
OWLAPY

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Ontolearn Team

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OWLAPY¹: Representation of OWL objects in python.

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

1 About owlapy

Version: owlapy 1.0.2

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

Publisher and maintainer: DICE² - data science research group of Paderborn University³.

Contact: onto-learn@lists.uni-paderborn.de

License: MIT License

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 and for manipulating OWL Ontologies 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](#)⁴ and [OntoSample](#)⁵.

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

1.2 What does owlapy have to offer?

- Create, manipulate and save Ontologies.
- Retrieving information from the signature of the ontology.
- Reasoning over ontology.
- Represent every notation in [OWL 2 Structural Specification and Functional-Style Syntax](#)⁶ 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.

² <https://dice-research.org/>

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

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

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

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

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 .
```

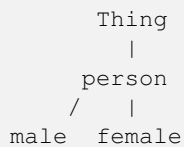
or using PyPI:

```
pip3 install owlapy
```

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`⁷:

```
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`⁸ is used to represent an *IRI*. Every named entity requires an *IRI*, whereas Anonymous entities do 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")
```

⁷ https://dice-group.github.io/owlapy/autoapi/owlapy/class_expression/owl_class/index.html#owlapy.class_expression.owl_class.OWLClass

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

2.2 Object Property

To represent the object property `hasChild` we can use the class `OWLObjectProperty`⁹:

```
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*”.

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`¹⁰. 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`¹¹ 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`¹²:

```
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)
```

(continues on next page)

⁹ https://dice-group.github.io/owlapy/autoapi/owlapy/owl_property/index.html#owlapy.owl_property.OWLObjectProperty

¹⁰ https://www.w3.org/TR/owl2-syntax/#Minimum_Cardinality

¹¹ https://dice-group.github.io/owlapy/autoapi/owlapy/class_expression/restriction/index.html#owlapy.class_expression.restriction.OWLObjectMinCardinality

¹² 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)

```
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/
↪ 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 and check more examples in the *examples*¹³ directory.

3 owlapy

3.1 Subpackages

owlapy.class_expression

OWL 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			

¹³ <https://github.com/dice-group/owlapy/tree/develop/examples>

Submodules

owlapy.class_expression.class_expression

OWL Base Classes Expressions

Classes

<i>OWLPropertyRange</i>	OWL Objects that can be the ranges of properties.
<i>HasOperands</i>	An interface to objects that have a collection of operands.
<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.

Module Contents

class owlapy.class_expression.class_expression.OWLPropertyRange

Bases: *owlapy.owl_object.OWLObject*

OWL Objects that can be the ranges of properties.

class owlapy.class_expression.class_expression.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.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)

__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

Classes

<i>OWLClassExpression</i>	OWL Class expressions represent sets of individuals by formally specifying conditions on the individuals' properties;
<i>OWLBooleanClassExpression</i>	Represent an anonymous boolean class expression.
<i>HasOperands</i>	An interface to objects that have a collection of operands.
<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

Module Contents

class owlapy.class_expression.nary_boolean_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)

__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.nary_boolean_expression.**OWLBooleanClassExpression**

Bases: *OWLAnonymousClassExpression*

Represent an anonymous boolean class expression.

__slots__ = ()

class owlapy.class_expression.nary_boolean_expression.**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.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

Classes

<i>OWLClassExpression</i>	OWL Class expressions represent sets of individuals by formally specifying conditions on the individuals' properties;
<i>OWLObjectComplementOf</i>	Represents an ObjectComplementOf class expression in the OWL 2 Specification.
<i>OWLEntity</i>	Represents Entities in the OWL 2 Specification.
<i>IRI</i>	An IRI, consisting of a namespace and a remainder.
<i>OWLClass</i>	An OWL 2 named Class. Classes can be understood as sets of individuals.

Module Contents

class owlapy.class_expression.owl_class.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)

__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.owl_class.OLObjectComplementOf (
    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.owl_class.OWLEntity
    Bases: OWLNamedObject
    Represents Entities in the OWL 2 Specification.
    __slots__ = ()
    to_string_id () → str
    is_anonymous () → bool

class owlapy.class_expression.owl_class.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.
    __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.

property_str: str
Returns: The string that specifies the IRI.

property_reminder: str
Returns: The string corresponding to the reminder of 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.

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>)

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

`type_index: Final = 1001`

`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

`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

Attributes

Literals

Classes

<i>HasFiller</i>	An interface to objects that have a filler.
<i>HasCardinality</i>	An interface to objects that have a cardinality.
<i>HasOperands</i>	An interface to objects that have a collection of operands.
<i>OWLObjectIntersectionOf</i>	An intersection class expression <i>ObjectIntersectionOf</i> (CE1 ... CEn) contains all individuals that are instances
<i>OWLObjectUnionOf</i>	A union class expression <i>ObjectUnionOf</i> (CE1 ... CEn) contains all individuals that are instances
<i>OWLAnonymousClassExpression</i>	A Class Expression which is not a named Class.
<i>OWLClassExpression</i>	OWL Class expressions represent sets of individuals by formally specifying conditions on the individuals' properties;
<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>OWLObjectPropertyExpression</i>	A high level interface to describe different types of data properties.
<i>OWLPropertyRange</i>	OWL Objects that can be the ranges of properties.
<i>OWLDatRange</i>	Represents a <i>DataRange</i> in the OWL 2 Specification.
<i>OWLLiteral</i>	Literals represent data values such as particular strings or integers. They are analogous to typed RDF
<i>OWLIndividual</i>	Represents a named or anonymous individual.
<i>OWLDatatype</i>	Datatypes are entities that refer to sets of data values. Thus, datatypes are analogous to classes,
<i>OWLObject</i>	Base interface for OWL objects
<i>OWLFacet</i>	Enumerations for OWL facets.
<i>OWLRestriction</i>	Represents an Object Property Restriction or Data Property Restriction in the OWL 2 specification.
<i>OWLHasValueRestriction</i>	Represent a <i>HasValue</i> 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> (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

continues on next page

Table 1 – continued from previous page

<i>OWLObjectExactCardinality</i>	An exact cardinality expression <code>ObjectExactCardinality(n OPE CE)</code> consists of a nonnegative integer <i>n</i> , an object
<i>OWLObjectSomeValuesFrom</i>	An existential class expression <code>ObjectSomeValuesFrom(OPE CE)</code> consists of an object property expression <i>OPE</i> and
<i>OWLObjectAllValuesFrom</i>	A universal class expression <code>ObjectAllValuesFrom(OPE CE)</code> consists of an object property expression <i>OPE</i> and a
<i>OWLObjectHasSelf</i>	A self-restriction <code>ObjectHasSelf(OPE)</code> consists of an object property expression <i>OPE</i> ,
<i>OWLObjectHasValue</i>	A has-value class expression <code>ObjectHasValue(OPE a)</code> consists of an object property expression <i>OPE</i> and an
<i>OWLObjectOneOf</i>	An enumeration of individuals <code>ObjectOneOf(a1 ... an)</code> contains exactly the individuals <i>a_i</i> with $1 \leq i \leq n$.
<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 <code>DataMinCardinality(n DPE DR)</code> consists of a nonnegative integer <i>n</i> , a data
<i>OWLDataMaxCardinality</i>	A maximum cardinality expression <code>ObjectMaxCardinality(n OPE CE)</code> consists of a nonnegative integer <i>n</i> , an object
<i>OWLDataExactCardinality</i>	An exact cardinality expression <code>ObjectExactCardinality(n OPE CE)</code> consists of a nonnegative integer <i>n</i> , an
<i>OWLDataSomeValuesFrom</i>	An existential class expression <code>DataSomeValuesFrom(DPE1 ... DPE_n DR)</code> consists of <i>n</i> data property expressions
<i>OWLDataAllValuesFrom</i>	A universal class expression <code>DataAllValuesFrom(DPE1 ... DPE_n DR)</code> consists of <i>n</i> data property expressions <i>DPE_i</i> ,
<i>OWLDataHasValue</i>	A has-value class expression <code>DataHasValue(DPE lt)</code> consists of a data property expression <i>DPE</i> and a literal <i>lt</i> ,
<i>OWLDataOneOf</i>	An enumeration of literals <code>DataOneOf(lt1 ... lt_n)</code> contains exactly the explicitly specified literals <i>lt_i</i> with
<i>OWLDatatypeRestriction</i>	A datatype restriction <code>DatatypeRestriction(DT F1 lt1 ... Fn lt_n)</code> consists of a unary datatype <i>DT</i> and <i>n</i> pairs
<i>OWLFacetRestriction</i>	A facet restriction is used to restrict a particular datatype.

Module Contents

class owlapy.class_expression.restriction.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.class_expression.restriction.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.

class owlapy.class_expression.restriction.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.class_expression.restriction.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

class owlapy.class_expression.restriction.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.restriction.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.restriction.**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)

__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.restriction.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.class_expression.restriction.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.class_expression.restriction.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.class_expression.restriction.OWLPropertyRange

Bases: *owlapy.owl_object.OWLObject*

OWL Objects that can be the ranges of properties.

class owlapy.class_expression.restriction.OWLDatRange

Bases: *OWLPropertyRange*

Represents a DataRange in the OWL 2 Specification.

class owlapy.class_expression.restriction.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.

class owlapy.class_expression.restriction.OWLIndividual

Bases: *owlapy.owl_object.OWLObject*

Represents a named or anonymous individual.

__slots__ = ()

class owlapy.class_expression.restriction.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>)

__slots__ = '_iri'

type_index: Final = 4001

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

class owlapy.class_expression.restriction.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.class_expression.restriction.OWLFacet (remainder: str, symbolic_form: str,
    operator: Callable[[_X, _X], bool])
    Bases: _Vocabulary, enum.Enum
    Enumerations for OWL facets.
    property symbolic_form
    property operator
    static from_str (name: str) → OWLFacet
    MIN_INCLUSIVE: Final
    MIN_EXCLUSIVE: Final
    MAX_INCLUSIVE: Final
    MAX_EXCLUSIVE: Final
    LENGTH: Final
    MIN_LENGTH: Final
    MAX_LENGTH: Final
    PATTERN: Final
    TOTAL_DIGITS: Final
    FRACTION_DIGITS: Final

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)

```
__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)

```
__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)

```
__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.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)

```

__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)

```

__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 ... a_n) contains exactly the individuals a_i with $1 \leq i \leq n$. (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 {`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*], *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.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)

    __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)

    __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 $(= 1 \text{ R D}) \Rightarrow (= 1 \text{ R D})$ 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*₁ ... *DPE*_{*n*} *DR*) consists of *n* data property expressions *DPE*_{*i*}, $1 \leq i \leq n$, and a data range *DR* whose arity must be *n*. Such a class expression contains all those individuals that are connected by *DPE*_{*i*} to literals *lti*, $1 \leq i \leq n$, such that the tuple (*lt*₁ , ..., *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)

__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*(*DPE*₁ ... *DPE*_{*n*} *DR*) consists of *n* data property expressions *DPE*_{*i*}, $1 \leq i \leq n$, and a data range *DR* whose arity must be *n*. Such a class expression contains all those individuals that

are connected by *DPE*_{*i*} only to literals *lti*, $1 \leq i \leq n$, such that each tuple (*lt*₁ , ..., *lt*_{*n*}) 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)

__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)

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

Bases: *owlapy.owl_data_ranges.OWLDataRange*

A datatype restriction *DatatypeRestriction*(DT F1 lt1 ... 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)

__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).

```

Attributes

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

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
<i>OWLObjectIntersectionOf</i>	An intersection class expression ObjectIntersectionOf(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 ObjectHasSelf(OPE) consists of an object property expression OPE,
<i>OWLDataOneOf</i>	An enumeration of literals DataOneOf(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.

continues on next page

Table 2 – continued from previous page

<i>OWLObjectSomeValuesFrom</i>	An existential class expression <code>ObjectSomeValuesFrom(OPE CE)</code> consists of an object property expression <code>OPE</code> and
<i>OWLObjectAllValuesFrom</i>	A universal class expression <code>ObjectAllValuesFrom(OPE CE)</code> consists of an object property expression <code>OPE</code> and a
<i>OWLObjectHasValue</i>	A has-value class expression <code>ObjectHasValue(OPE a)</code> consists of an object property expression <code>OPE</code> and an
<i>OWLDatatypeRestriction</i>	A datatype restriction <code>DatatypeRestriction(DT F1 lt1 ... Fn ltn)</code> consists of a unary datatype <code>DT</code> and <code>n</code> 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 <code>ObjectMinCardinality(n OPE CE)</code> consists of a nonnegative integer <code>n</code> , an object
<i>OWLObjectMaxCardinality</i>	A maximum cardinality expression <code>ObjectMaxCardinality(n OPE CE)</code> consists of a nonnegative integer <code>n</code> , an object
<i>OWLObjectExactCardinality</i>	An exact cardinality expression <code>ObjectExactCardinality(n OPE CE)</code> consists of a nonnegative integer <code>n</code> , an object
<i>OWLDataSomeValuesFrom</i>	An existential class expression <code>DataSomeValuesFrom(DPE1 ... DPEn DR)</code> consists of <code>n</code> data property expressions
<i>OWLDataAllValuesFrom</i>	A universal class expression <code>DataAllValuesFrom(DPE1 ... DPEn DR)</code> consists of <code>n</code> data property expressions <code>DPEi</code> ,
<i>OWLDataHasValue</i>	A has-value class expression <code>DataHasValue(DPE lt)</code> consists of a data property expression <code>DPE</code> and a literal <code>lt</code> ,
<i>OWLDataMinCardinality</i>	A minimum cardinality expression <code>DataMinCardinality(n DPE DR)</code> consists of a nonnegative integer <code>n</code> , a data
<i>OWLDataMaxCardinality</i>	A maximum cardinality expression <code>ObjectMaxCardinality(n OPE CE)</code> consists of a nonnegative integer <code>n</code> , an object
<i>OWLDataExactCardinality</i>	An exact cardinality expression <code>ObjectExactCardinality(n OPE CE)</code> consists of a nonnegative integer <code>n</code> , an
<i>OWLObjectOneOf</i>	An enumeration of individuals <code>ObjectOneOf(a1 ... an)</code> contains exactly the individuals <code>ai</code> with $1 \leq i \leq n$.
<i>OWLRDFVocabulary</i>	Enumerations for OWL/RDF vocabulary.

Package Contents

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)

__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.OLObjectComplementOf (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)
    __slots__ = ('_iri', '_is_nothing', '_is_thing')
    type_index: Final = 1001
    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
    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)

__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)

__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.OLObjectRestriction
    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.OLObjectPropertyExpression

        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)

```

```

__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)

```

__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` , `li`). 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 `li`. (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

    static from_str(name: str) → OWLFacet

    MIN_INCLUSIVE: Final

    MIN_EXCLUSIVE: Final

    MAX_INCLUSIVE: Final

    MAX_EXCLUSIVE: Final

    LENGTH: Final

    MIN_LENGTH: Final

    MAX_LENGTH: Final

    PATTERN: Final

    TOTAL_DIGITS: Final

    FRACTION_DIGITS: Final

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)

```

__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)

```

__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 ($= 1 \text{ R C}$) $\Rightarrow 1 \text{ R C}$ 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 `(lt1 , ..., ltn)` 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)

```
__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 `DPEi` 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)

```
__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* *It*) consists of a data property expression *DPE* and a literal *It*, and it contains all those individuals that are connected by *DPE* to *It*. Each such class expression can be seen as a syntactic shortcut for the class expression *DataSomeValuesFrom*(*DPE* *DataOneOf*(*It*)). (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)

```
__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)

```
__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)

```
__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*(a1 ... an) contains exactly the individuals ai with $1 \leq i \leq n$. (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.OWLRDFVocabulary(
    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.

Attributes

<i>TopOWLDatatype</i>
<i>converter</i>

Classes

<i>OWLObjectHasValue</i>	A has-value class expression <code>ObjectHasValue(OPE a)</code> consists of an object property expression OPE and an
<i>OWLObjectOneOf</i>	An enumeration of individuals <code>ObjectOneOf(a1 ... an)</code> contains exactly the individuals a_i with $1 \leq i \leq n$.
<i>OWLDatatypeRestriction</i>	A datatype restriction <code>DatatypeRestriction(DT F1 lt1 ... Fn ltn)</code> consists of a unary datatype DT and n pairs
<i>OWLDataMinCardinality</i>	A minimum cardinality expression <code>DataMinCardinality(n DPE DR)</code> consists of a nonnegative integer n, a data
<i>OWLDataMaxCardinality</i>	A maximum cardinality expression <code>ObjectMaxCardinality(n OPE CE)</code> consists of a nonnegative integer n, an object
<i>OWLDataExactCardinality</i>	An exact cardinality expression <code>ObjectExactCardinality(n OPE CE)</code> consists of a nonnegative integer n, an
<i>OWLClass</i>	An OWL 2 named Class. Classes can be understood as sets of individuals.
<i>OWLClassExpression</i>	OWL Class expressions represent sets of individuals by formally specifying conditions on the individuals' properties;
<i>OWLObjectIntersectionOf</i>	An intersection class expression <code>ObjectIntersectionOf(CE1 ... CEn)</code> contains all individuals that are instances
<i>OWLObjectUnionOf</i>	A union class expression <code>ObjectUnionOf(CE1 ... CEn)</code> contains all individuals that are instances
<i>OWLObjectComplementOf</i>	Represents an <code>ObjectComplementOf</code> class expression in the OWL 2 Specification.
<i>OWLObjectSomeValuesFrom</i>	An existential class expression <code>ObjectSomeValuesFrom(OPE CE)</code> consists of an object property expression OPE and
<i>OWLObjectAllValuesFrom</i>	A universal class expression <code>ObjectAllValuesFrom(OPE CE)</code> consists of an object property expression OPE and a
<i>OWLObjectCardinalityRestriction</i>	Represents Object Property Cardinality Restrictions in the OWL 2 specification.
<i>OWLObjectMinCardinality</i>	A minimum cardinality expression <code>ObjectMinCardinality(n OPE CE)</code> consists of a nonnegative integer n, an object
<i>OWLObjectMaxCardinality</i>	A maximum cardinality expression <code>ObjectMaxCardinality(n OPE CE)</code> consists of a nonnegative integer n, an object
<i>OWLObjectExactCardinality</i>	An exact cardinality expression <code>ObjectExactCardinality(n OPE CE)</code> consists of a nonnegative integer n, an object
<i>OWLDataCardinalityRestriction</i>	Represents Data Property Cardinality Restrictions.

continues on next page

Table 3 – continued from previous page

<i>OWLObjectHasSelf</i>	A self-restriction <code>ObjectHasSelf(OPE)</code> consists of an object property expression <code>OPE</code> ,
<i>OWLDataSomeValuesFrom</i>	An existential class expression <code>DataSomeValuesFrom(DPE1 ... DPE_n DR)</code> consists of <i>n</i> data property expressions
<i>OWLDataAllValuesFrom</i>	A universal class expression <code>DataAllValuesFrom(DPE1 ... DPE_n DR)</code> consists of <i>n</i> data property expressions <code>DPE_i</code> ,
<i>OWLDataHasValue</i>	A has-value class expression <code>DataHasValue(DPE lt)</code> consists of a data property expression <code>DPE</code> and a literal <code>lt</code> ,
<i>OWLDataOneOf</i>	An enumeration of literals <code>DataOneOf(lt1 ... lt_n)</code> contains exactly the explicitly specified literals <code>lt_i</code> with
<i>OWLNamedIndividual</i>	Named individuals are identified using an IRI. Since they are given an IRI, named individuals are entities.
<i>OWLLiteral</i>	Literals represent data values such as particular strings or integers. They are analogous to typed RDF
<i>OWLObjectProperty</i>	Represents an Object Property in the OWL 2 Specification. Object properties connect pairs of individuals.
<i>OWLDataProperty</i>	Represents a Data Property in the OWL 2 Specification. Data properties connect individuals with literals.
<i>OWLEntity</i>	Represents Entities in the OWL 2 Specification.
<i>OWLDatatype</i>	Datatypes are entities that refer to sets of data values. Thus, datatypes are analogous to classes,
<i>OWLFacet</i>	Enumerations for OWL facets.
<i>OWLRDFVocabulary</i>	Enumerations for OWL/RDF vocabulary.
<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 (https://www.w3.org/TR/owl2-syntax/#Class_Expressions) into a SPARQL query

Module Contents

```
class owlapy.converter.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)

```

__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.converter.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)
    __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.converter.OWLDataTypeRestriction (type_: owlapy.owl_datatype.OWLDatatype,
    facet_restrictions: OWLFacetRestriction | Iterable[OWLFacetRestriction])
```

Bases: *owlapy.owl_data_ranges.OWLDataRange*

A datatype restriction *DataTypeRestriction*(DT F1 lt1 ... 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)

```
__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.converter.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.converter.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)

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

```
type_index: Final = 3017
```

```
class owlapy.converter.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)

```
__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 ($= 1 \text{ R D} \Rightarrow 1 \text{ R D}$ and $\leq 1 \text{ R D}$).

```
class owlapy.converter.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>)

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

```
type_index: Final = 1001
```

```
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

```
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.converter.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)

__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.converter.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

class owlapy.converter.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.converter.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.converter.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.converter.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)

```
__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.converter.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.converter.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.converter.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)

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

type_index: Final = 3010

class owlapy.converter.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)

__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.converter.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.converter.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.converter.OWLDataSomeValuesFrom(
property: owlapy.owl_property.OWLDataPropertyExpression,
filler: owlapy.owl_data_ranges.OWLDataRange)
Bases: OWLQuantifiedDataRestriction

An existential class expression DataSomeValuesFrom(DPE1 ... DPE_n DR) consists of n data property expressions DPE_i, 1 ≤ i ≤ n, and a data range DR whose arity must be n. Such a class expression contains all those individuals that are connected by DPE_i to literals lti, 1 ≤ i ≤ n, such that the tuple (lt1 , ..., ltn) 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)

```

__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.converter.OWLDataAllValuesFrom (
    property: owlapy.owl_property.OWLDataPropertyExpression,
    filler: owlapy.owl_data_ranges.OWLDataRange)
```

Bases: OWLQuantifiedDataRestriction

A universal class expression DataAllValuesFrom(DPE₁ ... DPE_n DR) consists of n data property expressions DPE_i, 1 ≤ i ≤ n, and a data range DR whose arity must be n. Such a class expression contains all those individuals that

are connected by DPE_i only to literals lti, 1 ≤ i ≤ n, such that each tuple (lt₁ , ..., lt_n) 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)

```
__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.converter.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)

```
__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.converter.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($l_{t1} \dots l_{tn}$) 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)

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.converter.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)

__slots__ = *'_iri'*

type_index: Final = 1005

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

class owlapy.converter.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.converter.TopOWLDatatype: Final`

`class owlapy.converter.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)

`__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.converter.OWLObjectProperty (iri: *owlapy.iri.IRI* | str)

Bases: OWLObjectPropertyExpression, OWLObjectProperty

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)

__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

class owlapy.converter.OWLEntity

Bases: OWLNamedObject

Represents Entities in the OWL 2 Specification.

__slots__ = ()

to_string_id () → str

is_anonymous () → bool

class owlapy.converter.OWLDatatype (iri: *owlapy.iri.IRI* | *owlapy.meta_classes.HasIRI*)

Bases: *owlapy.owl_object.OWLEntity*, *owlapy.owl_data_ranges.OWLDatatype*

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>)

```
__slots__ = '_iri'
```

```
type_index: Final = 4001
```

```
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

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

Bases: `_Vocabulary`, `enum.Enum`

Enumerations for OWL facets.

```
property symbolic_form
```

```
property operator
```

```
static from_str (name: str) → OWLFacet
```

```
MIN_INCLUSIVE: Final
```

```
MIN_EXCLUSIVE: Final
```

```
MAX_INCLUSIVE: Final
```

```
MAX_EXCLUSIVE: Final
```

```
LENGTH: Final
```

```
MIN_LENGTH: Final
```

```
MAX_LENGTH: Final
```

```
PATTERN: Final
```

```
TOTAL_DIGITS: Final
```

```
FRACTION_DIGITS: Final
```

```
class owlapy.converter.OWLRDFVocabulary (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.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.

`__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]

property modal_depth

abstract render (e)

stack_variable (var)

stack_parent (parent: owlapy.class_expression.OWLClassExpression)

property current_variable

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) 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

Classes

<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.
<i>Namespaces</i>	Namespaces provide a simple method for qualifying element and attribute names used in Extensible Markup
<i>IRI</i>	An IRI, consisting of a namespace and a remainder.

Module Contents

class owlapy.iri.OWLAnnotationSubject

Bases: OWLAnnotationObject

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

__slots__ = ()

class owlapy.iri.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

```
class owlapy.iri.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

```
__slots__ = ('_prefix', '_ns')
```

```
property ns: str
```

```
property prefix: str
```

```
__repr__()
```

Return repr(self).

```
__hash__()
```

Return hash(self).

```
__eq__(other)
```

Return self==value.

```
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.

```
__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.

property str: str

Returns: The string that specifies the IRI.

property reminder: str

Returns: The string corresponding to the reminder of 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.

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.

Module Contents

class owlapy.meta_classes.**HasIRI**

Simple class to access the IRI.

__slots__ = ()

property `iri`: *IRI*

Abstractmethod

Gets the IRI of this object.

Returns

The IRI of this object.

property `str`: `str`

Abstractmethod

Gets the string representation of this object

Returns

The IRI as string

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.

Attributes

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

Classes

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

Module Contents

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

__slots__ = ('_prefix', '_ns')

property ns: str

property prefix: str

__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

Classes

<i>OWLObject</i>	Base interface for OWL objects
<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.

Module Contents

class owlapy.owl_annotation.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_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

owlapy.owl_axiom

OWL Axioms

Attributes

OWLNothing

OWLThing

Classes

<i>OWLDataPropertyExpression</i>	A high level interface to describe different types of data properties.
<i>OWLObjectPropertyExpression</i>	A high level interface to describe different types of object properties.
<i>OWLObject</i>	Base interface for OWL objects
<i>OWLEntity</i>	Represents Entities in the OWL 2 Specification.
<i>OWLDatatype</i>	Datatypes are entities that refer to sets of data values. Thus, datatypes are analogous to classes,
<i>OWLDatRange</i>	Represents a DataRange in the OWL 2 Specification.
<i>HasOperands</i>	An interface to objects that have a collection of operands.
<i>OWLPropertyExpression</i>	Represents a property or possibly the inverse of a property.
<i>OWLProperty</i>	A base class for properties that aren't expression i.e. named properties. By definition, properties
<i>OWLClassExpression</i>	OWL Class expressions represent sets of individuals by formally specifying conditions on the individuals' properties;
<i>OWLClass</i>	An OWL 2 named Class. Classes can be understood as sets of individuals.

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Table 4 – continued from previous page

<i>OWLObjectUnionOf</i>	A union class expression <code>ObjectUnionOf(CE1 ... CEn)</code> contains all individuals that are instances
<i>OWLIndividual</i>	Represents a named or anonymous individual.
<i>IRI</i>	An IRI, consisting of a namespace and a remainder.
<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.
<i>OWLLiteral</i>	Literals represent data values such as particular strings or integers. They are analogous to typed RDF
<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>OWLObjectPropertyAxiom</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 <code>DatatypeDefinition(DT DR)</code> defines a new datatype DT as being semantically
<i>OWLHasKeyAxiom</i>	A key axiom <code>HasKey(CE (OPE1 ... OPEm) (DPE1 ... DPEn))</code> 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 <code>EquivalentClasses(CE1 ... CEn)</code> states that all of the class expressions CE_i ,
<i>OWLDisjointClassesAxiom</i>	A disjoint classes axiom <code>DisjointClasses(CE1 ... CEn)</code> states that all of the class expressions CE_i , $1 \leq i \leq n$,
<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 <code>DifferentIndividuals(a1 ... an)</code> states that all of the individuals a_i ,
<i>OWLSameIndividualAxiom</i>	An individual equality axiom <code>SameIndividual(a1 ... an)</code> states that all of the individuals a_i , $1 \leq i \leq n$,
<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 <code>EquivalentObjectProperties(OPE1 ... OPEn)</code> states that all of the object
<i>OWLDisjointObjectPropertiesAxiom</i>	A disjoint object properties axiom <code>DisjointObjectProperties(OPE1 ... OPEn)</code> states that all of the object
<i>OWLInverseObjectPropertiesAxiom</i>	An inverse object properties axiom <code>InverseObjectProperties(OPE1 OPE2)</code> states that the object property
<i>OWLEquivalentDataPropertiesAxiom</i>	An equivalent data properties axiom <code>EquivalentDataProperties(DPE1 ... DPEn)</code> states that all the data property
<i>OWLDisjointDataPropertiesAxiom</i>	A disjoint data properties axiom <code>DisjointDataProperties(DPE1 ... DPEn)</code> states that all of the data property

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Table 4 – continued from previous page

<i>OWLSubClassOfAxiom</i>	A subclass axiom <code>SubClassOf(CE1 CE2)</code> states that the class expression CE1 is a subclass of the class
<i>OWLDisjointUnionAxiom</i>	A disjoint union axiom <code>DisjointUnion(C CE1 ... CEn)</code> states that a class C is a disjoint union of the class
<i>OWLClassAssertionAxiom</i>	A class assertion <code>ClassAssertion(CE a)</code> states that the individual a is an instance of the class expression CE.
<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 as — an IRI or an
<i>OWLSubAnnotationPropertyOfAxiom</i>	An annotation subproperty axiom <code>SubAnnotationPropertyOf(AP1 AP2)</code> states that the annotation property AP1 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 DPE1 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 a1 is
<i>OWLNegativeObjectPropertyAssertionAxiom</i>	A negative object property assertion <code>NegativeObjectPropertyAssertion(OPE a1 a2)</code> states that the individual a1
<i>OWLDataPropertyAssertionAxiom</i>	A positive data property assertion <code>DataPropertyAssertion(DPE a lt)</code> states that the individual a is connected
<i>OWLNegativeDataPropertyAssertionAxiom</i>	A negative data property assertion <code>NegativeDataPropertyAssertion(DPE a lt)</code> states that the individual a 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

continues on next page

Table 4 – continued from previous page

<i>OWLSymmetricObjectPropertyAxiom</i>	An object property symmetry axiom <i>SymmetricObjectProperty</i> (OPE) states that
<i>OWLTransitiveObjectPropertyAxiom</i>	An object property transitivity axiom <i>TransitiveObjectProperty</i> (OPE) states that the
<i>OWLDataPropertyCharacteristicAxiom</i>	Base interface for Functional data property axiom.
<i>OWLFunctionalDataPropertyAxiom</i>	A data property functionality axiom <i>FunctionalDataProperty</i> (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 <i>ObjectPropertyDomain</i> (OPE CE) states that the domain of the
<i>OWLDataPropertyDomainAxiom</i>	A data property domain axiom <i>DataPropertyDomain</i> (DPE CE) states that the domain of the
<i>OWLObjectPropertyRangeAxiom</i>	An object property range axiom <i>ObjectPropertyRange</i> (OPE CE) states that the range of the object property
<i>OWLDataPropertyRangeAxiom</i>	A data property range axiom <i>DataPropertyRange</i> (DPE DR) states that the range of the data property

Module Contents

class owlapy.owl_axiom.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_axiom.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_axiom.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_axiom.OWLEntity
```

Bases: OWLNamedObject

Represents Entities in the OWL 2 Specification.

```
__slots__ = ()
```

```
to_string_id() → str
```

```
is_anonymous() → bool
```

```
class owlapy.owl_axiom.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>)

```
__slots__ = '_iri'
```

```
type_index: Final = 4001
```

```
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

```
class owlapy.owl_axiom.OWLDataRange
```

Bases: OWLPropertyRange

Represents a DataRange in the OWL 2 Specification.

```
class owlapy.owl_axiom.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.owl_axiom.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_axiom.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.

```
__slots__ = '_iri'
```



```

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.

class owlapy.owl_axiom.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)

    __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.owl_axiom.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)

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

    type_index: Final = 1001

```

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

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.owl_axiom.OWLNothing: *Final*

owlapy.owl_axiom.OWLThing: *Final*

class *owlapy.owl_axiom.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 ≤ i ≤ n. (https://www.w3.org/TR/owl2-syntax/#Union_of_Class_Expressions)

__slots__ = *'_operands'*

type_index: *Final* = 3002

class *owlapy.owl_axiom.OWLIndividual*

Bases: *owlapy.owl_object.OWLObject*

Represents a named or anonymous individual.

__slots__ = ()

class owlapy.owl_axiom.**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.

__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.

property str: str

Returns: The string that specifies the IRI.

property remainder: str

Returns: The string corresponding to the remainder of 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.

class owlapy.owl_axiom.**OWLAnnotationSubject**

Bases: `OWLAnnotationObject`

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

__slots__ = ()

class owlapy.owl_axiom.**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

class owlapy.owl_axiom.**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.

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 expres-
    sions 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 InverseFunc-
    tionalObjectProperty( 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 CE_i, 1 ≤ i ≤ n, are semantically equivalent to each other. This axiom allows one to use each CE_i as a synonym for each CE_j — that is, in any expression in the ontology containing such an axiom, CE_i can be replaced with CE_j 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)

```
__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)

```
__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)

```

__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)

```
__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_n) states that all the data property expressions DPE_i, 1 ≤ i ≤ n, are semantically equivalent to each other. This axiom allows one to use each DPE_i as a synonym for each DPE_j — that is, in any expression in the ontology containing such an axiom, DPE_i can be replaced with DPE_j without affecting the meaning of the ontology.

(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_n) states that all of the data property expressions DPE_i, 1 ≤ i ≤ n, are pairwise disjoint; that is, no individual x can be connected to a literal y by both

DPE_i and DPE_j for i ≠ j.

(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)

```

__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.

    __slots__ = '_iri'

    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

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)

__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)

__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)

```

__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)

```

__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)

```

__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)

```
__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)

```
__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)

```
__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)

```
__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)

```
__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)

```
__slots__ = ()
```

owlapy.owl_data_ranges

OWL Data Ranges

https://www.w3.org/TR/owl2-syntax/#Data_Ranges

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

Classes

<i>OWLObject</i>	Base interface for OWL objects
<i>HasOperands</i>	An interface to objects that have a collection of operands.
<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

Module Contents

class owlapy.owl_data_ranges.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_data_ranges.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.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)

```

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

Classes

<i>OWLEntity</i>	Represents Entities in the OWL 2 Specification.
<i>OWLDataRange</i>	Represents a DataRange in the OWL 2 Specification.
<i>IRI</i>	An IRI, consisting of a namespace and a remainder.
<i>HasIRI</i>	Simple class to access the IRI.
<i>OWLDatatype</i>	Datatypes are entities that refer to sets of data values. Thus, datatypes are analogous to classes,

Module Contents

class owlapy.owl_datatype.**OWLEntity**

Bases: OWLNamedObject

Represents Entities in the OWL 2 Specification.

__slots__ = ()

to_string_id() → str

is_anonymous() → bool

class owlapy.owl_datatype.**OWLDataRange**

Bases: OWLPropertyRange

Represents a DataRange in the OWL 2 Specification.

class owlapy.owl_datatype.**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.

__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.

property str: str

Returns: The string that specifies the IRI.

property reminder: str

Returns: The string corresponding to the reminder of 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.

class owlapy.owl_datatype.HasIRI

Simple class to access the IRI.

__slots__ = ()

property iri: *IRI*

Abstractmethod

Gets the IRI of this object.

Returns

The IRI of this object.

property str: str

Abstractmethod

Gets the string representation of this object

Returns

The IRI as string

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>)

__slots__ = `'_iri'`

type_index: `Final = 4001`

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

owlapy.owl_hierarchy

Classes representing hierarchy in OWL.

Attributes

OWLThing

OWLNothing

OWLTopObjectProperty

OWLBottomObjectProperty

OWLTopDataProperty

OWLBottomDataProperty

Classes

<i>OWLClass</i>	An OWL 2 named Class. Classes can be understood as sets of individuals.
<i>HasIRI</i>	Simple class to access the IRI.
<i>OWLObjectProperty</i>	Represents an Object Property in the OWL 2 Specification. Object properties connect pairs of individuals.
<i>OWLObjectProperty</i>	Represents a Data Property in the OWL 2 Specification. Data properties connect individuals with literals.
<i>OWLReasoner</i>	An OWLReasoner reasons over a set of axioms (the set of reasoner axioms) that is based on the imports closure of
<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 object property hierarchy.
<i>DatatypePropertyHierarchy</i>	Representation of a data property hierarchy.

Module Contents

class owlapy.owl_hierarchy.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>)

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

type_index: Final = 1001

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

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.owl_hierarchy.OwlThing: Final

owlapy.owl_hierarchy.OwlNothing: Final

class owlapy.owl_hierarchy.HasIRI
    Simple class to access the IRI.

    __slots__ = ()

    property iri: IRI

        Abstractmethod
            Gets the IRI of this object.

            Returns
                The IRI of this object.

    property str: str

        Abstractmethod
            Gets the string representation of this object

            Returns
                The IRI as string

owlapy.owl_hierarchy.OwlTopObjectProperty: Final

owlapy.owl_hierarchy.OwlBottomObjectProperty: Final

owlapy.owl_hierarchy.OwlTopDataProperty: Final

owlapy.owl_hierarchy.OwlBottomDataProperty: Final

class owlapy.owl_hierarchy.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)

    __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_hierarchy.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)

__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

class owlapy.owl_hierarchy.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 `super_classes(DataSomeValuesFrom(pe rdfs:Literal), true)`. If `direct` is `False`: then the result of `super_classes(DataSomeValuesFrom(pe rdfs:Literal), false)` together with N if N is non-empty. (Note, `rdfs:Literal` is the top datatype).

abstract object_property_domains (*pe*: *owlapy.owl_property.OWLObjectProperty*,
direct: *bool* = *False*) \rightarrow *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 $N = \text{equivalent_classes}(\text{ObjectSomeValuesFrom}(\text{pe } \text{owl:Thing}))$. If `direct` is `True`: then if N is not empty then the return value is N , else the return value is the result of `super_classes(ObjectSomeValuesFrom(pe owl:Thing), true)`. If `direct` is `False`: then the result of `super_classes(ObjectSomeValuesFrom(pe owl:Thing), false)` together with N if N is non-empty.

abstract object_property_ranges (*pe*: *owlapy.owl_property.OWLObjectProperty*,
direct: *bool* = *False*) \rightarrow *Iterable*[*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 `super_classes(ObjectSomeValuesFrom(ObjectInverseOf(pe owl:Thing), true)`. If `direct` is `False`: then the result of `super_classes(ObjectSomeValuesFrom(ObjectInverseOf(pe owl:Thing), false)` together with N if N is non-empty.

abstract equivalent_classes (*ce*: *owlapy.class_expression.OWLClassExpression*,
only_named: *bool* = *True*) \rightarrow *Iterable*[*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 Object-ComplementOf(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.OWL ontology*

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.

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', ...)

classmethod get_top_entity () → _S

Abstractmethod

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

classmethod **get_bottom_entity** () → *_S*

Abstractmethod

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

Classes

<i>OWLObject</i>	Base interface for OWL objects
<i>OWLEntity</i>	Represents Entities in the OWL 2 Specification.
<i>IRI</i>	An IRI, consisting of a namespace and a remainder.
<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.

Module Contents

class owlapy.owl_individual.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_individual.OWLEntity

Bases: OWLNamedObject

Represents Entities in the OWL 2 Specification.

__slots__ = ()

to_string_id () → str

is_anonymous () → bool

class owlapy.owl_individual.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.

__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.

property str: str

Returns: The string that specifies the IRI.

property reminder: str

Returns: The string corresponding to the reminder of 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.

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)

```
__slots__ = '_iri'
```

```
type_index: Final = 1005
```

```
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

owlapy.owl_literal

OWL Literals

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>

Classes

<i>OWLAnnotationValue</i>	A marker interface for annotation values, which can either be an IRI (URI), Literal or Anonymous Individual.
<i>OWLDatatype</i>	Datatypes are entities that refer to sets of data values. Thus, datatypes are analogous to classes,
<i>OWLRDFVocabulary</i>	Enumerations for OWL/RDF vocabulary.
<i>XSDVocabulary</i>	Enumerations for XSD vocabulary.
<i>OWLObjectProperty</i>	Represents an Object Property in the OWL 2 Specification. Object properties connect pairs of individuals.
<i>OWLDataProperty</i>	Represents a Data Property in the OWL 2 Specification. Data properties connect individuals with literals.
<i>OWLLiteral</i>	Literals represent data values such as particular strings or integers. They are analogous to typed RDF

Module Contents

class owlapy.owl_literal.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

class owlapy.owl_literal.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>)

__slots__ = '_iri'

type_index: Final = 4001

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

class owlapy.owl_literal.OWLRDFVocabulary(*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.owl_literal.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.owl_literal.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)

__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_literal.OWLObjectProperty(*iri: owlapy.iri.IRI | str*)

Bases: OWLObjectPropertyExpression, OWLObjectProperty

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)

__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_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

Classes

<i>HasIRI</i>	Simple class to access the IRI.
<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.

Module Contents

```
class owlapy.owl_object.HasIRI
```

Simple class to access the IRI.

```
__slots__ = ()
```

```
property iri: IRI
```

Abstractmethod

Gets the IRI of this object.

Returns

The IRI of this object.

```
property str: str
```

Abstractmethod

Gets the string representation of this object

Returns

The IRI as string

```
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

Attributes

<i>IntegerOWLDatatype</i>
<i>DoubleOWLDatatype</i>
<i>BooleanOWLDatatype</i>
<i>StringOWLDatatype</i>
<i>DateOWLDatatype</i>
<i>DateTimeOWLDatatype</i>
<i>DurationOWLDatatype</i>
<i>OWLThing</i>
<i>logger</i>
<i>OWLREADY2_FACET_KEYS</i>

Classes

<i>OWLEquivalentClassesAxiom</i>	An equivalent classes axiom <code>EquivalentClasses(CE1 ... CEn)</code> states that all of the class expressions <code>CEi</code> ,
<i>OWLClassAxiom</i>	The base interface for class axioms.
<i>OWLDataPropertyDomainAxiom</i>	A data property domain axiom <code>DataPropertyDomain(DPE CE)</code> states that the domain of the
<i>OWLDataPropertyRangeAxiom</i>	A data property range axiom <code>DataPropertyRange(DPE DR)</code> states that the range of the data property
<i>OWLObjectPropertyDomainAxiom</i>	An object property domain axiom <code>ObjectPropertyDomain(OPE CE)</code> states that the domain of the
<i>OWLObjectPropertyRangeAxiom</i>	An object property range axiom <code>ObjectPropertyRange(OPE CE)</code> states that the range of the object property
<i>OWLSubClassOfAxiom</i>	A subclass axiom <code>SubClassOf(CE1 CE2)</code> states that the class expression <code>CE1</code> is a subclass of the class
<i>OWLAnnotationProperty</i>	Represents an <code>AnnotationProperty</code> in the OWL 2 specification.
<i>OWLDatRange</i>	Represents a <code>DataRange</code> in the OWL 2 Specification.
<i>OWLDatComplementOf</i>	A complement data range <code>DataComplementOf(DR)</code> contains all tuples of literals that are not contained in the

continues on next page

Table 5 – continued from previous page

<i>OWLDataUnionOf</i>	A union data range <i>DataUnionOf</i> (DR1 ... DRn) contains all tuples of literals that are contained in the at least
<i>OWLDataIntersectionOf</i>	An intersection data range <i>DataIntersectionOf</i> (DR1 ... DRn) contains all tuples of literals that are contained
<i>OWLDatatype</i>	Datatypes are entities that refer to sets of data values. Thus, datatypes are analogous to classes,
<i>OWLNamedIndividual</i>	Named individuals are identified using an IRI. Since they are given an IRI, named individuals are entities.
<i>OWLIndividual</i>	Represents a named or anonymous individual.
<i>OWLLiteral</i>	Literals represent data values such as particular strings or integers. They are analogous to typed RDF
<i>OWLObject</i>	Base interface for OWL objects
<i>IRI</i>	An IRI, consisting of a namespace and a remainder.
<i>OWLClass</i>	An OWL 2 named Class. Classes can be understood as sets of individuals.
<i>OWLClassExpression</i>	OWL Class expressions represent sets of individuals by formally specifying conditions on the individuals' properties;
<i>OWLObjectComplementOf</i>	Represents an <i>ObjectComplementOf</i> class expression in the OWL 2 Specification.
<i>OWLObjectUnionOf</i>	A union class expression <i>ObjectUnionOf</i> (CE1 ... CEn) contains all individuals that are instances
<i>OWLObjectIntersectionOf</i>	An intersection class expression <i>ObjectIntersectionOf</i> (CE1 ... CEn) contains all individuals that are instances
<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>OWLObjectOneOf</i>	An enumeration of individuals <i>ObjectOneOf</i> (a1 ... an) contains exactly the individuals ai with $1 \leq i \leq n$.
<i>OWLObjectExactCardinality</i>	An exact cardinality expression <i>ObjectExactCardinality</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>OWLObjectMinCardinality</i>	A minimum cardinality expression <i>ObjectMinCardinality</i> (n OPE CE) consists of a nonnegative integer n, an object
<i>OWLObjectHasValue</i>	A has-value class expression <i>ObjectHasValue</i> (OPE a) consists of an object property expression OPE and an
<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>OWLDataExactCardinality</i>	An exact cardinality expression <i>ObjectExactCardinality</i> (n OPE CE) consists of a nonnegative integer n, an
<i>OWLDataMaxCardinality</i>	A maximum cardinality expression <i>ObjectMaxCardinality</i> (n OPE CE) consists of a nonnegative integer n, an object

continues on next page

Table 5 – continued from previous page

<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>OWLDataHasValue</i>	A has-value class expression <i>DataHasValue</i> (DPE <i>It</i>) consists of a data property expression DPE and a literal <i>It</i> ,
<i>OWLDataOneOf</i>	An enumeration of literals <i>DataOneOf</i> (<i>It</i> ₁ ... <i>It</i> _{<i>n</i>}) contains exactly the explicitly specified literals <i>It</i> _{<i>i</i>} with
<i>OWLDatatypeRestriction</i>	A datatype restriction <i>DatatypeRestriction</i> (DT F ₁ <i>It</i> ₁ ... F _{<i>n</i>} <i>It</i> _{<i>n</i>}) consists of a unary datatype DT and <i>n</i> pairs
<i>OWLRestriction</i>	Represents an Object Property Restriction or Data Property Restriction in the OWL 2 specification.
<i>OWLObjectRestriction</i>	Represents an Object Property Restriction in the OWL 2 specification.
<i>OWLDataRestriction</i>	Represents a Data Property Restriction.
<i>OWLFacetRestriction</i>	A facet restriction is used to restrict a particular datatype.
<i>OWLDataProperty</i>	Represents a Data Property in the OWL 2 Specification. Data properties connect individuals with literals.
<i>OWLObjectProperty</i>	Represents an Object Property in the OWL 2 Specification. Object properties connect pairs of individuals.
<i>OWLPropertyExpression</i>	Represents a property or possibly the inverse of a property.
<i>OWLObjectInverseOf</i>	Represents the inverse of a property expression (<i>ObjectInverseOf</i>). An inverse object property expression
<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>OWLFacet</i>	Enumerations for OWL facets.
<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.
<i>Ontology</i>	Represents an OWL 2 Ontology in the OWL 2 specification.
<i>ToOwlready2</i>	
<i>FromOwlready2</i>	Map owlready2 classes to owlapy model classes.

Module Contents

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

Bases: OWLNaryClassAxiom

An equivalent classes axiom *EquivalentClasses*(CE₁ ... CE_{*n*}) states that all of the class expressions CE_{*i*}, 1 ≤ *i* ≤ *n*, are semantically equivalent to each other. This axiom allows one to use each CE_{*i*} as a synonym for each CE_{*j*} — that is, in any expression in the ontology containing such an axiom, CE_{*i*} can be replaced with CE_{*j*} 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_ontology.OWLClassAxiom (
    annotations: Iterable[OWLAnnotation] | None = None)
    Bases: OWLLogicalAxiom
    The base interface for class axioms.

    __slots__ = ()

class owlapy.owl_ontology.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 expression 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_ontology.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)

    __slots__ = ()

class owlapy.owl_ontology.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_ontology.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)

```
__slots__ = ()
```

```
class owlapy.owl_ontology.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)

```
__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_ontology.OwlAnnotationProperty(iri: owlapy.iri.IRI | str)
```

```
Bases: owlapy.owl_property.OwlProperty
```

Represents an `AnnotationProperty` in the OWL 2 specification.

```
__slots__ = '_iri'
```

```
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

class owlapy.owl_ontology.OWLDataRange
    Bases: OWLPropertyRange

    Represents a DataRange in the OWL 2 Specification.

class owlapy.owl_ontology.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)

    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).

class owlapy.owl_ontology.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_ontology.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_ontology.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>)

```
__slots__ = '_iri'
```

```
type_index: Final = 4001
```

```
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

```
class owlapy.owl_ontology.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)

```
__slots__ = '_iri'
```

```
type_index: Final = 1005
```

```
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

```
class owlapy.owl_ontology.OWLIndividual
```

Bases: *owlapy.owl_object.OWLObject*

Represents a named or anonymous individual.

```
__slots__ = ()
```

```
owlapy.owl_ontology.IntegerOWLDatatype: Final
```

```
owlapy.owl_ontology.DoubleOWLDatatype: Final
```

```
owlapy.owl_ontology.BooleanOWLDatatype: Final
owlapy.owl_ontology.StringOWLDatatype: Final
owlapy.owl_ontology.DateOWLDatatype: Final
owlapy.owl_ontology.DateTimeOWLDatatype: Final
owlapy.owl_ontology.DurationOWLDatatype: Final
```

```
class owlapy.owl_ontology.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.

class owlapy.owl_ontology.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_ontology.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.

    __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.

property str: str
 Returns: The string that specifies the IRI.

property reminder: str
 Returns: The string corresponding to the reminder of 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.

class owlapy.owl_ontology.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>)

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

type_index: Final = 1001

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

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.owl_ontology.OWLThing: Final

class owlapy.owl_ontology.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)

__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.owl_ontology.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.owl_ontology.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 ≤ i ≤ n. (https://www.w3.org/TR/owl2-syntax/#Union\_of\_Class\_Expressions)

    __slots__ = '_operands'

    type_index: Final = 3002

class owlapy.owl_ontology.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 ≤ i ≤ n. (https://www.w3.org/TR/owl2-syntax/#Intersection\_of\_Class\_Expressions)

    __slots__ = '_operands'

    type_index: Final = 3001

class owlapy.owl_ontology.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.owl_ontology.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)

```

__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.owl_ontology.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 `ai` with $1 \leq i \leq n$. (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.owl_ontology.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)

__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.owl_ontology.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)

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

type_index: Final = 3010

```
class owlapy.owl_ontology.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.owl_ontology.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)

```
__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.owl_ontology.OwlDataSomeValuesFrom(  

    property: owlapy.owl_property.OwlDataPropertyExpression,  

    filler: owlapy.owl_data_ranges.OwlDataRange)
```

Bases: OwlQuantifiedDataRestriction

An existential class expression DataSomeValuesFrom(DPE₁ ... DPE_{*n*} DR) consists of *n* data property expressions DPE_{*i*}, $1 \leq i \leq n$, and a data range DR whose arity must be *n*. Such a class expression contains all those individuals that are connected by DPE_{*i*} to literals *lt*_{*i*}, $1 \leq i \leq n$, such that the tuple (*lt*₁ , ..., *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)

```
__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.owl_ontology.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 `DPEi` 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)

```

__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.owl_ontology.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)

```

__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.owl_ontology.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)

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

type_index: Final = 3017

```
class owlapy.owl_ontology.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.owl_ontology.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)

__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.owl_ontology.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($l_{t1} \dots l_{tn}$) 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)

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

Bases: *owlapy.owl_data_ranges.OWLDataRange*

A datatype restriction DatatypeRestriction(DT $F_1\ l_{t1} \dots F_n\ l_{tn}$) 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, v_i) (multiple pairs are interpreted conjunctively), where v_i are the data values of the literals l_{ti} . (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.owl_ontology.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.owl_ontology.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.owl_ontology.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.owl_ontology.**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.owl_ontology.**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)

__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

class owlapy.owl_ontology.**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)

__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_ontology.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_ontology.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)

```
__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_ontology.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_ontology.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_ontology.OWLFacet (remainder: str, symbolic_form: str,  
    operator: Callable[[X, X], bool])
```

Bases: *_Vocabulary*, *enum.Enum*

Enumerations for OWL facets.

```
property symbolic_form
```

```
property operator
```

```
static from_str (name: str) → OWLFacet
```

```
MIN_INCLUSIVE: Final
```

```
MIN_EXCLUSIVE: Final
```

```
MAX_INCLUSIVE: Final
```

```
MAX_EXCLUSIVE: Final
```

```
LENGTH: Final
```

```
MIN_LENGTH: Final
```

```
MAX_LENGTH: Final
```

```
PATTERN: Final
```

```
TOTAL_DIGITS: Final
```

```
FRACTION_DIGITS: Final
```

```
owlapy.owl_ontology.logger
```

```
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.

```
class owlapy.owl_ontology.Ontology (manager: OntologyManager, ontology_iri: owlapy.iri.IRI,
    load: bool)
```

Bases: *OWLOntology*

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__ = ('_manager', '_iri', '_world', '_onto')
```

```
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.

```
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.

```
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.

```
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.

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.

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.

get_owl_ontology_manager () → *OntologyManager*

Gets the manager that manages this ontology.

get_ontology_id () → *OWLOntologyID*

Gets the OWLOntologyID belonging to this object.

Returns

The OWLOntologyID.

data_property_domain_axioms (*pe*: *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.

data_property_range_axioms (*pe*: *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.

object_property_domain_axioms (*pe*: *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.

object_property_range_axioms (*pe: 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.

get_original_iri ()

Get the IRI argument that was used to create this ontology.

__eq__ (*other*)

Return self==value.

__hash__ ()

Return hash(self).

__repr__ ()

Return repr(self).

owlapy.owl_ontology.OWLREADY2_FACET_KEYS

class owlapy.owl_ontology.ToOwlready2 (*world: owlready2.World*)

__slots__ = '_world'

abstract map_object (*o: owlapy.owl_object.OWLObject*)

Map owlapy object classes.

abstract map_concept (*o: owlapy.class_expression.OWLClassExpression*)

→ owlready2.ClassConstruct | owlready2.ThingClass

Map owlapy concept classes.

abstract map_datarange (*p: owlapy.owl_data_ranges.OWLDataRange*)

→ owlready2.ClassConstruct | type

Map owlapy data range classes.

class owlapy.owl_ontology.FromOwlready2

Map owlready2 classes to owlapy model classes.

__slots__ = ()

abstract map_concept (*c: owlready2.ClassConstruct | owlready2.ThingClass*)

→ owlapy.class_expression.OWLClassExpression

Map concept classes.

abstract map_datarange (*p: owlready2.ClassConstruct*)

→ owlapy.owl_data_ranges.OWLDataRange

Map data range classes.

Attributes

OWLThing

Classes

<i>IRI</i>	An IRI, consisting of a namespace and a remainder.
<i>HasIRI</i>	Simple class to access the IRI.
<i>OWLObject</i>	Base interface for OWL objects
<i>OWLClass</i>	An OWL 2 named Class. Classes can be understood as sets of individuals.
<i>OWLQuantifiedDataRestriction</i>	Represents a quantified data restriction.
<i>OWLDataHasValue</i>	A has-value class expression <code>DataHasValue(DPE It)</code> consists of a data property expression DPE and a literal It,
<i>OWLNaryBooleanClassExpression</i>	<code>OWLNaryBooleanClassExpression</code> .
<i>OWLObjectOneOf</i>	An enumeration of individuals <code>ObjectOneOf(a1 ... an)</code> contains exactly the individuals a_i with $1 \leq i \leq n$.
<i>OWLObjectComplementOf</i>	Represents an <code>ObjectComplementOf</code> class expression in the OWL 2 Specification.
<i>OWLObjectHasValue</i>	A has-value class expression <code>ObjectHasValue(OPE a)</code> consists of an object property expression OPE and an
<i>OWLQuantifiedObjectRestriction</i>	Represents a quantified object restriction.
<i>OWLObjectPropertyRangeAxiom</i>	An object property range axiom <code>ObjectPropertyRange(OPE CE)</code> states that the range of the object property
<i>OWLAxiom</i>	Represents Axioms in the OWL 2 Specification.
<i>OWLSubClassOfAxiom</i>	A subclass axiom <code>SubClassOf(CE1 CE2)</code> states that the class expression CE1 is a subclass of the class
<i>OWLEquivalentClassesAxiom</i>	An equivalent classes axiom <code>EquivalentClasses(CE1 ... CEn)</code> states that all of the class expressions CE_i ,
<i>OWLDisjointUnionAxiom</i>	A disjoint union axiom <code>DisjointUnion(C CE1 ... CEn)</code> states that a class C is a disjoint union of the class
<i>OWLAnnotationAssertionAxiom</i>	An annotation assertion <code>AnnotationAssertion(AP as av)</code> states that the annotation subject as — an IRI or an
<i>OWLAnnotationProperty</i>	Represents an <code>AnnotationProperty</code> in the OWL 2 specification.
<i>OWLSubPropertyAxiom</i>	Base interface for object and data sub-property axioms.
<i>OWLPropertyRangeAxiom</i>	Base class for Property Range axioms.
<i>OWLClassAssertionAxiom</i>	A class assertion <code>ClassAssertion(CE a)</code> states that the individual a is an instance of the class expression CE.
<i>OWLDeclarationAxiom</i>	Represents a Declaration axiom in the OWL 2 Specification. A declaration axiom declares an entity in an ontology.
<i>OWLObjectPropertyAssertionAxiom</i>	A positive object property assertion <code>ObjectPropertyAssertion(OPE a1 a2)</code> states that the individual a1 is

continues on next page

Table 6 – continued from previous page

<i>OWLSymmetricObjectPropertyAxiom</i>	An object property symmetry axiom <i>SymmetricObjectProperty</i> (OPE) states that
<i>OWLTransitiveObjectPropertyAxiom</i>	An object property transitivity axiom <i>TransitiveObjectProperty</i> (OPE) states that the
<i>OWLPropertyDomainAxiom</i>	Base class for Property Domain axioms.
<i>OWLAsymmetricObjectPropertyAxiom</i>	An object property asymmetry axiom <i>AsymmetricObjectProperty</i> (OPE) states that
<i>OWLDataPropertyCharacteristicAxiom</i>	Base interface for Functional data property axiom.
<i>OWLFunctionalDataPropertyAxiom</i>	A data property functionality axiom <i>FunctionalDataProperty</i> (DPE) states that
<i>OWLReflexiveObjectPropertyAxiom</i>	An object property reflexivity axiom <i>ReflexiveObjectProperty</i> (OPE) states that the
<i>OWLDataPropertyAssertionAxiom</i>	A positive data property assertion <i>DataPropertyAssertion</i> (DPE a lt) states that the individual a is connected
<i>OWLFunctionalObjectPropertyAxiom</i>	An object property functionality axiom <i>FunctionalObjectProperty</i> (OPE) states that
<i>OWLObjectPropertyCharacteristicAxiom</i>	Base interface for functional object property axiom.
<i>OWLIrreflexiveObjectPropertyAxiom</i>	An object property irreflexivity axiom <i>IrreflexiveObjectProperty</i> (OPE) states that the
<i>OWLInverseFunctionalObjectPropertyAxiom</i>	An object property inverse functionality axiom <i>InverseFunctionalObjectProperty</i> (OPE)
<i>OWLDisjointDataPropertiesAxiom</i>	A disjoint data properties axiom <i>DisjointDataProperties</i> (DPE1 ... DPE _n) states that all of the data property
<i>OWLDisjointObjectPropertiesAxiom</i>	A disjoint object properties axiom <i>DisjointObjectProperties</i> (OPE1 ... OPE _n) states that all of the object
<i>OWLEquivalentDataPropertiesAxiom</i>	An equivalent data properties axiom <i>EquivalentDataProperties</i> (DPE1 ... DPE _n) states that all the data property
<i>OWLEquivalentObjectPropertiesAxiom</i>	An equivalent object properties axiom <i>EquivalentObjectProperties</i> (OPE1 ... OPE _n) 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>OWLNaryPropertyAxiom</i>	Represents an axiom that contains two or more operands that could also be represented with
<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 ... a _n) states that all of the individuals a _i ,
<i>OWLDisjointClassesAxiom</i>	A disjoint classes axiom <i>DisjointClasses</i> (CE1 ... CE _n) states that all of the class expressions CE _i , 1 ≤ i ≤ n,
<i>OWLSameIndividualAxiom</i>	An individual equality axiom <i>SameIndividual</i> (a1 ... a _n) states that all of the individuals a _i , 1 ≤ i ≤ n,
<i>OWLNamedIndividual</i>	Named individuals are identified using an IRI. Since they are given an IRI, named individuals are entities.
<i>OWLIndividual</i>	Represents a named or anonymous individual.
<i>OWLOntology</i>	Represents an OWL 2 Ontology in the OWL 2 specification.
<i>Ontology</i>	Represents an OWL 2 Ontology in the OWL 2 specification.
<i>ToOwlready2</i>	
<i>OWLDataProperty</i>	Represents a Data Property in the OWL 2 Specification. Data properties connect individuals with literals.

continues on next page

Table 6 – continued from previous page

<i>OWLObjectInverseOf</i>	Represents the inverse of a property expression (Object-InverseOf). An inverse object property expression
<i>OWLObjectProperty</i>	Represents an Object Property in the OWL 2 Specification. Object properties connect pairs of individuals.
<i>OWLProperty</i>	A base class for properties that aren't expression i.e. named properties. By definition, properties
<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.
<i>OntologyManager</i>	An OWLOntologyManager manages a set of ontologies. It is the main point for creating, loading and accessing

Module Contents

```
class owlapy.owl_ontology_manager.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.

__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.

property str: str

Returns: The string that specifies the IRI.

property reminder: str

Returns: The string corresponding to the reminder of 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.

class owlapy.owl_ontology_manager.**HasIRI**

Simple class to access the IRI.

__slots__ = ()

property iri: *IRI*

Abstractmethod

Gets the IRI of this object.

Returns

The IRI of this object.

property str: str

Abstractmethod

Gets the string representation of this object

Returns

The IRI as string

```

class owlapy.owl_ontology_manager.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

owlapy.owl_ontology_manager.OWLThing: Final

class owlapy.owl_ontology_manager.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)

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

    type_index: Final = 1001

    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

    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.owl_ontology_manager.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.owl_ontology_manager.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 It) consists of a data property expression DPE and a literal It, and it contains all those individuals that are connected by DPE to It. Each such class expression can be seen as a syntactic shortcut for the class expression DataSomeValuesFrom(DPE DataOneOf(It)). (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.owl_ontology_manager.**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.owl_ontology_manager.**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)

__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.owl_ontology_manager.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.owl_ontology_manager.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)

    __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.owl_ontology_manager.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.owl_ontology_manager.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)

__slots__ = ()

class owlapy.owl_ontology_manager.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_ontology_manager.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)

```

__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_ontology_manager.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, $1 \leq i \leq n$, 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_ontology_manager.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, $1 \leq i \leq n$, 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_ontology_manager.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_ontology_manager.OWLAnnotationProperty (iri: owlapy.iri.IRI | str)
    Bases: owlapy.owl_property.OWLProperty
    Represents an AnnotationProperty in the OWL 2 specification.
    __slots__ = '_iri'
    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
class owlapy.owl_ontology_manager.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_ontology_manager.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_ontology_manager.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_ontology_manager.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_ontology_manager.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)

```

__slots__ = ()

```

```
class owlapy.owl_ontology_manager.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_ontology_manager.OwlsTransitiveObjectPropertyAxiom (
    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_ontology_manager.OwlsPropertyDomainAxiom (property_: _P,
    domain: owlapy.class_expression.OwlsClassExpression,
    annotations: Iterable[OWLAnnotation] | None = None)
```

Bases: *Generic[_P]*, *OwlsUnaryPropertyAxiom[_P]*

Base class for Property Domain axioms.

__slots__ = '_domain'

get_domain() → *owlapy.class_expression.OwlsClassExpression*

__eq__(other)

Return self==value.

__hash__()

Return hash(self).

__repr__()

Return repr(self).

```
class owlapy.owl_ontology_manager.OwlsAsymmetricObjectPropertyAxiom (
    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)

```

__slots__ = ()

class owlapy.owl_ontology_manager.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_ontology_manager.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_ontology_manager.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)

__slots__ = ()

class owlapy.owl_ontology_manager.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)

```

```
__slots__ = ()
```

```
class owlapy.owl_ontology_manager.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_ontology_manager.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_ontology_manager.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)

```
__slots__ = ()
```

```
class owlapy.owl_ontology_manager.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)

```
__slots__ = ()
```



```

class owlapy.owl_ontology_manager.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 ... DPEn ) states that all of the data property
expressions DPEi, 1 ≤ i ≤ n, are pairwise disjoint; that is, no individual x can be connected to a literal y by both
    DPEi and DPEj for i ≠ j.

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

__slots__ = ()

class owlapy.owl_ontology_manager.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_ontology_manager.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 ... DPEn ) states that all the data property
expressions DPEi, 1 ≤ i ≤ n, are semantically equivalent to each other. This axiom allows one to use each DPEi
as a synonym for each DPEj — that is, in any expression in the ontology containing such an axiom, DPEi can be
replaced with DPEj without affecting the meaning of the ontology.

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

__slots__ = ()

class owlapy.owl_ontology_manager.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_ontology_manager.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 expres-
sion 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)

__slots__ = ('_first', '_second')

get_first_property() → owlapy.owl_property.OWLObjectPropertyExpression

get_second_property() → owlapy.owl_property.OWLObjectPropertyExpression

__repr__()
    Return repr(self).

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

Bases: *OWLNaryIndividualAxiom*

An individual inequality axiom **DifferentIndividuals**(*a*₁ ... *a*_{*n*}) states that all of the individuals *a*_{*i*}, 1 ≤ *i* ≤ *n*, are different from each other; that is, no individuals *a*_{*i*} and *a*_{*j*} with *i* ≠ *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)

__slots__ = ()

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

Bases: *OWLNaryClassAxiom*

A disjoint classes axiom **DisjointClasses**(*CE*₁ ... *CE*_{*n*}) states that all of the class expressions *CE*_{*i*}, 1 ≤ *i* ≤ *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* ≠ *j*.

(https://www.w3.org/TR/owl2-syntax/#Disjoint_Classes)

__slots__ = ()

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

Bases: *OWLNaryIndividualAxiom*

An individual equality axiom **SameIndividual**(*a*₁ ... *a*_{*n*}) states that all of the individuals *a*_{*i*}, 1 ≤ *i* ≤ *n*, are equal to each other. This axiom allows one to use each *a*_{*i*} as a synonym for each *a*_{*j*} — that is, in any expression in the ontology containing such an axiom, *a*_{*i*} can be replaced with *a*_{*j*} without affecting the meaning of the ontology.

(https://www.w3.org/TR/owl2-syntax/#Individual_Equality)

__slots__ = ()

class owlapy.owl_ontology_manager.**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)

```

__slots__ = '_iri'

type_index: Final = 1005

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

```

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

```

__slots__ = ()

```

class *owlapy.owl_ontology_manager.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: owlpy.owl_property.OWLObjectProperty)
    → Iterable[owlpy.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.

```
class owlpy.owl_ontology_manager.Ontology (manager: OntologyManager,
    ontology_iri: owlpy.iri.IRI, load: bool)
```

Bases: *OWLOntology*

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__ = ('_manager', '_iri', '_world', '_onto')
```

```
classes_in_signature () → Iterable[owlpy.class_expression.OWLClass]
```

Gets the classes in the signature of this object.

Returns

Classes in the signature of this object.

```
data_properties_in_signature () → Iterable[owlpy.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.

```
object_properties_in_signature () → Iterable[owlpy.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.

```
individuals_in_signature () → Iterable[owlpy.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.

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.

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.

get_owl_ontology_manager () → *OntologyManager*

Gets the manager that manages this ontology.

get_ontology_id () → *OWLOntologyID*

Gets the OWLOntologyID belonging to this object.

Returns

The OWLOntologyID.

data_property_domain_axioms (*pe*: *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.

data_property_range_axioms (*pe*: *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.

object_property_domain_axioms (*pe*: *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.

object_property_range_axioms (*pe: 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.

get_original_iri ()

Get the IRI argument that was used to create this ontology.

__eq__ (*other*)

Return self==value.

__hash__ ()

Return hash(self).

__repr__ ()

Return repr(self).

class owlapy.owl_ontology_manager.**ToOwlready2** (*world: owlready2.World*)

__slots__ = **'_world'**

abstract map_object (*o: owlapy.owl_object.OWLObject*)

Map owlapy object classes.

abstract map_concept (*o: owlapy.class_expression.OWLClassExpression*)

→ owlready2.ClassConstruct | owlready2.ThingClass

Map owlapy concept classes.

abstract map_data_range (*p: owlapy.owl_data_ranges.OWLDataRange*)

→ owlready2.ClassConstruct | type

Map owlapy data range classes.

class owlapy.owl_ontology_manager.**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)

__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

class owlapy.owl_ontology_manager.**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)

__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_ontology_manager.**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)

__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_ontology_manager.**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.

__slots__ = '_iri'

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.

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.OWLAxiom)

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.OWLAxiom)

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.OWLontology*,
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.

__slots__ = **'_iri'**

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

class `owlapy.owl_ontology_manager.AddImport` (*ontology*: *owlapy.owl_ontology.OWLOntology*,
import_declaration: *OWLImportsDeclaration*)

Bases: *OWLOntologyChange*

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.

class `owlapy.owl_ontology_manager.OntologyManager` (*world_store*=None)

Bases: *OWLOntologyManager*

An OWLOntologyManager manages a set of ontologies. It is the main point for creating, loading and accessing ontologies.

`__slots__` = '_world'

`create_ontology` (*iri*: *owlapy.iri.IRI*) → *owlapy.owl_ontology.Ontology*

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.

`load_ontology` (*iri*: *owlapy.iri.IRI*) → *owlapy.owl_ontology.Ontology*

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.

`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.

add_axiom (*ontology*: *owlapy.owl_ontology.OWL ontology*, *axiom*: *owlapy.owl_axiom.OWL axiom*)

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.

remove_axiom (*ontology*: *owlapy.owl_ontology.OWL ontology*, *axiom*: *owlapy.owl_axiom.OWL axiom*)

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.

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.

save_world ()

Saves the actual state of the quadstore in the SQLite3 file.

owlapy.owl_property

OWL Properties

Classes

<i>OWLObject</i>	Base interface for OWL objects
<i>OWLEntity</i>	Represents Entities in the OWL 2 Specification.
<i>IRI</i>	An IRI, consisting of a namespace and a remainder.
<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 (ObjectInverseOf). An inverse object property expression
<i>OWLDataProperty</i>	Represents a Data Property in the OWL 2 Specification. Data properties connect individuals with literals.

Module Contents

class owlapy.owl_property.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_property.OWLEntity

Bases: OWLNamedObject

Represents Entities in the OWL 2 Specification.

__slots__ = ()

to_string_id () → str

is_anonymous () → bool

class owlapy.owl_property.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.

```

__slots__ = ('_namespace', '_remainder', '__weakref__')

type_index: Final = 0

static create(namespace: owlpy.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.

property str: str
    Returns: The string that specifies the IRI.

property remainder: str
    Returns: The string corresponding to the remainder of 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.

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.

__slots__ = '_iri'

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.

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)

__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)

__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)

```
__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

Attributes

<i>logger</i>

Classes

<i>OWLClassExpression</i>	OWL Class expressions represent sets of individuals by formally specifying conditions on the individuals' properties;
<i>OWLObjectSomeValuesFrom</i>	An existential class expression <code>ObjectSomeValuesFrom(OPE CE)</code> consists of an object property expression <code>OPE</code> and
<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
<i>OWLObjectComplementOf</i>	Represents an <code>ObjectComplementOf</code> class expression in the OWL 2 Specification.
<i>OWLObjectAllValuesFrom</i>	A universal class expression <code>ObjectAllValuesFrom(OPE CE)</code> consists of an object property expression <code>OPE</code> and a
<i>OWLObjectOneOf</i>	An enumeration of individuals <code>ObjectOneOf(a1 ... an)</code> contains exactly the individuals <code>ai</code> with $1 \leq i \leq n$.
<i>OWLObjectHasValue</i>	A has-value class expression <code>ObjectHasValue(OPE a)</code> consists of an object property expression <code>OPE</code> and an
<i>OWLObjectMinCardinality</i>	A minimum cardinality expression <code>ObjectMinCardinality(n OPE CE)</code> consists of a nonnegative integer <code>n</code> , an object
<i>OWLObjectMaxCardinality</i>	A maximum cardinality expression <code>ObjectMaxCardinality(n OPE CE)</code> consists of a nonnegative integer <code>n</code> , an object

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<i>OWLObjectExactCardinality</i>	An exact cardinality expression <code>ObjectExactCardinality(n OPE CE)</code> consists of a nonnegative integer <i>n</i> , an object
<i>OWLObjectCardinalityRestriction</i>	Represents Object Property Cardinality Restrictions in the OWL 2 specification.
<i>OWLDataSomeValuesFrom</i>	An existential class expression <code>DataSomeValuesFrom(DPE1 ... DPE_n DR)</code> consists of <i>n</i> data property expressions
<i>OWLDataOneOf</i>	An enumeration of literals <code>DataOneOf(lt1 ... lt_n)</code> contains exactly the explicitly specified literals <i>lt_i</i> with
<i>OWLDatatypeRestriction</i>	A datatype restriction <code>DatatypeRestriction(DT F1 lt1 ... Fn lt_n)</code> consists of a unary datatype <i>DT</i> and <i>n</i> pairs
<i>OWLFacetRestriction</i>	A facet restriction is used to restrict a particular datatype.
<i>OWLDataHasValue</i>	A has-value class expression <code>DataHasValue(DPE lt)</code> consists of a data property expression <i>DPE</i> and a literal <i>lt</i> ,
<i>OWLDataAllValuesFrom</i>	A universal class expression <code>DataAllValuesFrom(DPE1 ... DPE_n DR)</code> consists of <i>n</i> data property expressions <i>DPE_i</i> ,
<i>OWLClass</i>	An OWL 2 named Class. Classes can be understood as sets of individuals.
<i>IRI</i>	An IRI, consisting of a namespace and a remainder.
<i>OWLAxiom</i>	Represents Axioms in the OWL 2 Specification.
<i>OWLSubClassOfAxiom</i>	A subclass axiom <code>SubClassOf(CE1 CE2)</code> states that the class expression <i>CE1</i> is a subclass of the class
<i>OWLDataRange</i>	Represents a <code>DataRange</code> in the OWL 2 Specification.
<i>OWLDataComplementOf</i>	A complement data range <code>DataComplementOf(DR)</code> contains all tuples of literals that are not contained in the
<i>OWLDataUnionOf</i>	A union data range <code>DataUnionOf(DR1 ... DR_n)</code> contains all tuples of literals that are contained in the at least
<i>OWLDataIntersectionOf</i>	An intersection data range <code>DataIntersectionOf(DR1 ... DR_n)</code> contains all tuples of literals that are contained
<i>OWLDatatype</i>	Datatypes are entities that refer to sets of data values. Thus, datatypes are analogous to classes,
<i>OWLOntology</i>	Represents an OWL 2 Ontology in the OWL 2 specification.
<i>Ontology</i>	Represents an OWL 2 Ontology in the OWL 2 specification.
<i>ToOwlready2</i>	
<i>OntologyManager</i>	An <code>OWLOntologyManager</code> manages a set of ontologies. It is the main point for creating, loading and accessing
<i>OWLObjectPropertyExpression</i>	A high level interface to describe different types of object properties.
<i>OWLDataProperty</i>	Represents a Data Property in the OWL 2 Specification. Data properties connect individuals with literals.
<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 (<code>ObjectInverseOf</code>). An inverse object property expression
<i>OWLPropertyExpression</i>	Represents a property or possibly the inverse of a property.
<i>OWLDataPropertyExpression</i>	A high level interface to describe different types of data properties.

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Table 7 – continued from previous page

<i>OWLNamedIndividual</i>	Named individuals are identified using an IRI. Since they are given an IRI, named individuals are entities.
<i>OWLLiteral</i>	Literals represent data values such as particular strings or integers. They are analogous to typed RDF
<i>LRUCache</i>	Constants shares by all lru cache instances.
<i>OWLReasoner</i>	An OWLReasoner reasons over a set of axioms (the set of reasoner axioms) that is based on the imports closure of
<i>BaseReasoner</i>	Enumeration class for base reasoner when calling <code>sync_reasoner</code> .
<i>OWLReasonerEx</i>	Extra convenience methods for OWL Reasoners
<i>OntologyReasoner</i>	Extra convenience methods for OWL Reasoners
<i>FastInstanceCheckerReasoner</i>	Tries to check instances fast (but maybe incomplete).
<i>SyncReasoner</i>	Extra convenience methods for OWL Reasoners

Module Contents

class owlapy.owl_reasoner.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)

__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.owl_reasoner.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.owl_reasoner.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.owl_reasoner.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
```

```
class owlapy.owl_reasoner.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.owl_reasoner.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)

__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.owl_reasoner.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 ai with 1 ≤ i ≤ n. (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.owl_reasoner.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)

__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.owl_reasoner.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.owl_reasoner.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)

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

```
type_index: Final = 3010
```

```
class owlapy.owl_reasoner.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)

```
__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 $(= 1 \text{ R C}) = \geq 1 \text{ R C}$ and $\leq 1 \text{ R C}$.

```
class owlapy.owl_reasoner.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.owl_reasoner.OWLObjectSomeValuesFrom(
 property: owlapy.owl_property.OWLObjectPropertyExpression,
 filler: owlapy.owl_data_ranges.OWLObjectRange)

Bases: OWLQuantifiedDataRestriction

An existential class expression DataSomeValuesFrom(DPE1 ... DPE_n DR) consists of n data property expressions DPE_i, 1 ≤ i ≤ n, and a data range DR whose arity must be n. Such a class expression contains all those individuals that are connected by DPE_i to literals lti, 1 ≤ i ≤ n, such that the tuple (lt1 , ..., ltn) 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)

__slots__ = '_property'

type_index: Final = 3012

__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.owl_reasoner.OWLDataOneOf(
 values: owlapy.owl_literal.OWLLiteral | Iterable[owlapy.owl_literal.OWLLiteral])

Bases: *owlapy.owl_data_ranges.OWLObjectRange*, *owlapy.meta_classes.HasOperands[owlapy.owl_literal.OWLLiteral]*

An enumeration of literals DataOneOf(lt1 ... ltn) contains exactly the explicitly specified literals lti with 1 ≤ i ≤ 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.owl_reasoner.OWLDatatypeRestriction (
    type_: owlapy.owl_datatype.OWLDatatype,
    facet_restrictions: OWLFacetRestriction | Iterable[OWLFacetRestriction])
    Bases: owlapy.owl_data_ranges.OWLDataRange

    A datatype restriction DatatypeRestriction( DT F1 lt1 ... 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)

    __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.owl_reasoner.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.owl_reasoner.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)

__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.owl_reasoner.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 DPEi 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)

__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.owl_reasoner.OWLObject (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>)

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

type_index: Final = 1001

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

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.owl_reasoner.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.

```
__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.

```
property str: str
```

Returns: The string that specifies the IRI.

property reminder: str

Returns: The string corresponding to the reminder of 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.

class owlapy.owl_reasoner.OWL`Axiom`(*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_reasoner.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)

__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_reasoner.OWLDataRange
    Bases: OWLPropertyRange

    Represents a DataRange in the OWL 2 Specification.

class owlapy.owl_reasoner.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)

    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).

class owlapy.owl_reasoner.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_reasoner.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_reasoner.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>)

```
__slots__ = '_iri'
```

```
type_index: Final = 4001
```

```
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

```
class owlapy.owl_reasoner.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.

```
class owlapy.owl_reasoner.Ontology (manager: OntologyManager, ontology_iri: owlapy.iri.IRI,
    load: bool)
```

Bases: *OWLOntology*

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__ = ('_manager', '_iri', '_world', '_onto')
```

```
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.

```
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.

```
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.

```
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.

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.

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.

get_owl_ontology_manager () → *OntologyManager*

Gets the manager that manages this ontology.

get_ontology_id () → *OWLOntologyID*

Gets the OWLOntologyID belonging to this object.

Returns

The OWLOntologyID.

data_property_domain_axioms (*pe*: *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.

data_property_range_axioms (*pe*: *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.

object_property_domain_axioms (*pe*: *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.

object_property_range_axioms (*pe: 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.

get_original_iri ()

Get the IRI argument that was used to create this ontology.

__eq__ (*other*)

Return self==value.

__hash__ ()

Return hash(self).

__repr__ ()

Return repr(self).

class owlapy.owl_reasoner.ToOwlready2 (*world: owlready2.World*)

__slots__ = '_world'

abstract map_object (*o: owlapy.owl_object.OWLObject*)

Map owlapy object classes.

abstract map_concept (*o: owlapy.class_expression.OWLClassExpression*)

→ owlready2.ClassConstruct | owlready2.ThingClass

Map owlapy concept classes.

abstract map_datarange (*p: owlapy.owl_data_ranges.OWLDataRange*)

→ owlready2.ClassConstruct | type

Map owlapy data range classes.

class owlapy.owl_reasoner.OntologyManager (*world_store=None*)

Bases: OWLOntologyManager

An OWLOntologyManager manages a set of ontologies. It is the main point for creating, loading and accessing ontologies.

__slots__ = '_world'

create_ontology (*iri: owlapy.iri.IRI*) → owlapy.owl_ontology.Ontology

Creates a new (empty) ontology that 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.

load_ontology (*iri: owlapy.iri.IRI*) → owlapy.owl_ontology.Ontology

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.

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.

add_axiom (*ontology*: *owlapy.owl_ontology.OWLOntology*, *axiom*: *owlapy.owl_axiom.OWLAxiom*)

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.

remove_axiom (*ontology*: *owlapy.owl_ontology.OWLOntology*, *axiom*: *owlapy.owl_axiom.OWLAxiom*)

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.

save_ontology (*ontology*: *owlapy.owl_ontology.OWLOntology*, *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.

save_world ()

Saves the actual state of the quadstore in the SQLite3 file.

class `owlapy.owl_reasoner.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_reasoner.OWLObjectProperty (*iri: owlapy.iri.IRI* | *str*)

Bases: *OWLObjectPropertyExpression*, 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)

__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

class owlapy.owl_reasoner.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)

__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_reasoner.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)

```
__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_reasoner.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_reasoner.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_reasoner.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)

__slots__ = '_iri'

type_index: Final = 1005

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

class owlapy.owl_reasoner.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.

class owlapy.owl_reasoner.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.owl_reasoner.logger`

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* = `equivalent_classes(DataSomeValuesFrom(pe 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 `super_classes(DataSomeValuesFrom(pe rdfs:Literal), true)`. If *direct* is False: then the result of `super_classes(DataSomeValuesFrom(pe rdfs:Literal), false)` together with *N* if *N* is non-empty. (Note, `rdfs:Literal` is the top datatype).

abstract object_property_domains (*pe*: *owlapy.owl_property.OWLObjectProperty*,
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* = `equivalent_classes(ObjectSomeValuesFrom(pe 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 `super_classes(ObjectSomeValuesFrom(pe owl:Thing), true)`. If *direct* is False: then the result

of `super_classes(ObjectSomeValuesFrom(pe owl:Thing), false)` together with `N` if `N` is non-empty.

abstract object_property_ranges (*pe*: *owlapy.owl_property.OWLObjectProperty*,
direct: *bool = False*) → *Iterable[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 = equivalent_classes(ObjectSomeValuesFrom(ObjectInverseOf(pe) 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 `super_classes(ObjectSomeValuesFrom(ObjectInverseOf(pe) owl:Thing), true)`. If `direct` is False: then the result of `super_classes(ObjectSomeValuesFrom(ObjectInverseOf(pe) owl:Thing), false)` together with `N` if `N` is non-empty.

abstract equivalent_classes (*ce*: *owlapy.class_expression.OWLClassExpression*,
only_named: *bool = True*) → *Iterable[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.

class owlapy.owl_reasoner.BaseReasoner

Bases: `enum.Enum`

Enumeration class for base reasoner when calling `sync_reasoner`.

PELLET

Pellet base reasoner.

HERMIT

HermiT base reasoner.

PELLET

HERMIT

class owlapy.owl_reasoner.OWLReasonerEx (*ontology: owlapy.owl_ontology.OWLontology*)

Bases: *OWLReasoner*

Extra convenience methods for OWL Reasoners

data_property_ranges (*pe: owlapy.owl_property.OWLDataProperty, direct: bool = False*)
→ `Iterable[owlapy.owl_data_ranges.OWLDataRange]`

Gets the data ranges 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:

all_data_property_values (*pe: owlapy.owl_property.OWLDataProperty, direct: bool = True*)
→ `Iterable[owlapy.owl_literal.OWLLiteral]`

Gets all values for the given data property expression that appear in the knowledge base.

Parameters

- **pe** – The data property expression whose values are to be retrieved
- **direct** – Specifies if only the direct values of the data property **pe** should be retrieved (True), or if the values of sub properties of **pe** should be taken into account (False).

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)` for any *ind*.

ind_data_properties (*ind*: *owlapy.owl_individual.OWLNamedIndividual*, *direct*: *bool* = *True*)
→ *Iterable[owlapy.owl_property.OWLDataProperty]*

Gets all data properties for the given individual that appear in the knowledge base.

Parameters

- **ind** – The named individual whose data properties are to be retrieved
- **direct** – Specifies if the direct data properties should be retrieved (*True*), or if all data properties should be retrieved (*False*), so that sub properties are taken into account.

Returns

All data properties *pe* where the set of reasoner axioms entails `DataPropertyAssertion(pe ind l)` for atleast one *l*.

ind_object_properties (*ind*: *owlapy.owl_individual.OWLNamedIndividual*, *direct*: *bool* = *True*)
→ *Iterable[owlapy.owl_property.OWLObjectProperty]*

Gets all object properties for the given individual that appear in the knowledge base.

Parameters

- **ind** – The named individual whose object properties are to be retrieved
- **direct** – Specifies if the direct object properties should be retrieved (*True*), or if all object properties should be retrieved (*False*), so that sub properties are taken into account.

Returns

All data properties *pe* where the set of reasoner axioms entails `ObjectPropertyAssertion(pe ind ind2)` for atleast one *ind2*.

class *owlapy.owl_reasoner.OntologyReasoner* (*ontology*: *owlapy.owl_ontology.Ontology*,
isolate: *bool* = *False*)

Bases: *OWLReasonerEx*

Extra convenience methods for OWL Reasoners

__slots__ = ('_ontology', '_world')

update_isolated_ontology (*axioms_to_add*: *List[owlapy.owl_axiom.OWLAxiom]* = *None*,
axioms_to_remove: *List[owlapy.owl_axiom.OWLAxiom]* = *None*)

Add or remove axioms to the isolated ontology that the reasoner is using.

Parameters

- **axioms_to_add** (*List[OWLAxiom]*) – Axioms to add to the isolated ontology.
- **axioms_to_remove** (*List[OWLAxiom]*) – Axioms to remove from the isolated ontology.

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, rdfs:Literal is the top datatype).

object_property_domains (*pe*: *owlapy.owl_property.OWLObjectProperty*, *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 $N = \text{equivalent_classes}(\text{ObjectSomeValuesFrom}(\text{pe } \text{owl:Thing}))$. 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.

object_property_ranges (*pe*: *owlapy.owl_property.OWLObjectProperty*, *direct*: *bool = False*)
 → *Iterable[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.

equivalent_classes (*ce*: *owlapy.class_expression.OWLClassExpression*, *only_named*: *bool = True*)
 → *Iterable[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.

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))`.

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)`.

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)`.

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)`.

all_data_property_values (*pe*: *owlapy.owl_property.OWLDataProperty*, *direct*: *bool = True*)
→ `Iterable[owlapy.owl_literal.OWLLiteral]`

Gets all values for the given data property expression that appear in the knowledge base.

Parameters

- **pe** – The data property expression whose values are to be retrieved
- **direct** – Specifies if only the direct values of the data property *pe* should be retrieved (True), or if the values of sub properties of *pe* should be taken into account (False).

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)` for any *ind*.

object_property_values (*ind*: *owlapy.owl_individual.OWLNamedIndividual*,
pe: *owlapy.owl_property.OWLObjectPropertyExpression*, *direct*: *bool = False*)
→ `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)`.

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.

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.

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.

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.

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.

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.

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))`.

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))`.

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.

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.

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.

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.

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).

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.

is_isolated ()

Return True if this reasoner is using an isolated ontology.

```
class owlapy.owl_reasoner.FastInstanceCheckerReasoner (
    ontology: owlapy.owl_ontology.OWLOntology, base_reasoner: OWLReasoner, *,
    property_cache: bool = True, negation_default: bool = True, sub_properties: bool = False)
```

Bases: *OWLReasonerEx*

Tries to check instances fast (but maybe incomplete).

```
__slots__ = ('_ontology', '_base_reasoner', '_ind_set', '_cls_to_ind',
             '_has_prop', ...)
```

```
reset()
```

The reset method shall reset any cached state.

```
is_isolated()
```

Return True if this reasoner is using an isolated ontology.

```
is_using_triplestore()
```

```
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, rdfs:Literal is the top datatype).

```
data_property_ranges (pe: owlapy.owl_property.OWLDataProperty, direct: bool = False)
    → Iterable[owlapy.owl_data_ranges.OWLDataRange]
```

Gets the data ranges 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:

```
object_property_domains (pe: owlapy.owl_property.OWLObjectProperty, 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 $N = \text{equivalent_classes}(\text{ObjectSomeValuesFrom}(\text{pe owl:Thing}))$. If **direct** is True: then if N is not empty then the return value is N , else the return value is the result of $\text{super_classes}(\text{ObjectSomeValuesFrom}(\text{pe owl:Thing}), \text{true})$. If **direct** is False: then the result of $\text{super_classes}(\text{ObjectSomeValuesFrom}(\text{pe owl:Thing}), \text{false})$ together with N if N is non-empty.

object_property_ranges (*pe: owlapy.owl_property.OWLObjectProperty, direct: bool = False*)
 → Iterable[*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 $N = \text{equivalent_classes}(\text{ObjectSomeValuesFrom}(\text{ObjectInverseOf}(\text{pe owl:Thing})))$. If **direct** is True: then if N is not empty then the return value is N , else the return value is the result of $\text{super_classes}(\text{ObjectSomeValuesFrom}(\text{ObjectInverseOf}(\text{pe owl:Thing})), \text{true})$. If **direct** is False: then the result of $\text{super_classes}(\text{ObjectSomeValuesFrom}(\text{ObjectInverseOf}(\text{pe owl:Thing})), \text{false})$ together with N if N is non-empty.

equivalent_classes (*ce: owlapy.class_expression.OWLClassExpression, only_named: bool = True*)
 → Iterable[*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 $\text{EquivalentClasses}(ce\ C)$. 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.

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))`.

different_individuals (*ce*: *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)`.

same_individuals (*ce*: *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)`.

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)`.

all_data_property_values (*pe*: *owlapy.owl_property.OWLDataProperty*, *direct*: *bool = True*)
→ *Iterable[owlapy.owl_literal.OWLLiteral]*

Gets all values for the given data property expression that appear in the knowledge base.

Parameters

- **pe** – The data property expression whose values are to be retrieved
- **direct** – Specifies if only the direct values of the data property pe should be retrieved (True), or if the values of sub properties of pe should be taken into account (False).

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)` for any ind.

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)`.

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.

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.

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.

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.

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)`.

equivalent_object_properties (*dp*: `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.

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.

disjoint_object_properties (*dp*: `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))`.

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))`.

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.

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.

super_object_properties (*op*: *owlapy.owl_property.OWLObjectProperty*, *direct*: *bool = False*)

→ `Iterable[owlapy.owl_property.OWLDataProperty]`

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.

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.

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.

class `owlapy.owl_reasoner.SyncReasoner` (*ontology: owlapy.owl_ontology.Ontology*,
base_reasoner: BaseReasoner | None = None, *infer_property_values: bool = True*,
infer_data_property_values: bool = True, *isolate: bool = False*)

Bases: *OntologyReasoner*

Extra convenience methods for OWL Reasoners

__slots__ = ('_cnt', '_conv', '_base_reasoner')

update_isolated_ontology (*axioms_to_add: List[owlapy.owl_axiom.OWLAxiom] = None*,
axioms_to_remove: List[owlapy.owl_axiom.OWLAxiom] = None)

Add or remove axioms to the isolated ontology that the reasoner is using.

Parameters

- **axioms_to_add** (*List [OWLAxiom]*) – Axioms to add to the isolated ontology.
- **axioms_to_remove** (*List [OWLAxiom]*) – Axioms to remove from the isolated ontology.

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.

`__del__()`

owlapy.parser

String to OWL parsers.

Attributes

<i>IntegerOWLDatatype</i>
<i>BooleanOWLDatatype</i>
<i>DoubleOWLDatatype</i>
<i>StringOWLDatatype</i>
<i>DateOWLDatatype</i>
<i>DateTimeOWLDatatype</i>
<i>DurationOWLDatatype</i>
<i>MANCHESTER_GRAMMAR</i>
<i>DL_GRAMMAR</i>
<i>DLparser</i>
<i>ManchesterParser</i>

Classes

<i>IRI</i>	An IRI, consisting of a namespace and a remainder.
<i>OWLNamedIndividual</i>	Named individuals are identified using an IRI. Since they are given an IRI, named individuals are entities.
<i>OWLLiteral</i>	Literals represent data values such as particular strings or integers. They are analogous to typed RDF
<i>OWLObjectPropertyExpression</i>	A high level interface to describe different types of object properties.
<i>OWLObjectProperty</i>	Represents an Object Property in the OWL 2 Specification. Object properties connect pairs of individuals.

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Table 8 – continued from previous page

<i>OWLDataProperty</i>	Represents a Data Property in the OWL 2 Specification. Data properties connect individuals with literals.
<i>OWLObjectParser</i>	Abstract class with a parse method to parse a string to an OWL Object.
<i>Namespaces</i>	Namespaces provide a simple method for qualifying element and attribute names used in Extensible Markup
<i>OWLDatatype</i>	Datatypes are entities that refer to sets of data values. Thus, datatypes are analogous to classes,
<i>OWLFacet</i>	Enumerations for OWL facets.
<i>OWLRDFVocabulary</i>	Enumerations for OWL/RDF vocabulary.
<i>OWLObjectHasSelf</i>	A self-restriction <code>ObjectHasSelf(OPE)</code> consists of an object property expression OPE,
<i>OWLObjectIntersectionOf</i>	An intersection class expression <code>ObjectIntersectionOf(CE1 ... CEn)</code> contains all individuals that are instances
<i>OWLObjectMinCardinality</i>	A minimum cardinality expression <code>ObjectMinCardinality(n OPE CE)</code> consists of a nonnegative integer n, an object
<i>OWLObjectSomeValuesFrom</i>	An existential class expression <code>ObjectSomeValuesFrom(OPE CE)</code> consists of an object property expression OPE and
<i>OWLObjectUnionOf</i>	A union class expression <code>ObjectUnionOf(CE1 ... CEn)</code> contains all individuals that are instances
<i>OWLClass</i>	An OWL 2 named Class. Classes can be understood as sets of individuals.
<i>OWLObjectOneOf</i>	An enumeration of individuals <code>ObjectOneOf(a1 ... an)</code> contains exactly the individuals a_i with $1 \leq i \leq n$.
<i>OWLClassExpression</i>	OWL Class expressions represent sets of individuals by formally specifying conditions on the individuals' properties;
<i>OWLObjectComplementOf</i>	Represents an <code>ObjectComplementOf</code> class expression in the OWL 2 Specification.
<i>OWLObjectExactCardinality</i>	An exact cardinality expression <code>ObjectExactCardinality(n OPE CE)</code> consists of a nonnegative integer n, an object
<i>OWLQuantifiedDataRestriction</i>	Represents a quantified data restriction.
<i>OWLQuantifiedObjectRestriction</i>	Represents a quantified object restriction.
<i>OWLFacetRestriction</i>	A facet restriction is used to restrict a particular datatype.
<i>OWLDDataSomeValuesFrom</i>	An existential class expression <code>DataSomeValuesFrom(DPE1 ... DPEn DR)</code> consists of n data property expressions
<i>OWLDDataExactCardinality</i>	An exact cardinality expression <code>ObjectExactCardinality(n OPE CE)</code> consists of a nonnegative integer n, an
<i>OWLObjectHasValue</i>	A has-value class expression <code>ObjectHasValue(OPE a)</code> consists of an object property expression OPE and an
<i>OWLDDataMaxCardinality</i>	A maximum cardinality expression <code>ObjectMaxCardinality(n OPE CE)</code> consists of a nonnegative integer n, an object
<i>OWLObjectMaxCardinality</i>	A maximum cardinality expression <code>ObjectMaxCardinality(n OPE CE)</code> consists of a nonnegative integer n, an object
<i>OWLDDataMinCardinality</i>	A minimum cardinality expression <code>DataMinCardinality(n DPE DR)</code> consists of a nonnegative integer n, a data

continues on next page

Table 8 – continued from previous page

<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>OWLDataOneOf</i>	An enumeration of literals <i>DataOneOf</i> (lt1 ... ltn) contains exactly the explicitly specified literals lti with
<i>OWLObjectCardinalityRestriction</i>	Represents Object Property Cardinality Restrictions in the OWL 2 specification.
<i>OWLDatatypeRestriction</i>	A datatype restriction <i>DatatypeRestriction</i> (DT F1 lt1 ... Fn ltn) consists of a unary datatype DT and n pairs
<i>OWLDataCardinalityRestriction</i>	Represents Data Property Cardinality Restrictions.
<i>OWLObjectAllValuesFrom</i>	A universal class expression <i>ObjectAllValuesFrom</i> (OPE CE) consists of an object property expression OPE and a
<i>OWLDataAllValuesFrom</i>	A universal class expression <i>DataAllValuesFrom</i> (DPE1 ... DPE _n DR) consists of n data property expressions DPE _i ,
<i>OWLDataIntersectionOf</i>	An intersection data range <i>DataIntersectionOf</i> (DR1 ... DR _n) contains all tuples of literals that are contained
<i>OWLDataUnionOf</i>	A union data range <i>DataUnionOf</i> (DR1 ... DR _n) contains all tuples of literals that are contained in the at least
<i>OWLDataComplementOf</i>	A complement data range <i>DataComplementOf</i> (DR) contains all tuples of literals that are not contained in the
<i>OWLDatRange</i>	Represents a <i>DataRange</i> in the OWL 2 Specification.
<i>ManchesterOWLSyntaxParser</i>	Manchester Syntax parser to parse strings to OWLClass-Expressions.
<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
...)
```

Module Contents

```

class owlapy.parser.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.
    __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.

property str: str

Returns: The string that specifies the IRI.

property reminder: str

Returns: The string corresponding to the reminder of 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.

```
class owlapy.parser.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)

```
__slots__ = '_iri'
```

```
type_index: Final = 1005
```

```
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

```
owlapy.parser.IntegerOWLDatatype: Final
```

```
owlapy.parser.BooleanOWLDatatype: Final
```

```
owlapy.parser.DoubleOWLDatatype: Final
```

```
owlapy.parser.StringOWLDatatype: Final
```

```
owlapy.parser.DateOWLDatatype: Final
```

```
owlapy.parser.DateTimeOWLDatatype: Final
```

```
owlapy.parser.DurationOWLDatatype: Final
```

```
class owlapy.parser.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.

class owlapy.parser.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.parser.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)

__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.parser.**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)

__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

class owlapy.parser.**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.parser.**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

__slots__ = (**'_prefix'**, **'_ns'**)

property ns: **str**


```

property prefix: str

__repr__()
    Return repr(self).

__hash__()
    Return hash(self).

__eq__(other)
    Return self==value.

```

class owlapy.parser.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>)

```

__slots__ = '_iri'

type_index: Final = 4001

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

```

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

Bases: _Vocabulary, enum.Enum

Enumerations for OWL facets.

```

property symbolic_form

property operator

static from_str (name: str) → OWLFacet

MIN_INCLUSIVE: Final

MIN_EXCLUSIVE: Final

MAX_INCLUSIVE: Final

MAX_EXCLUSIVE: Final

LENGTH: Final

```

```

MIN_LENGTH: Final

MAX_LENGTH: Final

PATTERN: Final

TOTAL_DIGITS: Final

FRACTION_DIGITS: Final

class owlapy.parser.OWLRDFVocabulary (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.parser.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.parser.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

class owlapy.parser.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.parser.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.parser.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.parser.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)

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

    type_index: Final = 1001

    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

    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.parser.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 ai with  $1 \leq i \leq n$ . (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.parser.OwLClassExpression
    Bases: owlapy.owl_data_ranges.OwLPropertyRange

    OWL Class expressions represent sets of individuals by formally specifying conditions on the individuals' prop-
    erties; 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)

    __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.parser.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.parser.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)

    __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 ( $= 1 R C$ )  $\Rightarrow 1 R C$  and  $\leq 1 R C$ .

class owlapy.parser.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.parser.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.parser.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.parser.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)

__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.parser.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)

__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.parser.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)

__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.parser.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)

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

type_index: Final = 3017

class owlapy.parser.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)

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

type_index: Final = 3010

```

```
class owlapy.parser.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.parser.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* *It*) consists of a data property expression *DPE* and a literal *It*, and it contains all those individuals that are connected by *DPE* to *It*. Each such class expression can be seen as a syntactic shortcut for the class expression *DataSomeValuesFrom*(*DPE* *DataOneOf*(*It*)). (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.parser.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*(*It*₁ ... *It*_{*n*}) contains exactly the explicitly specified literals *It*_{*i*} 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.parser.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.parser.OwlDatatypeRestriction (type_: owlapy.owl_datatype.OwlDatatype,
 facet_restrictions: OwlFacetRestriction | Iterable[OwlFacetRestriction])
 Bases: owlapy.owl_data_ranges.OwlDataRange
 A datatype restriction DatatypeRestriction(DT F1 lt1 ... 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)

__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.parser.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.parser.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)

__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.parser.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_i 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)

```
__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.parser.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.parser.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.parser.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)

    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).

class owlapy.parser.OWLDataRange
    Bases: OWLPropertyRange

    Represents a DataRange in the OWL 2 Specification.

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.

Attributes

Restriction_Literals

Classes

<i>OWLLiteral</i>	Literals represent data values such as particular strings or integers. They are analogous to typed RDF
<i>OWLDatatypeRestriction</i>	A datatype restriction <code>DatatypeRestriction(DT F1 lt1 ... Fn ltn)</code> consists of a unary datatype <code>DT</code> and <code>n</code> pairs
<i>OWLFacet</i>	Enumerations for OWL facets.
<i>OWLFacetRestriction</i>	A facet restriction is used to restrict a particular datatype.

Functions

<i>owl_datatype_max_exclusive_restriction</i>	Create a max exclusive restriction.
<i>owl_datatype_min_exclusive_restriction</i>	Create a min exclusive restriction.
<i>owl_datatype_max_inclusive_restriction</i>	Create a max inclusive restriction.
<i>owl_datatype_min_inclusive_restriction</i>	Create a min inclusive restriction.
<i>owl_datatype_min_max_exclusive_restric</i>	Create a min-max exclusive restriction.
<i>owl_datatype_min_max_inclusive_restric</i>	Create a min-max inclusive restriction.

Module Contents

class owlapy.providers.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.

class owlapy.providers.**OWLDatatypeRestriction**(type_: *owlapy.owl_datatype.OWLDatatype*,
facet_restrictions: *OWLFacetRestriction* | *Iterable[OWLFacetRestriction]*)
Bases: *owlapy.owl_data_ranges.OWLDataRange*

A datatype restriction DatatypeRestriction(DT F1 lt1 ... 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)

__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.providers.**OWLFacet**(remainder: str, symbolic_form: str,
operator: Callable[[X, X], bool])
Bases: *_Vocabulary, enum.Enum*

Enumerations for OWL facets.

```

property symbolic_form

property operator

static from_str(name: str) → OWLFacet

MIN_INCLUSIVE: Final

MIN_EXCLUSIVE: Final

MAX_INCLUSIVE: Final

MAX_EXCLUSIVE: Final

LENGTH: Final

MIN_LENGTH: Final

MAX_LENGTH: Final

PATTERN: Final

TOTAL_DIGITS: Final

FRACTION_DIGITS: Final

class owlapy.providers.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).

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.

Attributes

DLrenderer

ManchesterRenderer

Classes

<i>IRI</i>	An IRI, consisting of a namespace and a remainder.
<i>OWLNamedIndividual</i>	Named individuals are identified using an IRI. Since they are given an IRI, named individuals are entities.
<i>OWLLiteral</i>	Literals represent data values such as particular strings or integers. They are analogous to typed RDF
<i>OWLObjectRenderer</i>	Abstract class with a render method to render an OWL Object into a string.
<i>OWLEntity</i>	Represents Entities in the OWL 2 Specification.
<i>OWLObject</i>	Base interface for OWL objects
<i>OWLObjectInverseOf</i>	Represents the inverse of a property expression (Object-InverseOf). An inverse object property expression
<i>OWLPropertyExpression</i>	Represents a property or possibly the inverse of a property.
<i>OWLClassExpression</i>	OWL Class expressions represent sets of individuals by formally specifying conditions on the individuals' properties;
<i>OWLBooleanClassExpression</i>	Represent an anonymous boolean class expression.

continues on next page

Table 9 – continued from previous page

<i>OWLClass</i>	An OWL 2 named Class. Classes can be understood as sets of individuals.
<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>OWLObjectUnionOf</i>	A union class expression <i>ObjectUnionOf</i> (CE1 ... CEn) contains all individuals that are instances
<i>OWLObjectIntersectionOf</i>	An intersection class expression <i>ObjectIntersectionOf</i> (CE1 ... CEn) contains all individuals that are instances
<i>OWLObjectComplementOf</i>	Represents an <i>ObjectComplementOf</i> class expression in the OWL 2 Specification.
<i>OWLObjectMinCardinality</i>	A minimum cardinality expression <i>ObjectMinCardinality</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>OWLObjectMaxCardinality</i>	A maximum cardinality expression <i>ObjectMaxCardinality</i> (n OPE CE) consists of a nonnegative integer n, an object
<i>OWLObjectHasSelf</i>	A self-restriction <i>ObjectHasSelf</i> (OPE) consists of an object property expression OPE,
<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 It) consists of a data property expression DPE and a literal It,
<i>OWLDataMinCardinality</i>	A minimum cardinality expression <i>DataMinCardinality</i> (n DPE DR) consists of a nonnegative integer n, a data
<i>OWLDataExactCardinality</i>	An exact cardinality expression <i>ObjectExactCardinality</i> (n OPE CE) consists of a nonnegative integer n, an
<i>OWLDataMaxCardinality</i>	A maximum cardinality expression <i>ObjectMaxCardinality</i> (n OPE CE) consists of a nonnegative integer n, an object
<i>OWLDataOneOf</i>	An enumeration of literals <i>DataOneOf</i> (It1 ... Itn) contains exactly the explicitly specified literals Iti with
<i>OWLNaryBooleanClassExpression</i>	<i>OWLNaryBooleanClassExpression</i> .
<i>OWLRestriction</i>	Represents an Object Property Restriction or Data Property Restriction in the OWL 2 specification.
<i>OWLFacet</i>	Enumerations for OWL facets.
<i>OWLNaryDataRange</i>	<i>OWLNaryDataRange</i> .
<i>OWLDataComplementOf</i>	A complement data range <i>DataComplementOf</i> (DR) contains all tuples of literals that are not contained in the
<i>OWLDataUnionOf</i>	A union data range <i>DataUnionOf</i> (DR1 ... DRn) contains all tuples of literals that are contained in the at least
<i>OWLDataIntersectionOf</i>	An intersection data range <i>DataIntersectionOf</i> (DR1 ... DRn) contains all tuples of literals that are contained

continues on next page

Table 9 – continued from previous page

<i>OWLObjectHasValue</i>	A has-value class expression <code>ObjectHasValue(OPE a)</code> consists of an object property expression OPE and an
<i>OWLFacetRestriction</i>	A facet restriction is used to restrict a particular datatype.
<i>OWLDatatypeRestriction</i>	A datatype restriction <code>DatatypeRestriction(DT F1 lt1 ... Fn ltn)</code> consists of a unary datatype DT and n pairs
<i>OWLObjectOneOf</i>	An enumeration of individuals <code>ObjectOneOf(a1 ... an)</code> contains exactly the individuals a_i with $1 \leq i \leq n$.
<i>OWLDatatype</i>	Datatypes are entities that refer to sets of data values. Thus, datatypes are analogous to classes,
<i>DLSyntaxObjectRenderer</i>	DL Syntax renderer for OWL Objects.
<i>ManchesterOWLSyntaxOWLObjectRenderer</i>	Manchester Syntax renderer for OWL Objects

Functions

```
owl_expression_to_dl( $\rightarrow$  str)

owl_expression_to_manchester( $\rightarrow$  str)
```

Module Contents

```
class owlapy.render.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.
    __slots__ = ('_namespace', '_remainder', '__weakref__')
    type_index: Final = 0
    static create (namespace: owlapy.namespaces.Namespaces, remainder: str)  $\rightarrow$  IRI
    static create (namespace: str, remainder: str)  $\rightarrow$  IRI
    static create (string: str)  $\rightarrow$  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#>](http://www.w3.org/1999/02/22-rdf-syntax-ns#) or [<http://www.w3.org/2000/01/rdf-schema#>](http://www.w3.org/2000/01/rdf-schema#) or [<http://www.w3.org/2001/XMLSchema#>](http://www.w3.org/2001/XMLSchema#) or [<http://www.w3.org/2002/07/owl#>](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.

property str: str

Returns: The string that specifies the IRI.

property reminder: str

Returns: The string corresponding to the reminder of 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.

class owlapy.render.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)

__slots__ = '_iri'

type_index: Final = 1005

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

class owlapy.render.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.

class owlapy.render.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.render.OWLEntity
    Bases: OWLNamedObject
    Represents Entities in the OWL 2 Specification.

    __slots__ = ()

    to_string_id () → str

    is_anonymous () → bool

class owlapy.render.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.render.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)

    __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.render.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.render.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)

__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.render.OWLBooleanClassExpression

Bases: *OWLAnonymousClassExpression*

Represent an anonymous boolean class expression.

__slots__ = ()

class owlapy.render.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>)

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

type_index: Final = 1001

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

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.render.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.render.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)

__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.render.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.render.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

class owlapy.render.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.render.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.render.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)

```
__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 ($= 1 \text{ R C} \Rightarrow 1 \text{ R C}$ and $\leq 1 \text{ R C}$).

```
class owlapy.render.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)

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

```
type_index: Final = 3010
```

```
class owlapy.render.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.render.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 DPE _{i} , $1 \leq i \leq n$, and a data range DR whose arity must be n . Such a class expression contains all those individuals that are connected by DPE _{i} to literals lt_i , $1 \leq i \leq n$, 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)

```
__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.render.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_i only to literals *l_i*, $1 \leq i \leq n$, such that each tuple (*l₁* , ..., *l_n*) 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)

```

__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.render.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)

```

__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.render.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.render.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)

__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 $(= 1\ R\ D) = \Rightarrow 1\ R\ D$ and $\leq 1\ R\ D$.

```
class owlapy.render.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)

```

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

type_index: Final = 3017

class owlapy.render.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.render.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.render.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.render.OWLFacet (remainder: str, symbolic_form: str,
                                operator: Callable[[_X, _X], bool])
    Bases: _Vocabulary, enum.Enum
    Enumerations for OWL facets.

    property symbolic_form

    property operator

    static from_str(name: str) → OWLFacet

    MIN_INCLUSIVE: Final

    MIN_EXCLUSIVE: Final

    MAX_INCLUSIVE: Final

    MAX_EXCLUSIVE: Final

    LENGTH: Final

    MIN_LENGTH: Final

    MAX_LENGTH: Final

    PATTERN: Final

    TOTAL_DIGITS: Final

    FRACTION_DIGITS: Final

class owlapy.render.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.render.**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)

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).

class owlapy.render.**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.render.**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.render.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)

    __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.render.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.render.OWLDatatypeRestriction(type_: owlapy.owl_datatype.OWLDatatype,
    facet_restrictions: OWLFacetRestriction | Iterable[OWLFacetRestriction])
    Bases: owlapy.owl_data_ranges.OWLDataRange

    A datatype restriction DatatypeRestriction( DT F1 lt1 ... 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 (F_i , v_i) (multiple pairs are interpreted conjunctively), where v_i are the data values of the literals l_{ti} . (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.render.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)

```
__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.render.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>)

```
__slots__ = '_iri'
```

```
type_index: Final = 4001
```

```
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

```
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.

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>	

Module Contents

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.

Attributes

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

Classes

<i>OWLNamedIndividual</i>	Named individuals are identified using an IRI. Since they are given an IRI, named individuals are entities.
<i>HasIRI</i>	Simple class to access the IRI.
<i>HasFiller</i>	An interface to objects that have a filler.
<i>HasCardinality</i>	An interface to objects that have a cardinality.
<i>HasOperands</i>	An interface to objects that have a collection of operands.
<i>OWLLiteral</i>	Literals represent data values such as particular strings or integers. They are analogous to typed RDF
<i>OWLObjectInverseOf</i>	Represents the inverse of a property expression (ObjectInverseOf). An inverse object property expression
<i>OWLObjectProperty</i>	Represents an Object Property in the OWL 2 Specification. Object properties connect pairs of individuals.
<i>OWLDataProperty</i>	Represents a Data Property in the OWL 2 Specification. Data properties connect individuals with literals.
<i>OWLClassExpression</i>	OWL Class expressions represent sets of individuals by formally specifying conditions on the individuals' properties;
<i>OWLClass</i>	An OWL 2 named Class. Classes can be understood as sets of individuals.
<i>OWLObjectCardinalityRestriction</i>	Represents Object Property Cardinality Restrictions in the OWL 2 specification.
<i>OWLObjectComplementOf</i>	Represents an ObjectComplementOf class expression in the OWL 2 Specification.
<i>OWLRestriction</i>	Represents an Object Property Restriction or Data Property Restriction in the OWL 2 specification.
<i>OWLObjectSomeValuesFrom</i>	An existential class expression ObjectSomeValuesFrom(OPE CE) consists of an object property expression OPE and
<i>OWLObjectMinCardinality</i>	A minimum cardinality expression ObjectMinCardinality(n OPE CE) consists of a nonnegative integer n, an object

continues on next page

Table 10 – continued from previous page

<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>OWLObjectHasSelf</i>	A self-restriction <i>ObjectHasSelf</i> (OPE) consists of an object property expression OPE,
<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>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>OWLDataExactCardinality</i>	An exact cardinality expression <i>ObjectExactCardinality</i> (<i>n</i> OPE CE) consists of a nonnegative integer <i>n</i> , an
<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>OWLDataAllValuesFrom</i>	A universal class expression <i>DataAllValuesFrom</i> (DPE1 ... DPE _n DR) consists of <i>n</i> data property expressions DPE _i ,
<i>OWLDataSomeValuesFrom</i>	An existential class expression <i>DataSomeValuesFrom</i> (DPE1 ... DPE _n DR) consists of <i>n</i> data property expressions
<i>OWLObjectAllValuesFrom</i>	A universal class expression <i>ObjectAllValuesFrom</i> (OPE CE) consists of an object property expression OPE and a
<i>OWLDataOneOf</i>	An enumeration of literals <i>DataOneOf</i> (lt1 ... lt _n) contains exactly the explicitly specified literals lt _i with
<i>OWLObjectIntersectionOf</i>	An intersection class expression <i>ObjectIntersectionOf</i> (CE1 ... CE _n) contains all individuals that are instances
<i>OWLDataCardinalityRestriction</i>	Represents Data Property Cardinality Restrictions.
<i>OWLNaryBooleanClassExpression</i>	OWLNaryBooleanClassExpression.
<i>OWLObjectUnionOf</i>	A union class expression <i>ObjectUnionOf</i> (CE1 ... CE _n) contains all individuals that are instances
<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 ... F _n lt _n) consists of a unary datatype DT and <i>n</i> pairs
<i>OWLFacetRestriction</i>	A facet restriction is used to restrict a particular datatype.
<i>OWLObjectOneOf</i>	An enumeration of individuals <i>ObjectOneOf</i> (a1 ... a _n) contains exactly the individuals a _i with 1 ≤ <i>i</i> ≤ <i>n</i> .
<i>OWLDataComplementOf</i>	A complement data range <i>DataComplementOf</i> (DR) contains all tuples of literals that are not contained in the
<i>OWLDataUnionOf</i>	A union data range <i>DataUnionOf</i> (DR1 ... DR _n) contains all tuples of literals that are contained in the at least
<i>OWLDataIntersectionOf</i>	An intersection data range <i>DataIntersectionOf</i> (DR1 ... DR _n) contains all tuples of literals that are contained
<i>OWLNaryDataRange</i>	OWLNaryDataRange.
<i>OWLDatatype</i>	Represents a <i>DataRange</i> in the OWL 2 Specification.
<i>OWLPropertyRange</i>	OWL Objects that can be the ranges of properties.
<i>OWLObject</i>	Base interface for OWL objects
<i>OWLDatatype</i>	Datatypes are entities that refer to sets of data values. Thus, datatypes are analogous to classes,
<i>OWLClassExpressionLengthMetric</i>	Length calculation of OWLClassExpression

continues on next page

Table 10 – continued from previous page

<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.

Module Contents

class owlapy.utils.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)

__slots__ = '_iri'

type_index: Final = 1005

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

```
class owlapy.utils.HasIRI
```

Simple class to access the IRI.

```
__slots__ = ()
```

```
property iri: IRI
```

Abstractmethod

Gets the IRI of this object.

Returns

The IRI of this object.

```
property str: str
```

Abstractmethod

Gets the string representation of this object

Returns

The IRI as string

```
class owlapy.utils.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.utils.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.

```
class owlapy.utils.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.utils.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.

class owlapy.utils.**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)

```
__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.utils.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)

```
__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.utils.**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)

__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

class owlapy.utils.**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)

__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.utils.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>)

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

`type_index`: `Final` = 1001

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

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.utils.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.utils.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.utils.OWLNothing: Final

class owlapy.utils.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.

owlapy.utils.OWLThing: **Final**

class owlapy.utils.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.utils.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.utils.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)

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

type_index: Final = 3010

```
class owlapy.utils.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)

```
__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 ($= 1 \text{ R } C$) $= \geq 1 \text{ R } C$ and $\leq 1 \text{ R } C$.

```
class owlapy.utils.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.utils.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)

```

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

type_index: Final = 3017

```

class owlapy.utils.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.utils.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)

```

__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.utils.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)

`__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.utils.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 DPEi 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)

`__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.utils.OWLDataSomeValuesFrom(  
    property: owlapy.owl_property.OWLDataPropertyExpression,  
    filler: owlapy.owl_data_ranges.OWLDataRange)
```

Bases: *OWLQuantifiedDataRestriction*

An existential class expression *DataSomeValuesFrom*(*DPE*₁ ... *DPE*_{*n*} *DR*) consists of *n* data property expressions *DPE*_{*i*}, $1 \leq i \leq n$, and a data range *DR* whose arity must be *n*. Such a class expression contains all those individuals that are connected by *DPE*_{*i*} to literals *lti*, $1 \leq i \leq n$, such that the tuple (*lt*₁ , ..., *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)

```
__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.utils.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)

```
__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.utils.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.utils.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

class owlapy.utils.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.utils.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.utils.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 ≤ i ≤ n. (https://www.w3.org/TR/owl2-syntax/#Union\_of\_Class\_Expressions)

    __slots__ = '_operands'

    type_index: Final = 3002

class owlapy.utils.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)

    __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.utils.**OWLDatatypeRestriction** (type_: *owlapy.owl_datatype.OWLDatatype*,
facet_restrictions: *OWLFacetRestriction* | *Iterable[OWLFacetRestriction]*)

Bases: *owlapy.owl_data_ranges.OWLDataRange*

A datatype restriction `DatatypeRestriction(DT F1 lt1 ... 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)

__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.utils.**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.utils.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 ai with  $1 \leq i \leq n$ . (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.utils.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)

    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).

```

class owlapy.utils.**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.utils.**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.utils.**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.utils.**OWLDataRange**

Bases: *OWLPropertyRange*

Represents a DataRange in the OWL 2 Specification.


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

```
class owlapy.utils.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.utils.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>)

```
__slots__ = '_iri'
```

```
type_index: Final = 4001
```

```
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

```
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

```

owlpy.utils.measurer

owlpy.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) → 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*)
→ *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*)
→ *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*)
→ *owlapy.class_expression.OWLClassExpression*

owlapy.utils.**combine_nary_expressions** (*ce: owlapy.owl_data_ranges.OWLDataRange*)
→ *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*) → int

Count the number of elements in an iterable.

owlapy.utils.**as_index** (*o: owlapy.owl_object.OWLObject*) → *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.

Classes

<i>HasIRI</i>	Simple class to access the IRI.
<i>IRI</i>	An IRI, consisting of a namespace and a remainder.
<i>Namespaces</i>	Namespaces provide a simple method for qualifying element and attribute names used in Extensible Markup
<i>OWLRDFVocabulary</i>	Enumerations for OWL/RDF vocabulary.
<i>XSDVocabulary</i>	Enumerations for XSD vocabulary.
<i>OWLFacet</i>	Enumerations for OWL facets.

Module Contents

class owlapy.vocab.**HasIRI**

Simple class to access the IRI.

__slots__ = ()

property iri: *IRI*

Abstractmethod

Gets the IRI of this object.

Returns

The IRI of this object.

property str: str

Abstractmethod

Gets the string representation of this object

Returns

The IRI as string

class owlapy.vocab.**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.

__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.

property str: str

Returns: The string that specifies the IRI.

property reminder: str

Returns: The string corresponding to the reminder of 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.

class owlapy.vocab.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

__slots__ = ('_prefix', '_ns')

property ns: str

property prefix: str

__repr__()

Return repr(self).

__hash__()

Return hash(self).

__eq__(*other*)

Return self==value.

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

static from_str(name: str) → *OWLFacet*

MIN_INCLUSIVE: Final

MIN_EXCLUSIVE: Final

MAX_INCLUSIVE: Final

MAX_EXCLUSIVE: Final

LENGTH: Final

MIN_LENGTH: Final

MAX_LENGTH: Final

PATTERN: Final

TOTAL_DIGITS: Final

FRACTION_DIGITS: Final

3.3 Attributes

```
__version__
```

3.4 Functions

```
owl_expression_to_dl(→ str)
```

```
owl_expression_to_manchester(→ str)
```

```
dl_to_owl_expression(dl_expression, namespace)
```

```
manchester_to_owl_expression(manchester_ex  
...)
```

```
owl_expression_to_sparql(→ str)
```

Convert an OWL Class Expression (https://www.w3.org/TR/owl2-syntax/#Class_Expressions) into a SPARQL query

3.5 Package Contents

```
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) 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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