inheriting from this class parameterized with one or more type variables. For example, a generic mapping type might be defined as:

```

class Mapping(Generic[KT, VT]):
    def __getitem__(self, key: KT) -> VT:
        ...
    # Etc.

```

This class can then be used as follows:



```
def lookup_name(mapping: Mapping[KT, VT], key: KT, default: VT) -> VT:
    try:
        return mapping[key]
    except KeyError:
        return default
```

```
__slots__ = ('items', '_max_size', '_Ordering')
```

```
items: SortedSet[_N]
```

```
maybe_add(node: _N)
```

```
clean()
```

```
worst()
```

```
best()
```

```
best_quality_value() -> float
```

```
__iter__() -> Iterable[_N]
```

```
class owlapy.utils.ConceptOperandSorter
```

```
    abstract sort(o: _O) -> _O
```

```
class owlapy.utils.OperandSetTransform
```

```
    simplify(o: owlapy.class_expression.OWLClassExpression)
        -> owlapy.class_expression.OWLClassExpression
```

```
class owlapy.utils.HasIndex
```

```
    Bases: Protocol
```

Interface for types with an index; this is used to group objects by type when sorting.

```
    type_index: ClassVar[int]
```

```
    __eq__(other)
```

Return self==value.

```
class owlapy.utils.OrderedOWLObject(o: _HasIndex)
```

Holder of OWL Objects that can be used for Python sorted.

The Ordering is dependent on the type\_index of the impl. classes recursively followed by all components of the OWL Object.

```
    o
```

OWL object.

```
__slots__ = ('o', '_chain')
```

```
o: _HasIndex
```

```
__lt__(other)
```

Return self<value.

```
__eq__(other)
```

Return self==value.

**class** owlapy.utils.NNF

This class contains functions to transform a Class Expression into Negation Normal Form.

**abstract** **get\_class\_nnf** (*ce: owlapy.class\_expression.OWLClassExpression*,  
*negated: bool = False*)  $\rightarrow$  *owlapy.class\_expression.OWLClassExpression*

Convert a Class Expression to Negation Normal Form. Operands will be sorted.

**Parameters**

- **ce** – Class Expression.
- **negated** – Whether the result should be negated.

**Returns**

Class Expression in Negation Normal Form.

**class** owlapy.utils.TopLevelCNF

This class contains functions to transform a class expression into Top-Level Conjunctive Normal Form.

**get\_top\_level\_cnf** (*ce: owlapy.class\_expression.OWLClassExpression*)  
 $\rightarrow$  *owlapy.class\_expression.OWLClassExpression*

Convert a class expression into Top-Level Conjunctive Normal Form. Operands will be sorted.

**Parameters**

**ce** – Class Expression.

**Returns**

Class Expression in Top-Level Conjunctive Normal Form.

**class** owlapy.utils.TopLevelDNF

This class contains functions to transform a class expression into Top-Level Disjunctive Normal Form.

**get\_top\_level\_dnf** (*ce: owlapy.class\_expression.OWLClassExpression*)  
 $\rightarrow$  *owlapy.class\_expression.OWLClassExpression*

Convert a class expression into Top-Level Disjunctive Normal Form. Operands will be sorted.

**Parameters**

**ce** – Class Expression.

**Returns**

Class Expression in Top-Level Disjunctive Normal Form.

owlapy.utils.**combine\_nary\_expressions** (*ce: owlapy.class\_expression.OWLClassExpression*)  
 $\rightarrow$  *owlapy.class\_expression.OWLClassExpression*

owlapy.utils.**combine\_nary\_expressions** (*ce: owlapy.owl\_data\_ranges.OWLDataRange*)  
 $\rightarrow$  *owlapy.owl\_data\_ranges.OWLDataRange*

Shortens an OWLClassExpression or OWLDataRange by combining all nested nary expressions of the same type. Operands will be sorted.

E.g. OWLObjectUnionOf(A, OWLObjectUnionOf(C, B)) -> OWLObjectUnionOf(A, B, C).

owlapy.utils.**iter\_count** (*i: Iterable*)  $\rightarrow$  int

Count the number of elements in an iterable.

owlapy.utils.**as\_index** (*o: owlapy.owl\_object.OWLObject*)  $\rightarrow$  *HasIndex*

Cast OWL Object to HasIndex.

**class** owlapy.utils.LRUCache (*maxsize: int | None = None*)

Bases: Generic[\_K, \_V]

Constants shares by all lru cache instances.

Adapted from `functools.lru_cache`.

**sentinel**

Unique object used to signal cache misses.

**PREV**

Name for the link field 0.

**NEXT**

Name for the link field 1.

**KEY**

Name for the link field 2.

**RESULT**

Name for the link field 3.

**sentinel**

**\_\_contains\_\_** (*item*: *\_K*) → bool

**\_\_getitem\_\_** (*item*: *\_K*) → *\_V*

**\_\_setitem\_\_** (*key*: *\_K*, *value*: *\_V*)

**cache\_info** ()

Report cache statistics.

**cache\_clear** ()

Clear the cache and cache statistics.

## **owlapy.vocab**

Enumerations.

## **Module Contents**

### **Classes**

<i>OWLRFDVocabulary</i>	Enumerations for OWL/RDF vocabulary.
<i>XSDVocabulary</i>	Enumerations for XSD vocabulary.
<i>OWLFacet</i>	Enumerations for OWL facets.

**class** owlapy.vocab.**OWLRFDVocabulary** (*namespace*: owlapy.namespaces.Namespaces,  
                                  *remainder*: str)

Bases: *\_Vocabulary*, enum.Enum

Enumerations for OWL/RDF vocabulary.

**OWL\_THING** = ()

**OWL\_NOTHING** = ()

**OWL\_CLASS** = ()

```

OWL_NAMED_INDIVIDUAL = ()

OWL_TOP_OBJECT_PROPERTY = ()

OWL_BOTTOM_OBJECT_PROPERTY = ()

OWL_TOP_DATA_PROPERTY = ()

OWL_BOTTOM_DATA_PROPERTY = ()

RDFS_LITERAL = ()

class owlapy.vocab.XSDVocabulary(remainder: str)
    Bases: _Vocabulary, enum.Enum
    Enumerations for XSD vocabulary.
    DECIMAL: Final = 'decimal'
    INTEGER: Final = 'integer'
    LONG: Final = 'long'
    DOUBLE: Final = 'double'
    FLOAT: Final = 'float'
    BOOLEAN: Final = 'boolean'
    STRING: Final = 'string'
    DATE: Final = 'date'
    DATE_TIME: Final = 'dateTime'
    DATE_TIME_STAMP: Final = 'dateTimeStamp'
    DURATION: Final = 'duration'

class owlapy.vocab.OWLFacet(remainder: str, symbolic_form: str,
    operator: Callable[[_X, _X], bool])
    Bases: _Vocabulary, enum.Enum
    Enumerations for OWL facets.
    property symbolic_form
    property operator
    MIN_INCLUSIVE: Final = ('minInclusive', '>=')
    MIN_EXCLUSIVE: Final = ('minExclusive', '>')
    MAX_INCLUSIVE: Final = ('maxInclusive', '<=')
    MAX_EXCLUSIVE: Final = ('maxExclusive', '<')
    LENGTH: Final = ('length', 'length')
    MIN_LENGTH: Final = ('minLength', 'minLength')

```

```

MAX_LENGTH: Final = ('maxLength', 'maxLength')

PATTERN: Final = ('pattern', 'pattern')

TOTAL_DIGITS: Final = ('totalDigits', 'totalDigits')

FRACTION_DIGITS: Final = ('fractionDigits', 'fractionDigits')

static from_str(name: str) → OWLFacet

```

## 3.3 Package Contents

### Functions

<code>owl_expression_to_dl(→ str)</code>	
<code>owl_expression_to_manchester(→ str)</code>	
<code>dl_to_owl_expression(dl_expression, namespace)</code>	
<code>manchester_to_owl_expression(manchester_ex ...)</code>	
<code>owl_expression_to_sparql(→ str)</code>	Convert an OWL Class Expression ( <a href="https://www.w3.org/TR/owl2-syntax/#Class_Expressions">https://www.w3.org/TR/owl2-syntax/#Class_Expressions</a> ) into a SPARQL query

### Attributes

<code>__version__</code>
--------------------------

`owlapy.owl_expression_to_dl(o: owlapy.owl_object.OWLObject) → str`

`owlapy.owl_expression_to_manchester(o: owlapy.owl_object.OWLObject) → str`

`owlapy.dl_to_owl_expression(dl_expression: str, namespace: str)`

`owlapy.manchester_to_owl_expression(manchester_expression: str, namespace: str)`

`owlapy.owl_expression_to_sparql(`  
     `expression: owlapy.class_expression.OWLClassExpression = None, root_variable: str = '?x',`  
     `values: Iterable[owlapy.owl_individual.OWLNamedIndividual] | None = None,`  
     `for_all_de_morgan: bool = True, named_individuals: bool = False) → str`

Convert an OWL Class Expression ([https://www.w3.org/TR/owl2-syntax/#Class\\_Expressions](https://www.w3.org/TR/owl2-syntax/#Class_Expressions)) into a SPARQL query  
 root variable: the variable that will be projected  
 expression: the class expression to be transformed to a SPARQL query

values: positive or negative examples from a class expression problem. Unclear for\_all\_de\_morgan: if set to True, the SPARQL mapping will use the mapping containing the nested FILTER NOT EXISTS patterns for the universal quantifier ( $\neg(\exists r. \neg C)$ ), instead of the counting query named\_individuals: if set to True, the generated SPARQL query will return only entities that are instances of owl:NamedIndividual

```
owlapy.__version__ = '1.0.2'
```

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