MACHINE

xOwl

DEFINITIONS

END_OF_GENERATED_DEFINITIONS_FOR == *xOwl*;

SETS

XOWL;
AXIOM;
CLASSEXPRESSION;
ENTITY;
ANNOTATION;
OBJECTPROPERTYEXPRESSION

ABSTRACT_VARIABLES

XOwl,
Axiom,
ClassExpression,
Entity,
Annotation,
ObjectPropertyExpression,
Assertion,
Class,
Individual,
ClassAxiom,
Declaration,
ObjectComplementOf,
ObjectOneOf,
ObjectHasValue,
ObjectProperty,
ObjectSomeValuesFrom,
ObjectAllValuesFrom,
Datatype,
ClassAssertion,
EquivalentClasses,
DisjointUnion,
DisjointClasses,
SubClassOf,
axioms,
classOfClassExp,
A_classExpression_classAssertion,
A_individual_classAssertion,
axiomAnnotations,
A_classExpressions_equivalentClasses,
A_class_disjointUnion,

$A\_disjointClassExpressions\_disjointUnion$,
$disjointClassExp$,
$subClassExp$,
$superClassExp$,
$A\_entity\_declaration$,
$A\_classExpression\_objectComplementOf$,
$A\_individuals\_objectOneOf$,
$A\_objectProperty\_objectPropertyExpression$,
$A\_objectPropertyExpression\_objectHasValue$,
$A\_individual\_objectHasValue$,
$A\_objectPropertyExpression\_objectSomeValuesFrom$,
$A\_classExpression\_objectSomeValuesFrom$,
$A\_objectPropertyExpression\_objectAllValuesFrom$,
$A\_classExpression\_objectAllValuesFrom$,
$xOwl\_ontologyIRI$,
$xOwl\_versionIRI$,
$Entity\_name$,
$Annotation\_annotationValue$

INVARIANT

$XOwl \in \mathcal{F}\ (XOWL) \land$
$Axiom \in \mathcal{F}\ (AXIOM) \land$
$ClassExpression \in \mathcal{F}\ (CLASSEXPRESSION) \land$
$Entity \in \mathcal{F}\ (ENTITY) \land$
$Annotation \in \mathcal{F}\ (ANNOTATION) \land$
$ObjectPropertyExpression \in \mathcal{F}\ (OBJECTPROPERTYEXPRESSION) \land$
$Assertion \subseteq Axiom \land$
$Class \subseteq Entity \land$
$Individual \subseteq Entity \land$
$ClassAxiom \subseteq Axiom \land$
$Declaration \subseteq Axiom \land$
$ObjectComplementOf \subseteq ClassExpression \land$
$ObjectOneOf \subseteq ClassExpression \land$
$ObjectHasValue \subseteq ClassExpression \land$
$ObjectProperty \subseteq Entity \land$
$ObjectSomeValuesFrom \subseteq ClassExpression \land$
$ObjectAllValuesFrom \subseteq ClassExpression \land$
$Datatype \subseteq Entity \land$
$ClassAssertion \subseteq Assertion \land$
$EquivalentClasses \subseteq ClassAxiom \land$
$DisjointUnion \subseteq ClassAxiom \land$
$DisjointClasses \subseteq ClassAxiom \land$
$SubClassOf \subseteq ClassAxiom \land$
$axioms \in Axiom \pfun XOwl \land$
$classOfClassExp \in ClassExpression \pfun Class \land$
$A\_classExpression\_classAssertion \in ClassAssertion \rightarrowtail ClassExpression \land$
$A\_individual\_classAssertion \in ClassAssertion \pfun Individual \land$
$axiomAnnotations \in Annotation \pfun ClassAxiom \land$

$A\_classExpressions\_equivalentClasses \in ClassExpression \nrightarrow EquivalentClasses \wedge$
$A\_class\_disjointUnion \in DisjointUnion \nrightarrow Class \wedge$
$A\_disjointClassExpressions\_disjointUnion \in ClassExpression \nrightarrow DisjointUnion \wedge$
$disjointClassExp \in ClassExpression \twoheadrightarrow DisjointClasses \wedge$
$subClassExp \in SubClassOf \rightarrowtail ClassExpression \wedge$
$superClassExp \in SubClassOf \rightarrowtail ClassExpression \wedge$
$A\_entity\_declaration \in Declaration \rightarrowtail Entity \wedge$
$A\_classExpression\_objectComplementOf \in ObjectComplementOf \rightarrowtail ClassExpression \wedge$
$A\_individuals\_objectOneOf \in ObjectOneOf \leftrightarrow Individual \wedge$
$A\_objectProperty\_objectPropertyExpression \in ObjectPropertyExpression \nrightarrow ObjectProperty \wedge$
$A\_objectPropertyExpression\_objectHasValue \in ObjectHasValue \rightarrowtail ObjectPropertyExpression \wedge$
$A\_individual\_objectHasValue \in ObjectHasValue \nrightarrow Individual \wedge$
$A\_objectPropertyExpression\_objectSomeValuesFrom \in ObjectSomeValuesFrom \rightarrowtail ObjectPropertyExpression \wedge$
$A\_classExpression\_objectSomeValuesFrom \in ObjectSomeValuesFrom \rightarrowtail ClassExpression \wedge$
$A\_objectPropertyExpression\_objectAllValuesFrom \in ObjectAllValuesFrom \rightarrowtail ObjectPropertyExpression \wedge$
$A\_classExpression\_objectAllValuesFrom \in ObjectAllValuesFrom \rightarrowtail ClassExpression \wedge$
$xOwl\_ontologyIRI \in XOwl \nrightarrow STRING \wedge$
$xOwl\_versionIRI \in XOwl \nrightarrow STRING \wedge$
$Entity\_name \in Entity \nrightarrow STRING \wedge$
$Annotation\_annotationValue \in Annotation \nrightarrow STRING \wedge$
$Assertion \cap Declaration = \emptyset \wedge$
$Assertion \cap ClassAxiom = \emptyset \wedge$
$Declaration \cap ClassAxiom = \emptyset \wedge$
$ObjectComplementOf \cap ObjectOneOf = \emptyset \wedge$
$ObjectComplementOf \cap ObjectAllValuesFrom = \emptyset \wedge$
$ObjectComplementOf \cap ObjectSomeValuesFrom = \emptyset \wedge$
$ObjectComplementOf \cap ObjectHasValue = \emptyset \wedge$
$ObjectOneOf \cap ObjectAllValuesFrom = \emptyset \wedge$
$ObjectOneOf \cap ObjectSomeValuesFrom = \emptyset \wedge$
$ObjectOneOf \cap ObjectHasValue = \emptyset \wedge$
$ObjectAllValuesFrom \cap ObjectSomeValuesFrom = \emptyset \wedge$
$ObjectAllValuesFrom \cap ObjectHasValue = \emptyset \wedge$
$ObjectSomeValuesFrom \cap ObjectHasValue = \emptyset \wedge$
$Class \cap Individual = \emptyset \wedge$
$Class \cap ObjectProperty = \emptyset \wedge$
$Class \cap Datatype = \emptyset \wedge$
$Individual \cap ObjectProperty = \emptyset \wedge$
$Individual \cap Datatype = \emptyset \wedge$
$ObjectProperty \cap Datatype = \emptyset \wedge$
$DisjointClasses \cap SubClassOf = \emptyset \wedge$
$DisjointClasses \cap EquivalentClasses = \emptyset \wedge$
$DisjointClasses \cap DisjointUnion = \emptyset \wedge$
$SubClassOf \cap EquivalentClasses = \emptyset \wedge$
$SubClassOf \cap DisjointUnion = \emptyset \wedge$
$EquivalentClasses \cap DisjointUnion = \emptyset \wedge$
$\forall\, aDisjointClasses.(\ aDisjointClasses \in \mathbf{ran}(disjointClassExp) \Rightarrow \mathbf{card}(disjointClassExp^{-1}[\{aDisjointClasses\}]) \geq 2)$

INITIALISATION

$XOwl := \emptyset \ ||$

$Axiom := \emptyset$ ||
$ClassExpression := \emptyset$ ||
$Entity := \emptyset$ ||
$Annotation := \emptyset$ ||
$ObjectPropertyExpression := \emptyset$ ||
$Assertion := \emptyset$ ||
$Class := \emptyset$ ||
$Individual := \emptyset$ ||
$ClassAxiom := \emptyset$ ||
$Declaration := \emptyset$ ||
$ObjectComplementOf := \emptyset$ ||
$ObjectOneOf := \emptyset$ ||
$ObjectHasValue := \emptyset$ ||
$ObjectProperty := \emptyset$ ||
$ObjectSomeValuesFrom := \emptyset$ ||
$ObjectAllValuesFrom := \emptyset$ ||
$Datatype := \emptyset$ ||
$ClassAssertion := \emptyset$ ||
$EquivalentClasses := \emptyset$ ||
$DisjointUnion := \emptyset$ ||
$DisjointClasses := \emptyset$ ||
$SubClassOf := \emptyset$ ||
$axioms := \emptyset$ ||
$classOfClassExp := \emptyset$ ||
$A\_classExpression\_classAssertion := \emptyset$ ||
$A\_individual\_classAssertion := \emptyset$ ||
$axiomAnnotations := \emptyset$ ||
$A\_classExpressions\_equivalentClasses := \emptyset$ ||
$A\_class\_disjointUnion := \emptyset$ ||
$A\_disjointClassExpressions\_disjointUnion := \emptyset$ ||
$disjointClassExp := \emptyset$ ||
$subClassExp := \emptyset$ ||
$superClassExp := \emptyset$ ||
$A\_entity\_declaration := \emptyset$ ||
$A\_classExpression\_objectComplementOf := \emptyset$ ||
$A\_individuals\_objectOneOf := \emptyset$ ||
$A\_objectProperty\_objectPropertyExpression := \emptyset$ ||
$A\_objectPropertyExpression\_objectHasValue := \emptyset$ ||
$A\_individual\_objectHasValue := \emptyset$ ||
$A\_objectPropertyExpression\_objectSomeValuesFrom := \emptyset$ ||
$A\_classExpression\_objectSomeValuesFrom := \emptyset$ ||
$A\_objectPropertyExpression\_objectAllValuesFrom := \emptyset$ ||
$A\_classExpression\_objectAllValuesFrom := \emptyset$ ||
$xOwl\_ontologyIRI := \emptyset$ ||
$xOwl\_versionIRI := \emptyset$ ||
$Entity\_name := \emptyset$ ||
$Annotation\_annotationValue := \emptyset$

OPERATIONS

xOwl_NEW($aXOwl$) =
PRE $aXOwl \in XOWL \wedge$
$aXOwl \notin XOwl$

THEN
$XOwl := XOwl \cup \{aXOwl\}$
END;

Axiom_NEW($aAxiom$) =
PRE $aAxiom \in AXIOM \wedge$
$aAxiom \notin Axiom$

THEN
$Axiom := Axiom \cup \{aAxiom\}$
END;

ClassExpression_NEW($aClassExpression$) =
PRE $aClassExpression \in CLASSEXPRESSION \wedge$
$aClassExpression \notin ClassExpression$

THEN
$ClassExpression := ClassExpression \cup \{aClassExpression\}$
END;

Entity_NEW($aEntity$) =
PRE $aEntity \in ENTITY \wedge$
$aEntity \notin Entity$

THEN
$Entity := Entity \cup \{aEntity\}$
END;

Annotation_NEW($aAnnotation$) =
PRE $aAnnotation \in ANNOTATION \wedge$
$aAnnotation \notin Annotation$

THEN
$Annotation := Annotation \cup \{aAnnotation\}$
END;

ObjectPropertyExpression_NEW($aObjectPropertyExpression$) =
PRE $aObjectPropertyExpression \in OBJECTPROPERTYEXPRESSION \wedge$
$aObjectPropertyExpression \notin ObjectPropertyExpression$

THEN
$ObjectPropertyExpression := ObjectPropertyExpression \cup \{aObjectPropertyExpression\}$
END;

Assertion_NEW($aAssertion$) =
PRE $aAssertion \in AXIOM \wedge$
$aAssertion \notin Axiom$

THEN

$Assertion := Assertion \cup \{aAssertion\}$ ||
$Axiom := Axiom \cup \{aAssertion\}$
END;

Class_NEW($aClass$) =
PRE $aClass \in ENTITY \wedge$
$aClass \notin Entity$

THEN
$Class := Class \cup \{aClass\}$ ||
$Entity := Entity \cup \{aClass\}$
END;

Individual_NEW($aIndividual$) =
PRE $aIndividual \in ENTITY \wedge$
$aIndividual \notin Entity$

THEN
$Individual := Individual \cup \{aIndividual\}$ ||
$Entity := Entity \cup \{aIndividual\}$
END;

ClassAxiom_NEW($aClassAxiom$) =
PRE $aClassAxiom \in AXIOM \wedge$
$aClassAxiom \notin Axiom$

THEN
$ClassAxiom := ClassAxiom \cup \{aClassAxiom\}$ ||
$Axiom := Axiom \cup \{aClassAxiom\}$
END;

Declaration_NEW($aDeclaration$) =
PRE $aDeclaration \in AXIOM \wedge$
$aDeclaration \notin Axiom$

THEN
$Declaration := Declaration \cup \{aDeclaration\}$ ||
$Axiom := Axiom \cup \{aDeclaration\}$
END;

ObjectComplementOf_NEW($aObjectComplementOf$) =
PRE $aObjectComplementOf \in CLASSEXPRESSION \wedge$
$aObjectComplementOf \notin ClassExpression$

THEN
$ObjectComplementOf := ObjectComplementOf \cup \{aObjectComplementOf\}$ ||
$ClassExpression := ClassExpression \cup \{aObjectComplementOf\}$
END;

ObjectOneOf_NEW($aObjectOneOf$) =
PRE $aObjectOneOf \in CLASSEXPRESSION \wedge$
$aObjectOneOf \notin ClassExpression$

THEN

$ObjectOneOf := ObjectOneOf \cup \{aObjectOneOf\} \;||$
$ClassExpression := ClassExpression \cup \{aObjectOneOf\}$
END;

ObjectHasValue_NEW$(aObjectHasValue) =$
PRE $aObjectHasValue \in CLASSEXPRESSION \wedge$
$aObjectHasValue \notin ClassExpression$

THEN
$ObjectHasValue := ObjectHasValue \cup \{aObjectHasValue\} \;||$
$ClassExpression := ClassExpression \cup \{aObjectHasValue\}$
END;

ObjectProperty_NEW$(aObjectProperty) =$
PRE $aObjectProperty \in ENTITY \wedge$
$aObjectProperty \notin Entity$

THEN
$ObjectProperty := ObjectProperty \cup \{aObjectProperty\} \;||$
$Entity := Entity \cup \{aObjectProperty\}$
END;

ObjectSomeValuesFrom_NEW$(aObjectSomeValuesFrom) =$
PRE $aObjectSomeValuesFrom \in CLASSEXPRESSION \wedge$
$aObjectSomeValuesFrom \notin ClassExpression$

THEN
$ObjectSomeValuesFrom := ObjectSomeValuesFrom \cup \{aObjectSomeValuesFrom\} \;||$
$ClassExpression := ClassExpression \cup \{aObjectSomeValuesFrom\}$
END;

ObjectAllValuesFrom_NEW$(aObjectAllValuesFrom) =$
PRE $aObjectAllValuesFrom \in CLASSEXPRESSION \wedge$
$aObjectAllValuesFrom \notin ClassExpression$

THEN
$ObjectAllValuesFrom := ObjectAllValuesFrom \cup \{aObjectAllValuesFrom\} \;||$
$ClassExpression := ClassExpression \cup \{aObjectAllValuesFrom\}$
END;

Datatype_NEW$(aDatatype) =$
PRE $aDatatype \in ENTITY \wedge$
$aDatatype \notin Entity$

THEN
$Datatype := Datatype \cup \{aDatatype\} \;||$
$Entity := Entity \cup \{aDatatype\}$
END;

ClassAssertion_NEW$(aClassAssertion) =$
PRE $aClassAssertion \in AXIOM \wedge$
$aClassAssertion \notin Axiom$

THEN

$ClassAssertion := ClassAssertion \cup \{aClassAssertion\}$ ||
$Assertion := Assertion \cup \{aClassAssertion\}$ ||
$Axiom := Axiom \cup \{aClassAssertion\}$
END;

EquivalentClasses_NEW($aEquivalentClasses$) =
PRE $aEquivalentClasses \in AXIOM \wedge$
$aEquivalentClasses \notin Axiom$

THEN
$EquivalentClasses := EquivalentClasses \cup \{aEquivalentClasses\}$ ||
$ClassAxiom := ClassAxiom \cup \{aEquivalentClasses\}$ ||
$Axiom := Axiom \cup \{aEquivalentClasses\}$
END;

DisjointUnion_NEW($aDisjointUnion$) =
PRE $aDisjointUnion \in AXIOM \wedge$
$aDisjointUnion \notin Axiom$

THEN
$DisjointUnion := DisjointUnion \cup \{aDisjointUnion\}$ ||
$ClassAxiom := ClassAxiom \cup \{aDisjointUnion\}$ ||
$Axiom := Axiom \cup \{aDisjointUnion\}$
END;

DisjointClasses_NEW($aDisjointClasses$,$theClassExpressions$) =
PRE $aDisjointClasses \in AXIOM \wedge$
$theClassExpressions \in \mathcal{F}\ (ClassExpression) \wedge$
$aDisjointClasses \notin Axiom \wedge$
card($theClassExpressions$) $\geq 2 \wedge$
$\forall\ added.(\ added \in theClassExpressions \Rightarrow disjointClassExp[\{added\}] = \emptyset\ )$

THEN
$DisjointClasses := DisjointClasses \cup \{aDisjointClasses\}$ ||
$ClassAxiom := ClassAxiom \cup \{aDisjointClasses\}$ ||
$Axiom := Axiom \cup \{aDisjointClasses\}$ ||
$disjointClassExp := disjointClassExp \cup (theClassExpressions \times \{aDisjointClasses\})$
END;

SubClassOf_NEW($aSubClassOf$,$aSubClassExpression$,$aSuperClassExpression$) =
PRE $aSubClassOf \in AXIOM \wedge$
$aSubClassExpression \in ClassExpression \wedge$
$aSuperClassExpression \in ClassExpression \wedge$
$aSubClassOf \notin Axiom \wedge$
$subClassExp^{-1}\ [\{aSubClassExpression\}] = \emptyset \wedge$
$superClassExp^{-1}\ [\{aSuperClassExpression\}] = \emptyset$

THEN
$SubClassOf := SubClassOf \cup \{aSubClassOf\}$ ||
$ClassAxiom := ClassAxiom \cup \{aSubClassOf\}$ ||
$Axiom := Axiom \cup \{aSubClassOf\}$ ||
$subClassExp := subClassExp \cup \{(aSubClassOf \mapsto aSubClassExpression)\}$ ||
$superClassExp := superClassExp \cup \{(aSubClassOf \mapsto aSuperClassExpression)\}$

END;

xOwl_Free($aXOwl$) =
PRE $aXOwl \in XOwl$

THEN
$XOwl := XOwl - \{aXOwl\}$ ||
$axioms := axioms \rhd \{aXOwl\}$ ||
$xOwl\_ontologyIRI := \{aXOwl\} \lhd xOwl\_ontologyIRI$ ||
$xOwl\_versionIRI := \{aXOwl\} \lhd xOwl\_versionIRI$
END;

Axiom_Free($aAxiom$) =
PRE $aAxiom \in Axiom \wedge$
$aAxiom \notin Assertion \wedge$
$aAxiom \notin Declaration \wedge$
$aAxiom \notin ClassAxiom$

THEN
$Axiom := Axiom - \{aAxiom\}$ ||
$axioms := \{aAxiom\} \lhd axioms$
END;

ClassExpression_Free($aClassExpression$) =
PRE $aClassExpression \in ClassExpression \wedge$
$aClassExpression \notin ObjectComplementOf \wedge$
$aClassExpression \notin ObjectOneOf \wedge$
$aClassExpression \notin ObjectAllValuesFrom \wedge$
$aClassExpression \notin ObjectSomeValuesFrom \wedge$
$aClassExpression \notin ObjectHasValue \wedge$
$\forall\ aDisjointClasses.(\ aDisjointClasses \in disjointClassExp[\{aClassExpression\}] \Rightarrow$ **card**$(disjointClassExp^{-1}[\{aDisjointClasses\}]) \geq 3) \wedge$
$subClassExp^{-1}[\{aClassExpression\}] = \emptyset \wedge$
$superClassExp^{-1}[\{aClassExpression\}] = \emptyset$

THEN
$ClassExpression := ClassExpression - \{aClassExpression\}$ ||
$classOfClassExp := \{aClassExpression\} \lhd classOfClassExp$ ||
$A\_classExpression\_classAssertion := A\_classExpression\_classAssertion \rhd \{aClassExpression\}$ ||
$A\_classExpressions\_equivalentClasses := \{aClassExpression\} \lhd A\_classExpressions\_equivalentClasses$ ||
$A\_disjointClassExpressions\_disjointUnion := \{aClassExpression\} \lhd A\_disjointClassExpressions\_disjointUnion$ ||
$disjointClassExp := \{aClassExpression\} \lhd disjointClassExp$ ||
$subClassExp := subClassExp \rhd \{aClassExpression\}$ ||
$superClassExp := superClassExp \rhd \{aClassExpression\}$ ||
$A\_classExpression\_objectComplementOf := A\_classExpression\_objectComplementOf \rhd \{aClassExpression\}$ ||
$A\_classExpression\_objectSomeValuesFrom := A\_classExpression\_objectSomeValuesFrom \rhd \{aClassExpression\}$ ||
$A\_classExpression\_objectAllValuesFrom := A\_classExpression\_objectAllValuesFrom \rhd \{aClassExpression\}$

END;

Entity_Free(*aEntity*) =
PRE $aEntity \in Entity \wedge$
$aEntity \notin Class \wedge$
$aEntity \notin Individual \wedge$
$aEntity \notin ObjectProperty \wedge$
$aEntity \notin Datatype$

THEN
$Entity := Entity - \{aEntity\} \;||$
$A\_entity\_declaration := A\_entity\_declaration \rhd \{aEntity\} \;||$
$Entity\_name := \{aEntity\} \lhd Entity\_name$
END;

Annotation_Free(*aAnnotation*) =
PRE $aAnnotation \in Annotation$

THEN
$Annotation := Annotation - \{aAnnotation\} \;||$
$axiomAnnotations := \{aAnnotation\} \lhd axiomAnnotations \;||$
$Annotation\_annotationValue := \{aAnnotation\} \lhd Annotation\_annotationValue$
END;

ObjectPropertyExpression_Free(*aObjectPropertyExpression*) =
PRE $aObjectPropertyExpression \in ObjectPropertyExpression$

THEN
$ObjectPropertyExpression := ObjectPropertyExpression - \{aObjectPropertyExpression\} \;||$
$A\_objectProperty\_objectPropertyExpression := \{aObjectPropertyExpression\} \lhd A\_objectProperty\_objectPropertyExpression \;||$
$A\_objectPropertyExpression\_objectHasValue := A\_objectPropertyExpression\_objectHasValue \rhd \{aObjectPropertyExpression\} \;||$
$A\_objectPropertyExpression\_objectSomeValuesFrom := A\_objectPropertyExpression\_objectSomeValu \rhd \{aObjectPropertyExpression\} \;||$
$A\_objectPropertyExpression\_objectAllValuesFrom := A\_objectPropertyExpression\_objectAllValuesFro \rhd \{aObjectPropertyExpression\}$
END;

Assertion_Free(*aAssertion*) =
PRE $aAssertion \in Assertion \wedge$
$aAssertion \notin ClassAssertion$

THEN
$Assertion := Assertion - \{aAssertion\} \;||$
$Axiom := Axiom - \{aAssertion\} \;||$
$axioms := \{aAssertion\} \lhd axioms$
END;

Class_Free(*aClass*) =
PRE $aClass \in Class$

THEN
$Class := Class - \{aClass\} \;||$

$Entity := Entity - \{aClass\} \parallel$
$classOfClassExp := classOfClassExp \rhd \{aClass\} \parallel$
$A\_class\_disjointUnion := A\_class\_disjointUnion \rhd \{aClass\} \parallel$
$A\_entity\_declaration := A\_entity\_declaration \rhd \{aClass\} \parallel$
$Entity\_name := \{aClass\} \lhd Entity\_name$
END;

Individual_Free($aIndividual$) =
PRE $aIndividual \in Individual$

THEN
$Individual := Individual - \{aIndividual\} \parallel$
$Entity := Entity - \{aIndividual\} \parallel$
$A\_individual\_classAssertion := A\_individual\_classAssertion \rhd \{aIndividual\} \parallel$
$A\_entity\_declaration := A\_entity\_declaration \rhd \{aIndividual\} \parallel$
$A\_individuals\_objectOneOf := A\_individuals\_objectOneOf \rhd \{aIndividual\} \parallel$
$A\_individual\_objectHasValue := A\_individual\_objectHasValue \rhd \{aIndividual\} \parallel$
$Entity\_name := \{aIndividual\} \lhd Entity\_name$
END;

ClassAxiom_Free($aClassAxiom$) =
PRE $aClassAxiom \in ClassAxiom \wedge$
$aClassAxiom \notin DisjointClasses \wedge$
$aClassAxiom \notin SubClassOf \wedge$
$aClassAxiom \notin EquivalentClasses \wedge$
$aClassAxiom \notin DisjointUnion$

THEN
$ClassAxiom := ClassAxiom - \{aClassAxiom\} \parallel$
$Axiom := Axiom - \{aClassAxiom\} \parallel$
$axioms := \{aClassAxiom\} \lhd axioms \parallel$
$axiomAnnotations := axiomAnnotations \rhd \{aClassAxiom\}$
END;

Declaration_Free($aDeclaration$) =
PRE $aDeclaration \in Declaration$

THEN
$Declaration := Declaration - \{aDeclaration\} \parallel$
$Axiom := Axiom - \{aDeclaration\} \parallel$
$axioms := \{aDeclaration\} \lhd axioms \parallel$
$A\_entity\_declaration := \{aDeclaration\} \lhd A\_entity\_declaration$
END;

ObjectComplementOf_Free($aObjectComplementOf$) =
PRE $aObjectComplementOf \in ObjectComplementOf \wedge$
$\forall\ aDisjointClasses.(\ aDisjointClasses \in disjointClassExp[\{aObjectComplementOf\}] \Rightarrow$
card($disjointClassExp^{-1}[\{aDisjointClasses\}]$) $\geq 3) \wedge$
$subClassExp^{-1}[\{aObjectComplementOf\}] = \emptyset \wedge$
$superClassExp^{-1}[\{aObjectComplementOf\}] = \emptyset$

THEN
$ObjectComplementOf := ObjectComplementOf - \{aObjectComplementOf\} \parallel$

$ClassExpression := ClassExpression - \{aObjectComplementOf\} \;||$
$classOfClassExp := \{aObjectComplementOf\} \lhd classOfClassExp \;||$
$A\_classExpression\_classAssertion := A\_classExpression\_classAssertion \rhd \{aObjectComplementOf\} \;||$
$A\_classExpressions\_equivalentClasses := \{aObjectComplementOf\} \lhd A\_classExpressions\_equivalentClasses \;||$
$A\_disjointClassExpressions\_disjointUnion := \{aObjectComplementOf\} \lhd A\_disjointClassExpressions\_disjointUnion \;||$
$disjointClassExp := \{aObjectComplementOf\} \lhd disjointClassExp \;||$
$subClassExp := subClassExp \rhd \{aObjectComplementOf\} \;||$
$superClassExp := superClassExp \rhd \{aObjectComplementOf\} \;||$
$A\_classExpression\_objectComplementOf := \{aObjectComplementOf\} \lhd (A\_classExpression\_objectComplementOf \rhd \{aObjectComplementOf\}) \;||$
$A\_classExpression\_objectSomeValuesFrom := A\_classExpression\_objectSomeValuesFrom \rhd \{aObjectComplementOf\} \;||$
$A\_classExpression\_objectAllValuesFrom := A\_classExpression\_objectAllValuesFrom \rhd \{aObjectComplementOf\}$

END;

ObjectOneOf_Free($aObjectOneOf$) =
PRE $aObjectOneOf \in ObjectOneOf \wedge$
$\forall\, aDisjointClasses.(\; aDisjointClasses \in disjointClassExp[\{aObjectOneOf\}] \Rightarrow \mathbf{card}(disjointClassExp^{-1}[\{aDisjointClasses\}]) \geq 3) \wedge$
$subClassExp^{-1}[\{aObjectOneOf\}] = \emptyset \wedge$
$superClassExp^{-1}[\{aObjectOneOf\}] = \emptyset$

THEN
$ObjectOneOf := ObjectOneOf - \{aObjectOneOf\} \;||$
$ClassExpression := ClassExpression - \{aObjectOneOf\} \;||$
$classOfClassExp := \{aObjectOneOf\} \lhd classOfClassExp \;||$
$A\_classExpression\_classAssertion := A\_classExpression\_classAssertion \rhd \{aObjectOneOf\} \;||$
$A\_classExpressions\_equivalentClasses := \{aObjectOneOf\} \lhd A\_classExpressions\_equivalentClasses \;||$
$A\_disjointClassExpressions\_disjointUnion := \{aObjectOneOf\} \lhd A\_disjointClassExpressions\_disjointUnion \;||$
$disjointClassExp := \{aObjectOneOf\} \lhd disjointClassExp \;||$
$subClassExp := subClassExp \rhd \{aObjectOneOf\} \;||$
$superClassExp := superClassExp \rhd \{aObjectOneOf\} \;||$
$A\_classExpression\_objectComplementOf := A\_classExpression\_objectComplementOf \rhd \{aObjectOneOf\} \;||$
$A\_individuals\_objectOneOf := \{aObjectOneOf\} \lhd A\_individuals\_objectOneOf \;||$
$A\_classExpression\_objectSomeValuesFrom := A\_classExpression\_objectSomeValuesFrom \rhd \{aObjectOneOf\} \;||$
$A\_classExpression\_objectAllValuesFrom := A\_classExpression\_objectAllValuesFrom \rhd \{aObjectOneOf\}$

END;

ObjectHasValue_Free($aObjectHasValue$) =
PRE $aObjectHasValue \in ObjectHasValue \wedge$
$\forall\, aDisjointClasses.(\; aDisjointClasses \in disjointClassExp[\{aObjectHasValue\}] \Rightarrow \mathbf{card}(disjointClassExp^{-1}[\{aDisjointClasses\}]) \geq 3) \wedge$
$subClassExp^{-1}[\{aObjectHasValue\}] = \emptyset \wedge$

$superClassExp^{-1}[\{aObjectHasValue\}] = \emptyset$

THEN
$ObjectHasValue := ObjectHasValue - \{aObjectHasValue\} \;||$
$ClassExpression := ClassExpression - \{aObjectHasValue\} \;||$
$classOfClassExp := \{aObjectHasValue\} \lhd classOfClassExp \;||$
$A\_classExpression\_classAssertion := A\_classExpression\_classAssertion \rhd \{aObjectHasValue\} \;||$
$A\_classExpressions\_equivalentClasses := \{aObjectHasValue\} \lhd A\_classExpressions\_equivalentClasses \;||$
$A\_disjointClassExpressions\_disjointUnion := \{aObjectHasValue\} \lhd A\_disjointClassExpressions\_disjointUnion \;||$
$disjointClassExp := \{aObjectHasValue\} \lhd disjointClassExp \;||$
$subClassExp := subClassExp \rhd \{aObjectHasValue\} \;||$
$superClassExp := superClassExp \rhd \{aObjectHasValue\} \;||$
$A\_classExpression\_objectComplementOf := A\_classExpression\_objectComplementOf \rhd \{aObjectHasValue\} \;||$
$A\_objectPropertyExpression\_objectHasValue := \{aObjectHasValue\} \lhd A\_objectPropertyExpression\_objectHasValue \;||$
$A\_individual\_objectHasValue := \{aObjectHasValue\} \lhd A\_individual\_objectHasValue \;||$
$A\_classExpression\_objectSomeValuesFrom := A\_classExpression\_objectSomeValuesFrom \rhd \{aObjectHasValue\} \;||$
$A\_classExpression\_objectAllValuesFrom := A\_classExpression\_objectAllValuesFrom \rhd \{aObjectHasValue\}$
END;

ObjectProperty_Free($aObjectProperty$) =
PRE $aObjectProperty \in ObjectProperty$

THEN
$ObjectProperty := ObjectProperty - \{aObjectProperty\} \;||$
$Entity := Entity - \{aObjectProperty\} \;||$
$A\_entity\_declaration := A\_entity\_declaration \rhd \{aObjectProperty\} \;||$
$A\_objectProperty\_objectPropertyExpression := A\_objectProperty\_objectPropertyExpression \rhd \{aObjectProperty\} \;||$
$Entity\_name := \{aObjectProperty\} \lhd Entity\_name$
END;

ObjectSomeValuesFrom_Free($aObjectSomeValuesFrom$) =
PRE $aObjectSomeValuesFrom \in ObjectSomeValuesFrom \wedge$
$\forall\, aDisjointClasses.(\; aDisjointClasses \in disjointClassExp[\{aObjectSomeValuesFrom\}] \Rightarrow \mathbf{card}(disjointClassExp^{-1}[\{aDisjointClasses\}]) \geq 3) \wedge$
$subClassExp^{-1}[\{aObjectSomeValuesFrom\}] = \emptyset \wedge$
$superClassExp^{-1}[\{aObjectSomeValuesFrom\}] = \emptyset$

THEN
$ObjectSomeValuesFrom := ObjectSomeValuesFrom - \{aObjectSomeValuesFrom\} \;||$
$ClassExpression := ClassExpression - \{aObjectSomeValuesFrom\} \;||$
$classOfClassExp := \{aObjectSomeValuesFrom\} \lhd classOfClassExp \;||$
$A\_classExpression\_classAssertion := A\_classExpression\_classAssertion \rhd \{aObjectSomeValuesFrom\} \;||$
$A\_classExpressions\_equivalentClasses := \{aObjectSomeValuesFrom\} \lhd A\_classExpressions\_equivalentClasses \;||$

$A\_disjointClassExpressions\_disjointUnion := \{aObjectSomeValuesFrom\} \lhd A\_disjointClassExpressions\_disjointUnion \;||$
$disjointClassExp := \{aObjectSomeValuesFrom\} \lhd disjointClassExp \;||$
$subClassExp := subClassExp \rhd \{aObjectSomeValuesFrom\} \;||$
$superClassExp := superClassExp \rhd \{aObjectSomeValuesFrom\} \;||$
$A\_classExpression\_objectComplementOf := A\_classExpression\_objectComplementOf \rhd \{aObjectSomeValuesFrom\} \;||$
$A\_objectPropertyExpression\_objectSomeValuesFrom := \{aObjectSomeValuesFrom\} \lhd A\_objectPropertyExpression\_objectSomeValuesFrom \;||$
$A\_classExpression\_objectSomeValuesFrom := \{aObjectSomeValuesFrom\} \lhd (A\_classExpression\_objectSomeValuesFrom \rhd \{aObjectSomeValuesFrom\}) \;||$
$A\_classExpression\_objectAllValuesFrom := A\_classExpression\_objectAllValuesFrom \rhd \{aObjectSomeValuesFrom\}$

END;

ObjectAllValuesFrom_Free($aObjectAllValuesFrom$) =
PRE $aObjectAllValuesFrom \in ObjectAllValuesFrom \wedge$
$\forall\, aDisjointClasses.(\, aDisjointClasses \in disjointClassExp[\{aObjectAllValuesFrom\}] \Rightarrow \mathbf{card}(disjointClassExp^{-1}[\{aDisjointClasses\}]) \geq 3) \wedge$
$subClassExp^{-1}[\{aObjectAllValuesFrom\}] = \emptyset \wedge$
$superClassExp^{-1}[\{aObjectAllValuesFrom\}] = \emptyset$

THEN
$ObjectAllValuesFrom := ObjectAllValuesFrom - \{aObjectAllValuesFrom\} \;||$
$ClassExpression := ClassExpression - \{aObjectAllValuesFrom\} \;||$
$classOfClassExp := \{aObjectAllValuesFrom\} \lhd classOfClassExp \;||$
$A\_classExpression\_classAssertion := A\_classExpression\_classAssertion \rhd \{aObjectAllValuesFrom\} \;||$
$A\_classExpressions\_equivalentClasses := \{aObjectAllValuesFrom\} \lhd A\_classExpressions\_equivalentClasses \;||$
$A\_disjointClassExpressions\_disjointUnion := \{aObjectAllValuesFrom\} \lhd A\_disjointClassExpressions\_disjointUnion \;||$
$disjointClassExp := \{aObjectAllValuesFrom\} \lhd disjointClassExp \;||$
$subClassExp := subClassExp \rhd \{aObjectAllValuesFrom\} \;||$
$superClassExp := superClassExp \rhd \{aObjectAllValuesFrom\} \;||$
$A\_classExpression\_objectComplementOf := A\_classExpression\_objectComplementOf \rhd \{aObjectAllValuesFrom\} \;||$
$A\_classExpression\_objectSomeValuesFrom := A\_classExpression\_objectSomeValuesFrom \rhd \{aObjectAllValuesFrom\} \;||$
$A\_objectPropertyExpression\_objectAllValuesFrom := \{aObjectAllValuesFrom\} \lhd A\_objectPropertyExpression\_objectAllValuesFrom \;||$
$A\_classExpression\_objectAllValuesFrom := \{aObjectAllValuesFrom\} \lhd (A\_classExpression\_objectAllValuesFrom \rhd \{aObjectAllValuesFrom\})$

END;

Datatype_Free($aDatatype$) =
PRE $aDatatype \in Datatype$

THEN
$Datatype := Datatype - \{aDatatype\} \;||$
$Entity := Entity - \{aDatatype\} \;||$
$A\_entity\_declaration := A\_entity\_declaration \rhd \{aDatatype\} \;||$
$Entity\_name := \{aDatatype\} \lhd Entity\_name$

END;

ClassAssertion_Free($aClassAssertion$) =
PRE $aClassAssertion \in ClassAssertion$

THEN
$ClassAssertion := ClassAssertion - \{aClassAssertion\} \;||$
$Assertion := Assertion - \{aClassAssertion\} \;||$
$Axiom := Axiom - \{aClassAssertion\} \;||$
$axioms := \{aClassAssertion\} \lhd axioms \;||$
$A\_classExpression\_classAssertion := \{aClassAssertion\} \lhd A\_classExpression\_classAssertion \;||$
$A\_individual\_classAssertion := \{aClassAssertion\} \lhd A\_individual\_classAssertion$
END;

EquivalentClasses_Free($aEquivalentClasses$) =
PRE $aEquivalentClasses \in EquivalentClasses$

THEN
$EquivalentClasses := EquivalentClasses - \{aEquivalentClasses\} \;||$
$ClassAxiom := ClassAxiom - \{aEquivalentClasses\} \;||$
$Axiom := Axiom - \{aEquivalentClasses\} \;||$
$axioms := \{aEquivalentClasses\} \lhd axioms \;||$
$axiomAnnotations := axiomAnnotations \rhd \{aEquivalentClasses\} \;||$
$A\_classExpressions\_equivalentClasses := A\_classExpressions\_equivalentClasses \rhd \{aEquivalentClasses\}$
END;

DisjointUnion_Free($aDisjointUnion$) =
PRE $aDisjointUnion \in DisjointUnion$

THEN
$DisjointUnion := DisjointUnion - \{aDisjointUnion\} \;||$
$ClassAxiom := ClassAxiom - \{aDisjointUnion\} \;||$
$Axiom := Axiom - \{aDisjointUnion\} \;||$
$axioms := \{aDisjointUnion\} \lhd axioms \;||$
$axiomAnnotations := axiomAnnotations \rhd \{aDisjointUnion\} \;||$
$A\_class\_disjointUnion := \{aDisjointUnion\} \lhd A\_class\_disjointUnion \;||$
$A\_disjointClassExpressions\_disjointUnion := A\_disjointClassExpressions\_disjointUnion \rhd \{aDisjointUnion\}$
END;

DisjointClasses_Free($aDisjointClasses$) =
PRE $aDisjointClasses \in DisjointClasses$

THEN
$DisjointClasses := DisjointClasses - \{aDisjointClasses\} \;||$
$ClassAxiom := ClassAxiom - \{aDisjointClasses\} \;||$
$Axiom := Axiom - \{aDisjointClasses\} \;||$
$axioms := \{aDisjointClasses\} \lhd axioms \;||$
$axiomAnnotations := axiomAnnotations \rhd \{aDisjointClasses\} \;||$
$disjointClassExp := disjointClassExp \rhd \{aDisjointClasses\}$

END;

SubClassOf_Free($aSubClassOf$) =
PRE $aSubClassOf \in SubClassOf$

THEN
$SubClassOf := SubClassOf - \{aSubClassOf\}$ ||
$ClassAxiom := ClassAxiom - \{aSubClassOf\}$ ||
$Axiom := Axiom - \{aSubClassOf\}$ ||
$axioms := \{aSubClassOf\} \lhd axioms$ ||
$axiomAnnotations := axiomAnnotations \rhd \{aSubClassOf\}$ ||
$subClassExp := \{aSubClassOf\} \lhd subClassExp$ ||
$superClassExp := \{aSubClassOf\} \lhd superClassExp$
END;

$result \leftarrow$ **xOwl_GetAxioms**($aXOwl$) =
PRE $aXOwl \in XOwl \wedge$
$aXOwl \in \mathbf{ran}(axioms)$

THEN
$result := axioms^{-1}[\{aXOwl\}]$
END;

$result \leftarrow$ **ClassAssertion_GetClassExpression**($aClassAssertion$) =
PRE $aClassAssertion \in ClassAssertion \wedge$
$aClassAssertion \in \mathbf{dom}(A\_classExpression\_classAssertion)$

THEN
$result := A\_classExpression\_classAssertion(aClassAssertion)$
END;

$result \leftarrow$ **ClassAssertion_GetIndividual**($aClassAssertion$) =
PRE $aClassAssertion \in ClassAssertion \wedge$
$aClassAssertion \in \mathbf{dom}(A\_individual\_classAssertion)$

THEN
$result := A\_individual\_classAssertion(aClassAssertion)$
END;

$result \leftarrow$ **ClassExpression_GetClass**($aClassExpression$) =
PRE $aClassExpression \in ClassExpression \wedge$
$aClassExpression \in \mathbf{dom}(classOfClassExp)$

THEN
$result := classOfClassExp(aClassExpression)$
END;

$result \leftarrow$ **ClassAxiom_GetAxiomAnnotations**($aClassAxiom$) =
PRE $aClassAxiom \in ClassAxiom \wedge$
$aClassAxiom \in \mathbf{ran}(axiomAnnotations)$

THEN
$result := axiomAnnotations^{-1}[\{aClassAxiom\}]$

END;

result ← **EquivalentClasses_GetClassExpressions**(*aEquivalentClasses*) =
PRE *aEquivalentClasses* ∈ *EquivalentClasses* ∧
aEquivalentClasses ∈ **ran**(*A_classExpressions_equivalentClasses*)

THEN
result := *A_classExpressions_equivalentClasses* $^{-1}$ [{*aEquivalentClasses*}]
END;

result ← **DisjointUnion_GetClass**(*aDisjointUnion*) =
PRE *aDisjointUnion* ∈ *DisjointUnion* ∧
aDisjointUnion ∈ **dom**(*A_class_disjointUnion*)

THEN
result := *A_class_disjointUnion*(*aDisjointUnion*)
END;

result ← **DisjointUnion_GetDisjointClassExpressions**(*aDisjointUnion*) =
PRE *aDisjointUnion* ∈ *DisjointUnion* ∧
aDisjointUnion ∈ **ran**(*A_disjointClassExpressions_disjointUnion*)

THEN
result := *A_disjointClassExpressions_disjointUnion* $^{-1}$ [{*aDisjointUnion*}]
END;

result ← **DisjointClasses_GetClassExpressions**(*aDisjointClasses*) =
PRE *aDisjointClasses* ∈ *DisjointClasses* ∧
aDisjointClasses ∈ **ran**(*disjointClassExp*)

THEN
result := *disjointClassExp* $^{-1}$ [{*aDisjointClasses*}]
END;

result ← **SubClassOf_GetSubClassExpression**(*aSubClassOf*) =
PRE *aSubClassOf* ∈ *SubClassOf* ∧
aSubClassOf ∈ **dom**(*subClassExp*)

THEN
result := *subClassExp*(*aSubClassOf*)
END;

result ← **SubClassOf_GetSuperClassExpression**(*aSubClassOf*) =
PRE *aSubClassOf* ∈ *SubClassOf* ∧
aSubClassOf ∈ **dom**(*superClassExp*)

THEN
result := *superClassExp*(*aSubClassOf*)
END;

result ← **Declaration_GetEntity**(*aDeclaration*) =
PRE *aDeclaration* ∈ *Declaration* ∧
aDeclaration ∈ **dom**(*A_entity_declaration*)

THEN
result := *A_entity_declaration*(*aDeclaration*)
END;

result ← **ObjectComplementOf_GetClassExpression**(*aObjectComplementOf*) =
PRE *aObjectComplementOf* ∈ *ObjectComplementOf* ∧
aObjectComplementOf ∈ **dom**(*A_classExpression_objectComplementOf*)

THEN
result := *A_classExpression_objectComplementOf*(*aObjectComplementOf*)
END;

result ← **ObjectOneOf_GetIndividuals**(*aObjectOneOf*) =
PRE *aObjectOneOf* ∈ *ObjectOneOf* ∧
aObjectOneOf ∈ **dom**(*A_individuals_objectOneOf*)

THEN
result := *A_individuals_objectOneOf*[{*aObjectOneOf*}]
END;

result ← **ObjectHasValue_GetObjectPropertyExpression**(*aObjectHasValue*) =
PRE *aObjectHasValue* ∈ *ObjectHasValue* ∧
aObjectHasValue ∈ **dom**(*A_objectPropertyExpression_objectHasValue*)

THEN
result := *A_objectPropertyExpression_objectHasValue*(*aObjectHasValue*)
END;

result ← **ObjectHasValue_GetIndividual**(*aObjectHasValue*) =
PRE *aObjectHasValue* ∈ *ObjectHasValue* ∧
aObjectHasValue ∈ **dom**(*A_individual_objectHasValue*)

THEN
result := *A_individual_objectHasValue*(*aObjectHasValue*)
END;

result ← **ObjectPropertyExpression_GetObjectProperty**(*aObjectPropertyExpression*)
=
PRE *aObjectPropertyExpression* ∈ *ObjectPropertyExpression* ∧
aObjectPropertyExpression ∈ **dom**(*A_objectProperty_objectPropertyExpression*)

THEN
result := *A_objectProperty_objectPropertyExpression*(*aObjectPropertyExpression*)
END;

result ← **ObjectSomeValuesFrom_GetObjectPropertyExpression**(*aObjectSomeValuesFrom*)
=
PRE *aObjectSomeValuesFrom* ∈ *ObjectSomeValuesFrom* ∧
aObjectSomeValuesFrom ∈ **dom**(*A_objectPropertyExpression_objectSomeValuesFrom*)

THEN
result := *A_objectPropertyExpression_objectSomeValuesFrom*(*aObjectSomeValuesFrom*)

END;

result ← **ObjectSomeValuesFrom_GetClassExpression**(*aObjectSomeValuesFrom*) =
PRE *aObjectSomeValuesFrom* ∈ *ObjectSomeValuesFrom* ∧
aObjectSomeValuesFrom ∈ **dom**(*A_classExpression_objectSomeValuesFrom*)

THEN
result := *A_classExpression_objectSomeValuesFrom*(*aObjectSomeValuesFrom*)
END;

result ← **ObjectAllValuesFrom_GetObjectPropertyExpression**(*aObjectAllValuesFrom*)
=
PRE *aObjectAllValuesFrom* ∈ *ObjectAllValuesFrom* ∧
aObjectAllValuesFrom ∈ **dom**(*A_objectPropertyExpression_objectAllValuesFrom*)

THEN
result := *A_objectPropertyExpression_objectAllValuesFrom*(*aObjectAllValuesFrom*)
END;

result ← **ObjectAllValuesFrom_GetClassExpression**(*aObjectAllValuesFrom*) =
PRE *aObjectAllValuesFrom* ∈ *ObjectAllValuesFrom* ∧
aObjectAllValuesFrom ∈ **dom**(*A_classExpression_objectAllValuesFrom*)

THEN
result := *A_classExpression_objectAllValuesFrom*(*aObjectAllValuesFrom*)
END;

xOwl_SetAxioms(*aXOwl*,*theAxioms*) =
PRE *aXOwl* ∈ *XOwl* ∧
theAxioms ∈ $\mathcal{F}$ (*Axiom*) ∧
(*theAxioms* × {*aXOwl*}) ⊈ *axioms* ∧
∀ *added*.(*added* ∈ *theAxioms* ⇒ *axioms*[{*added*}] = ∅)

THEN
axioms := (*axioms* ⩥ {*aXOwl*}) ∪ (*theAxioms* × {*aXOwl*})
END;

ClassAssertion_SetClassExpression(*aClassAssertion*,*aClassExpression*) =
PRE *aClassAssertion* ∈ *ClassAssertion* ∧
aClassExpression ∈ *ClassExpression* ∧
{(*aClassAssertion* ↦ *aClassExpression*)} ⊈ *A_classExpression_classAssertion* ∧
A_classExpression_classAssertion $^{-1}$ [{*aClassExpression*}] = ∅

THEN
A_classExpression_classAssertion := ({*aClassAssertion*} ⩤
A_classExpression_classAssertion) ∪ {(*aClassAssertion* ↦ *aClassExpression*)}
END;

ClassAssertion_SetIndividual(*aClassAssertion*,*aIndividual*) =
PRE *aClassAssertion* ∈ *ClassAssertion* ∧
aIndividual ∈ *Individual* ∧
{(*aClassAssertion* ↦ *aIndividual*)} ⊈ *A_individual_classAssertion*

THEN

$A\_individual\_classAssertion := (\{aClassAssertion\} \lhd A\_individual\_classAssertion) \cup \{(aClassAssertion \mapsto aIndividual)\}$

END;

ClassExpression_SetClass($aClassExpression$,$aClass$) =

PRE $aClassExpression \in ClassExpression \wedge$
$aClass \in Class \wedge$
$\{(aClassExpression \mapsto aClass)\} \not\subseteq classOfClassExp$

THEN
$classOfClassExp := (\{aClassExpression\} \lhd classOfClassExp) \cup \{(aClassExpression \mapsto aClass)\}$

END;

ClassAxiom_SetAxiomAnnotations($aClassAxiom$,$theAxiomAnnotations$) =

PRE $aClassAxiom \in ClassAxiom \wedge$
$theAxiomAnnotations \in \mathcal{F}\ (Annotation) \wedge$
$(theAxiomAnnotations \times \{aClassAxiom\}) \not\subseteq axiomAnnotations \wedge$
$\forall\ added.(\ added \in theAxiomAnnotations \Rightarrow axiomAnnotations[\{added\}] = \emptyset\ )$

THEN
$axiomAnnotations := (axiomAnnotations \rhd \{aClassAxiom\}) \cup (theAxiomAnnotations \times \{aClassAxiom\})$

END;

EquivalentClasses_SetClassExpressions($aEquivalentClasses$,$theClassExpressions$) =

PRE $aEquivalentClasses \in EquivalentClasses \wedge$
$theClassExpressions \in \mathcal{F}\ (ClassExpression) \wedge$
$(theClassExpressions \times \{aEquivalentClasses\}) \not\subseteq A\_classExpressions\_equivalentClasses \wedge$
$\forall\ added.(\ added \in theClassExpressions \Rightarrow A\_classExpressions\_equivalentClasses[\{added\}] = \emptyset\ )$

THEN
$A\_classExpressions\_equivalentClasses := (A\_classExpressions\_equivalentClasses \rhd \{aEquivalentClasses\}) \cup (theClassExpressions \times \{aEquivalentClasses\})$

END;

DisjointUnion_SetClass($aDisjointUnion$,$aClass$) =

PRE $aDisjointUnion \in DisjointUnion \wedge$
$aClass \in Class \wedge$
$\{(aDisjointUnion \mapsto aClass)\} \not\subseteq A\_class\_disjointUnion$

THEN
$A\_class\_disjointUnion := (\{aDisjointUnion\} \lhd A\_class\_disjointUnion) \cup \{(aDisjointUnion \mapsto aClass)\}$

END;

DisjointUnion_SetDisjointClassExpressions($aDisjointUnion$,$theDisjointClassExpressions$) =

PRE $aDisjointUnion \in DisjointUnion \wedge$
$theDisjointClassExpressions \in \mathcal{F}\ (ClassExpression) \wedge$
$(theDisjointClassExpressions \times \{aDisjointUnion\}) \not\subseteq A\_disjointClassExpressions\_disjointUnion \wedge$
$\forall\ added.(\ added \in theDisjointClassExpressions \Rightarrow$

$A\_disjointClassExpressions\_disjointUnion[\{added\}] = \emptyset$)

THEN
$A\_disjointClassExpressions\_disjointUnion := (A\_disjointClassExpressions\_disjointUnion \rhd \{aDisjointUnion\}) \cup (theDisjointClassExpressions \times \{aDisjointUnion\})$
END;

DisjointClasses_SetClassExpressions($aDisjointClasses$,$theClassExpressions$) =
PRE $aDisjointClasses \in DisjointClasses \wedge$
$theClassExpressions \in \mathcal{F}\ (ClassExpression) \wedge$
$(theClassExpressions \times \{aDisjointClasses\}) \not\subseteq disjointClassExp \wedge$
card($theClassExpressions$) $\geq 2 \wedge$
$\forall\ added.(\ added \in theClassExpressions \Rightarrow disjointClassExp[\{added\}] = \emptyset\ )$

THEN
$disjointClassExp := (disjointClassExp \rhd \{aDisjointClasses\}) \cup (theClassExpressions \times \{aDisjointClasses\})$
END;

SubClassOf_SetSubClassExpression($aSubClassOf$,$aSubClassExpression$) =
PRE $aSubClassOf \in SubClassOf \wedge$
$aSubClassExpression \in ClassExpression \wedge$
$\{(aSubClassOf \mapsto aSubClassExpression)\} \not\subseteq subClassExp \wedge$
$subClassExp^{-1}[\{aSubClassExpression\}] = \emptyset$

THEN
$subClassExp := (\{aSubClassOf\} \lhd subClassExp) \cup \{(aSubClassOf \mapsto aSubClassExpression)\}$
END;

SubClassOf_SetSuperClassExpression($aSubClassOf$,$aSuperClassExpression$) =
PRE $aSubClassOf \in SubClassOf \wedge$
$aSuperClassExpression \in ClassExpression \wedge$
$\{(aSubClassOf \mapsto aSuperClassExpression)\} \not\subseteq superClassExp \wedge$
$superClassExp^{-1}[\{aSuperClassExpression\}] = \emptyset$

THEN
$superClassExp := (\{aSubClassOf\} \lhd superClassExp) \cup \{(aSubClassOf \mapsto aSuperClassExpression)\}$
END;

Declaration_SetEntity($aDeclaration$,$aEntity$) =
PRE $aDeclaration \in Declaration \wedge$
$aEntity \in Entity \wedge$
$\{(aDeclaration \mapsto aEntity)\} \not\subseteq A\_entity\_declaration \wedge$
$A\_entity\_declaration^{-1}[\{aEntity\}] = \emptyset$

THEN
$A\_entity\_declaration := (\{aDeclaration\} \lhd A\_entity\_declaration) \cup \{(aDeclaration \mapsto aEntity)\}$
END;

ObjectComplementOf_SetClassExpression($aObjectComplementOf$,$aClassExpression$) =

PRE $aObjectComplementOf \in ObjectComplementOf \wedge$
$aClassExpression \in ClassExpression \wedge$
$\{(aObjectComplementOf \mapsto aClassExpression)\} \not\subseteq A\_classExpression\_objectComplementOf$
$\wedge$
$A\_classExpression\_objectComplementOf^{-1}[\{aClassExpression\}] = \emptyset$

THEN
$A\_classExpression\_objectComplementOf := (\{aObjectComplementOf\} \lhd A\_classExpression\_objectComplementOf) \cup \{(aObjectComplementOf \mapsto aClassExpression)\}$
END;

ObjectOneOf_SetIndividuals($aObjectOneOf$,$theIndividuals$) =
PRE $aObjectOneOf \in ObjectOneOf \wedge$
$theIndividuals \in \mathcal{F}(Individual) \wedge$
$(\{aObjectOneOf\} \times theIndividuals) \not\subseteq A\_individuals\_objectOneOf$

THEN
$A\_individuals\_objectOneOf := (\{aObjectOneOf\} \lhd A\_individuals\_objectOneOf) \cup (\{aObjectOneOf\} \times theIndividuals)$
END;

ObjectHasValue_SetObjectPropertyExpression($aObjectHasValue$,$aObjectPropertyExpression$) =
PRE $aObjectHasValue \in ObjectHasValue \wedge$
$aObjectPropertyExpression \in ObjectPropertyExpression \wedge$
$\{(aObjectHasValue \mapsto aObjectPropertyExpression)\} \not\subseteq A\_objectPropertyExpression\_objectHasValue$
$\wedge$
$A\_objectPropertyExpression\_objectHasValue^{-1}[\{aObjectPropertyExpression\}] = \emptyset$

THEN
$A\_objectPropertyExpression\_objectHasValue := (\{aObjectHasValue\} \lhd A\_objectPropertyExpression\_objectHasValue) \cup \{(aObjectHasValue \mapsto aObjectPropertyExpression)\}$
END;

ObjectHasValue_SetIndividual($aObjectHasValue$,$aIndividual$) =
PRE $aObjectHasValue \in ObjectHasValue \wedge$
$aIndividual \in Individual \wedge$
$\{(aObjectHasValue \mapsto aIndividual)\} \not\subseteq A\_individual\_objectHasValue$

THEN
$A\_individual\_objectHasValue := (\{aObjectHasValue\} \lhd A\_individual\_objectHasValue) \cup \{(aObjectHasValue \mapsto aIndividual)\}$
END;

ObjectPropertyExpression_SetObjectProperty($aObjectPropertyExpression$,$aObjectProperty$) =
PRE $aObjectPropertyExpression \in ObjectPropertyExpression \wedge$
$aObjectProperty \in ObjectProperty \wedge$
$\{(aObjectPropertyExpression \mapsto aObjectProperty)\} \not\subseteq A\_objectProperty\_objectPropertyExpression$

THEN
$A\_objectProperty\_objectPropertyExpression := (\{aObjectPropertyExpression\} \lhd$

$A\_objectProperty\_objectPropertyExpression) \cup \{(aObjectPropertyExpression \mapsto aObject-Property)\}$

END;

ObjectSomeValuesFrom_SetObjectPropertyExpression($aObjectSomeValuesFrom$,$aObjectProper$
=

PRE $aObjectSomeValuesFrom \in ObjectSomeValuesFrom \wedge$
$aObjectPropertyExpression \in ObjectPropertyExpression \wedge$
$\{(aObjectSomeValuesFrom \mapsto aObjectPropertyExpression)\} \not\subseteq A\_objectPropertyExpression\_objectSomeValuesFrom \wedge$
$A\_objectPropertyExpression\_objectSomeValuesFrom^{-1}[\{aObjectPropertyExpression\}] = \emptyset$

THEN
$A\_objectPropertyExpression\_objectSomeValuesFrom := (\{aObjectSomeValuesFrom\} \lhd A\_objectPropertyExpression\_objectSomeValuesFrom) \cup \{(aObjectSomeValuesFrom \mapsto aObject-PropertyExpression)\}$

END;

ObjectSomeValuesFrom_SetClassExpression($aObjectSomeValuesFrom$,$aClassExpression$)
=

PRE $aObjectSomeValuesFrom \in ObjectSomeValuesFrom \wedge$
$aClassExpression \in ClassExpression \wedge$
$\{(aObjectSomeValuesFrom \mapsto aClassExpression)\} \not\subseteq A\_classExpression\_objectSomeValuesFrom \wedge$
$A\_classExpression\_objectSomeValuesFrom^{-1}[\{aClassExpression\}] = \emptyset$

THEN
$A\_classExpression\_objectSomeValuesFrom := (\{aObjectSomeValuesFrom\} \lhd A\_classExpression\_objectSomeValuesFrom) \cup \{(aObjectSomeValuesFrom \mapsto aClassExpression)\}$

END;

ObjectAllValuesFrom_SetObjectPropertyExpression($aObjectAllValuesFrom$,$aObjectPropertyEx$
=

PRE $aObjectAllValuesFrom \in ObjectAllValuesFrom \wedge$
$aObjectPropertyExpression \in ObjectPropertyExpression \wedge$
$\{(aObjectAllValuesFrom \mapsto aObjectPropertyExpression)\} \not\subseteq A\_objectPropertyExpression\_objectAllValuesFrom \wedge$
$A\_objectPropertyExpression\_objectAllValuesFrom^{-1}[\{aObjectPropertyExpression\}] = \emptyset$

THEN
$A\_objectPropertyExpression\_objectAllValuesFrom := (\{aObjectAllValuesFrom\} \lhd A\_objectPropertyExpression\_objectAllValuesFrom) \cup \{(aObjectAllValuesFrom \mapsto aObject-PropertyExpression)\}$

END;

ObjectAllValuesFrom_SetClassExpression($aObjectAllValuesFrom$,$aClassExpression$) =
PRE $aObjectAllValuesFrom \in ObjectAllValuesFrom \wedge$
$aClassExpression \in ClassExpression \wedge$
$\{(aObjectAllValuesFrom \mapsto aClassExpression)\} \not\subseteq A\_classExpression\_objectAllValuesFrom \wedge$
$A\_classExpression\_objectAllValuesFrom^{-1}[\{aClassExpression\}] = \emptyset$

THEN
$A\_classExpression\_objectAllValuesFrom := (\{aObjectAllValuesFrom\} \lhd A\_classExpression\_objectAllValuesFrom) \cup \{(aObjectAllValuesFrom \mapsto aClassExpression)\}$
END;

xOwl_UnsetAxioms$(aXOwl) =$
PRE $aXOwl \in XOwl$

THEN
$axioms := axioms \rhd \{aXOwl\}$
END;

ClassAssertion_UnsetClassExpression$(aClassAssertion) =$
PRE $aClassAssertion \in ClassAssertion$

THEN
$A\_classExpression\_classAssertion := \{aClassAssertion\} \lhd A\_classExpression\_classAssertion$
END;

ClassAssertion_UnsetIndividual$(aClassAssertion) =$
PRE $aClassAssertion \in ClassAssertion$

THEN
$A\_individual\_classAssertion := \{aClassAssertion\} \lhd A\_individual\_classAssertion$
END;

ClassExpression_UnsetClass$(aClassExpression) =$
PRE $aClassExpression \in ClassExpression$

THEN
$classOfClassExp := \{aClassExpression\} \lhd classOfClassExp$
END;

ClassAxiom_UnsetAxiomAnnotations$(aClassAxiom) =$
PRE $aClassAxiom \in ClassAxiom$

THEN
$axiomAnnotations := axiomAnnotations \rhd \{aClassAxiom\}$
END;

EquivalentClasses_UnsetClassExpressions$(aEquivalentClasses) =$
PRE $aEquivalentClasses \in EquivalentClasses$

THEN
$A\_classExpressions\_equivalentClasses := A\_classExpressions\_equivalentClasses \rhd \{aEquivalentClasses\}$
END;

DisjointUnion_UnsetClass$(aDisjointUnion) =$
PRE $aDisjointUnion \in DisjointUnion$

THEN

$A\_class\_disjointUnion := \{aDisjointUnion\} \lhd A\_class\_disjointUnion$
END;

DisjointUnion_UnsetDisjointClassExpressions($aDisjointUnion$) =
PRE $aDisjointUnion \in DisjointUnion$

THEN
$A\_disjointClassExpressions\_disjointUnion := A\_disjointClassExpressions\_disjointUnion \rhd \{aDisjointUnion\}$
END;

Declaration_UnsetEntity($aDeclaration$) =
PRE $aDeclaration \in Declaration$

THEN
$A\_entity\_declaration := \{aDeclaration\} \lhd A\_entity\_declaration$
END;

ObjectComplementOf_UnsetClassExpression($aObjectComplementOf$) =
PRE $aObjectComplementOf \in ObjectComplementOf$

THEN
$A\_classExpression\_objectComplementOf := \{aObjectComplementOf\} \lhd A\_classExpression\_objectComplementOf$
END;

ObjectOneOf_UnsetIndividuals($aObjectOneOf$) =
PRE $aObjectOneOf \in ObjectOneOf$

THEN
$A\_individuals\_objectOneOf := \{aObjectOneOf\} \lhd A\_individuals\_objectOneOf$
END;

ObjectHasValue_UnsetObjectPropertyExpression($aObjectHasValue$) =
PRE $aObjectHasValue \in ObjectHasValue$

THEN
$A\_objectPropertyExpression\_objectHasValue := \{aObjectHasValue\} \lhd A\_objectPropertyExpression\_objectHasValue$
END;

ObjectHasValue_UnsetIndividual($aObjectHasValue$) =
PRE $aObjectHasValue \in ObjectHasValue$

THEN
$A\_individual\_objectHasValue := \{aObjectHasValue\} \lhd A\_individual\_objectHasValue$
END;

ObjectPropertyExpression_UnsetObjectProperty($aObjectPropertyExpression$) =
PRE $aObjectPropertyExpression \in ObjectPropertyExpression$

THEN
$A\_objectProperty\_objectPropertyExpression := \{aObjectPropertyExpression\} \lhd A\_objectProperty\_objectPropertyExpression$

END;

ObjectSomeValuesFrom_UnsetObjectPropertyExpression(*aObjectSomeValuesFrom*) =
PRE $aObjectSomeValuesFrom \in ObjectSomeValuesFrom$

THEN
$A\_objectPropertyExpression\_objectSomeValuesFrom := \{aObjectSomeValuesFrom\} \lhd A\_objectPropertyExpression\_objectSomeValuesFrom$
END;

ObjectSomeValuesFrom_UnsetClassExpression(*aObjectSomeValuesFrom*) =
PRE $aObjectSomeValuesFrom \in ObjectSomeValuesFrom$

THEN
$A\_classExpression\_objectSomeValuesFrom := \{aObjectSomeValuesFrom\} \lhd A\_classExpression\_objectSomeValuesFrom$
END;

ObjectAllValuesFrom_UnsetObjectPropertyExpression(*aObjectAllValuesFrom*) =
PRE $aObjectAllValuesFrom \in ObjectAllValuesFrom$

THEN
$A\_objectPropertyExpression\_objectAllValuesFrom := \{aObjectAllValuesFrom\} \lhd A\_objectPropertyExpression\_objectAllValuesFrom$
END;

ObjectAllValuesFrom_UnsetClassExpression(*aObjectAllValuesFrom*) =
PRE $aObjectAllValuesFrom \in ObjectAllValuesFrom$

THEN
$A\_classExpression\_objectAllValuesFrom := \{aObjectAllValuesFrom\} \lhd A\_classExpression\_objectAllValuesFrom$
END;

xOwl_AddAxioms(*aXOwl*,*aAxioms*) =
PRE $aXOwl \in XOwl \land$
$aAxioms \in Axiom \land$
$(aAxioms \mapsto aXOwl) \notin axioms \land$
$axioms[\{aAxioms\}] = \emptyset$

THEN
$axioms := axioms \cup \{(aAxioms \mapsto aXOwl)\}$
END;

ClassAxiom_AddAxiomAnnotations(*aClassAxiom*,*aAxiomAnnotations*) =
PRE $aClassAxiom \in ClassAxiom \land$
$aAxiomAnnotations \in Annotation \land$
$(aAxiomAnnotations \mapsto aClassAxiom) \notin axiomAnnotations \land$
$axiomAnnotations[\{aAxiomAnnotations\}] = \emptyset$

THEN
$axiomAnnotations := axiomAnnotations \cup \{(aAxiomAnnotations \mapsto aClassAxiom)\}$

END;

EquivalentClasses_AddClassExpressions($aEquivalentClasses$,$aClassExpressions$) =
PRE $aEquivalentClasses \in EquivalentClasses \wedge$
$aClassExpressions \in ClassExpression \wedge$
$(aClassExpressions \mapsto aEquivalentClasses) \notin A\_classExpressions\_equivalentClasses \wedge$
$A\_classExpressions\_equivalentClasses[\{aClassExpressions\}] = \emptyset$

THEN
$A\_classExpressions\_equivalentClasses := A\_classExpressions\_equivalentClasses \cup \{(aClassExpressions \mapsto aEquivalentClasses)\}$
END;

DisjointUnion_AddDisjointClassExpressions($aDisjointUnion$,$aDisjointClassExpressions$) =
PRE $aDisjointUnion \in DisjointUnion \wedge$
$aDisjointClassExpressions \in ClassExpression \wedge$
$(aDisjointClassExpressions \mapsto aDisjointUnion) \notin A\_disjointClassExpressions\_disjointUnion \wedge$
$A\_disjointClassExpressions\_disjointUnion[\{aDisjointClassExpressions\}] = \emptyset$

THEN
$A\_disjointClassExpressions\_disjointUnion := A\_disjointClassExpressions\_disjointUnion \cup \{(aDisjointClassExpressions \mapsto aDisjointUnion)\}$
END;

DisjointClasses_AddClassExpressions($aDisjointClasses$,$aClassExpressions$) =
PRE $aDisjointClasses \in DisjointClasses \wedge$
$aClassExpressions \in ClassExpression \wedge$
$(aClassExpressions \mapsto aDisjointClasses) \notin disjointClassExp \wedge$
$disjointClassExp[\{aClassExpressions\}] = \emptyset$

THEN
$disjointClassExp := disjointClassExp \cup \{(aClassExpressions \mapsto aDisjointClasses)\}$
END;

ObjectOneOf_AddIndividuals($aObjectOneOf$,$aIndividuals$) =
PRE $aObjectOneOf \in ObjectOneOf \wedge$
$aIndividuals \in Individual \wedge$
$(aObjectOneOf \mapsto aIndividuals) \notin A\_individuals\_objectOneOf$

THEN
$A\_individuals\_objectOneOf := A\_individuals\_objectOneOf \cup \{(aObjectOneOf \mapsto aIndividuals)\}$
END;

xOwl_RemoveAxioms($aXOwl$,$aAxioms$) =
PRE $aXOwl \in XOwl \wedge$
$aAxioms \in Axiom \wedge$
$(aAxioms \mapsto aXOwl) \in axioms$

THEN
$axioms := axioms$ - $\{(aAxioms \mapsto aXOwl)\}$

END;

ClassAssertion_RemoveClassExpression(*aClassAssertion*,*aClassExpression*) =
PRE *aClassAssertion* ∈ *ClassAssertion* ∧
aClassExpression ∈ *ClassExpression* ∧
(*aClassAssertion* ↦ *aClassExpression*) ∈ *A_classExpression_classAssertion*

THEN
A_classExpression_classAssertion := *A_classExpression_classAssertion* - {(*aClassAssertion* ↦ *aClassExpression*)}
END;

ClassAssertion_RemoveIndividual(*aClassAssertion*,*aIndividual*) =
PRE *aClassAssertion* ∈ *ClassAssertion* ∧
aIndividual ∈ *Individual* ∧
(*aClassAssertion* ↦ *aIndividual*) ∈ *A_individual_classAssertion*

THEN
A_individual_classAssertion := *A_individual_classAssertion* - {(*aClassAssertion* ↦ *aIndividual*)}
END;

ClassExpression_RemoveClass(*aClassExpression*,*aClass*) =
PRE *aClassExpression* ∈ *ClassExpression* ∧
aClass ∈ *Class* ∧
(*aClassExpression* ↦ *aClass*) ∈ *classOfClassExp*

THEN
classOfClassExp := *classOfClassExp* - {(*aClassExpression* ↦ *aClass*)}
END;

ClassAxiom_RemoveAxiomAnnotations(*aClassAxiom*,*aAxiomAnnotations*) =
PRE *aClassAxiom* ∈ *ClassAxiom* ∧
aAxiomAnnotations ∈ *Annotation* ∧
(*aAxiomAnnotations* ↦ *aClassAxiom*) ∈ *axiomAnnotations*

THEN
axiomAnnotations := *axiomAnnotations* - {(*aAxiomAnnotations* ↦ *aClassAxiom*)}
END;

EquivalentClasses_RemoveClassExpressions(*aEquivalentClasses*,*aClassExpressions*) =
PRE *aEquivalentClasses* ∈ *EquivalentClasses* ∧
aClassExpressions ∈ *ClassExpression* ∧
(*aClassExpressions* ↦ *aEquivalentClasses*) ∈ *A_classExpressions_equivalentClasses*

THEN
A_classExpressions_equivalentClasses := *A_classExpressions_equivalentClasses* - {(*aClassExpressions* ↦ *aEquivalentClasses*)}
END;

DisjointUnion_RemoveClass(*aDisjointUnion*,*aClass*) =
PRE *aDisjointUnion* ∈ *DisjointUnion* ∧
aClass ∈ *Class* ∧
(*aDisjointUnion* ↦ *aClass*) ∈ *A_class_disjointUnion*

THEN
$A\_class\_disjointUnion := A\_class\_disjointUnion - \{(aDisjointUnion \mapsto aClass)\}$
END;

DisjointUnion_RemoveDisjointClassExpressions($aDisjointUnion$,$aDisjointClassExpressions$) =
PRE $aDisjointUnion \in DisjointUnion \wedge$
$aDisjointClassExpressions \in ClassExpression \wedge$
$(aDisjointClassExpressions \mapsto aDisjointUnion) \in A\_disjointClassExpressions\_disjointUnion$

THEN
$A\_disjointClassExpressions\_disjointUnion := A\_disjointClassExpressions\_disjointUnion - \{(aDisjointClassExpressions \mapsto aDisjointUnion)\}$
END;

DisjointClasses_RemoveClassExpressions($aDisjointClasses$,$aClassExpressions$) =
PRE $aDisjointClasses \in DisjointClasses \wedge$
$aClassExpressions \in ClassExpression \wedge$
$(aClassExpressions \mapsto aDisjointClasses) \in disjointClassExp \wedge$
$\mathbf{card}(disjointClassExp^{-1}[\{aDisjointClasses\}]) \geq 3$

THEN
$disjointClassExp := disjointClassExp - \{(aClassExpressions \mapsto aDisjointClasses)\}$
END;

Declaration_RemoveEntity($aDeclaration$,$aEntity$) =
PRE $aDeclaration \in Declaration \wedge$
$aEntity \in Entity \wedge$
$(aDeclaration \mapsto aEntity) \in A\_entity\_declaration$

THEN
$A\_entity\_declaration := A\_entity\_declaration - \{(aDeclaration \mapsto aEntity)\}$
END;

ObjectComplementOf_RemoveClassExpression($aObjectComplementOf$,$aClassExpression$) =
PRE $aObjectComplementOf \in ObjectComplementOf \wedge$
$aClassExpression \in ClassExpression \wedge$
$(aObjectComplementOf \mapsto aClassExpression) \in A\_classExpression\_objectComplementOf$

THEN
$A\_classExpression\_objectComplementOf := A\_classExpression\_objectComplementOf - \{(aObjectComplementOf \mapsto aClassExpression)\}$
END;

ObjectOneOf_RemoveIndividuals($aObjectOneOf$,$aIndividuals$) =
PRE $aObjectOneOf \in ObjectOneOf \wedge$
$aIndividuals \in Individual \wedge$
$(aObjectOneOf \mapsto aIndividuals) \in A\_individuals\_objectOneOf$

THEN
$A\_individuals\_objectOneOf := A\_individuals\_objectOneOf - \{(aObjectOneOf \mapsto aIndividuals)\}$

END;

ObjectHasValue_RemoveObjectPropertyExpression(*aObjectHasValue*,*aObjectPropertyExpressio*
=
PRE *aObjectHasValue* ∈ *ObjectHasValue* ∧
aObjectPropertyExpression ∈ *ObjectPropertyExpression* ∧
(*aObjectHasValue* ↦ *aObjectPropertyExpression*) ∈ *A_objectPropertyExpression_objectHasValue*

THEN
A_objectPropertyExpression_objectHasValue := *A_objectPropertyExpression_objectHasValue*
- {(*aObjectHasValue* ↦ *aObjectPropertyExpression*)}
END;

ObjectHasValue_RemoveIndividual(*aObjectHasValue*,*aIndividual*) =
PRE *aObjectHasValue* ∈ *ObjectHasValue* ∧
aIndividual ∈ *Individual* ∧
(*aObjectHasValue* ↦ *aIndividual*) ∈ *A_individual_objectHasValue*

THEN
A_individual_objectHasValue := *A_individual_objectHasValue* - {(*aObjectHasValue* ↦
aIndividual)}
END;

ObjectPropertyExpression_RemoveObjectProperty(*aObjectPropertyExpression*,*aObjectProperty*
=
PRE *aObjectPropertyExpression* ∈ *ObjectPropertyExpression* ∧
aObjectProperty ∈ *ObjectProperty* ∧
(*aObjectPropertyExpression* ↦ *aObjectProperty*) ∈ *A_objectProperty_objectPropertyExpression*

THEN
A_objectProperty_objectPropertyExpression := *A_objectProperty_objectPropertyExpression*
- {(*aObjectPropertyExpression* ↦ *aObjectProperty*)}
END;

ObjectSomeValuesFrom_RemoveObjectPropertyExpression(*aObjectSomeValuesFrom*,*aObjectP*
=
PRE *aObjectSomeValuesFrom* ∈ *ObjectSomeValuesFrom* ∧
aObjectPropertyExpression ∈ *ObjectPropertyExpression* ∧
(*aObjectSomeValuesFrom* ↦ *aObjectPropertyExpression*) ∈
A_objectPropertyExpression_objectSomeValuesFrom

THEN
A_objectPropertyExpression_objectSomeValuesFrom := *A_objectPropertyExpression_objectSomeValu*
- {(*aObjectSomeValuesFrom* ↦ *aObjectPropertyExpression*)}
END;

ObjectSomeValuesFrom_RemoveClassExpression(*aObjectSomeValuesFrom*,*aClassExpression*)
=
PRE *aObjectSomeValuesFrom* ∈ *ObjectSomeValuesFrom* ∧
aClassExpression ∈ *ClassExpression* ∧
(*aObjectSomeValuesFrom* ↦ *aClassExpression*) ∈ *A_classExpression_objectSomeValuesFrom*

THEN
A_classExpression_objectSomeValuesFrom := *A_classExpression_objectSomeValuesFrom*

- $\{(aObjectSomeValuesFrom \mapsto aClassExpression)\}$
END;

ObjectAllValuesFrom_RemoveObjectPropertyExpression($aObjectAllValuesFrom$,$aObjectPropet$
=
PRE $aObjectAllValuesFrom \in ObjectAllValuesFrom \wedge$
$aObjectPropertyExpression \in ObjectPropertyExpression \wedge$
$(aObjectAllValuesFrom \mapsto aObjectPropertyExpression) \in$
$A\_objectPropertyExpression\_objectAllValuesFrom$

THEN
$A\_objectPropertyExpression\_objectAllValuesFrom := A\_objectPropertyExpression\_objectAllValuesFro$
- $\{(aObjectAllValuesFrom \mapsto aObjectPropertyExpression)\}$
END;

ObjectAllValuesFrom_RemoveClassExpression($aObjectAllValuesFrom$,$aClassExpression$)
=
PRE $aObjectAllValuesFrom \in ObjectAllValuesFrom \wedge$
$aClassExpression \in ClassExpression \wedge$
$(aObjectAllValuesFrom \mapsto aClassExpression) \in A\_classExpression\_objectAllValuesFrom$

THEN
$A\_classExpression\_objectAllValuesFrom := A\_classExpression\_objectAllValuesFrom$ -
$\{(aObjectAllValuesFrom \mapsto aClassExpression)\}$
END;

$result \leftarrow$ **xOwl_GetOntologyIRI**($aXOwl$) =
PRE $aXOwl \in XOwl \wedge$
$aXOwl \in$ **dom**($xOwl\_ontologyIRI$)

THEN
$result := xOwl\_ontologyIRI(aXOwl)$
END;

$result \leftarrow$ **xOwl_GetVersionIRI**($aXOwl$) =
PRE $aXOwl \in XOwl \wedge$
$aXOwl \in$ **dom**($xOwl\_versionIRI$)

THEN
$result := xOwl\_versionIRI(aXOwl)$
END;

$result \leftarrow$ **Entity_GetName**($aEntity$) =
PRE $aEntity \in Entity \wedge$
$aEntity \in$ **dom**($Entity\_name$)

THEN
$result := Entity\_name(aEntity)$
END;

$result \leftarrow$ **Annotation_GetAnnotationValue**($aAnnotation$) =
PRE $aAnnotation \in Annotation \wedge$
$aAnnotation \in$ **dom**($Annotation\_annotationValue$)

THEN
$result := Annotation\_annotationValue(aAnnotation)$
END;

xOwl_SetOntologyIRI($aXOwl$,$aOntologyIRI$) =
PRE $aXOwl \in XOwl \wedge$
$aOntologyIRI \in STRING$

THEN
$xOwl\_ontologyIRI := (\{aXOwl\} \lhd xOwl\_ontologyIRI) \quad \cup \{(aXOwl \mapsto aOntologyIRI)\}$
END;

xOwl_SetVersionIRI($aXOwl$,$aVersionIRI$) =
PRE $aXOwl \in XOwl \wedge$
$aVersionIRI \in STRING$

THEN
$xOwl\_versionIRI := (\{aXOwl\} \lhd xOwl\_versionIRI) \quad \cup \{(aXOwl \mapsto aVersionIRI)\}$
END;

Entity_SetName($aEntity$,$aName$) =
PRE $aEntity \in Entity \wedge$
$aName \in STRING$

THEN
$Entity\_name := (\{aEntity\} \lhd Entity\_name) \quad \cup \{(aEntity \mapsto aName)\}$
END;

Annotation_SetAnnotationValue($aAnnotation$,$aAnnotationValue$) =
PRE $aAnnotation \in Annotation \wedge$
$aAnnotationValue \in STRING$

THEN
$Annotation\_annotationValue := (\{aAnnotation\} \lhd Annotation\_annotationValue) \quad \cup \{(aAnnotation \mapsto aAnnotationValue)\}$
END;

xOwl_UnsetOntologyIRI($aXOwl$) =
PRE $aXOwl \in XOwl$

THEN
$xOwl\_ontologyIRI := \{aXOwl\} \lhd xOwl\_ontologyIRI$
END;

xOwl_UnsetVersionIRI($aXOwl$) =
PRE $aXOwl \in XOwl$

THEN
$xOwl\_versionIRI := \{aXOwl\} \lhd xOwl\_versionIRI$
END;

Entity_UnsetName($aEntity$) =
PRE $aEntity \in Entity$

THEN
$Entity\_name := \{aEntity\} \lhd Entity\_name$
END;

Annotation_UnsetAnnotationValue($aAnnotation$) =
PRE $aAnnotation \in Annotation$

THEN
$Annotation\_annotationValue := \{aAnnotation\} \lhd Annotation\_annotationValue$
END;

xOwl_RemoveOntologyIRI($aXOwl$,$aOntologyIRI$) =
PRE $aXOwl \in XOwl \land$
$aOntologyIRI \in STRING \land$
$\{(aXOwl \mapsto aOntologyIRI)\} \subseteq xOwl\_ontologyIRI$

THEN
$xOwl\_ontologyIRI := xOwl\_ontologyIRI - \{(aXOwl \mapsto aOntologyIRI)\}$
END;

xOwl_RemoveVersionIRI($aXOwl$,$aVersionIRI$) =
PRE $aXOwl \in XOwl \land$
$aVersionIRI \in STRING \land$
$\{(aXOwl \mapsto aVersionIRI)\} \subseteq xOwl\_versionIRI$

THEN
$xOwl\_versionIRI := xOwl\_versionIRI - \{(aXOwl \mapsto aVersionIRI)\}$
END;

Entity_RemoveName($aEntity$,$aName$) =
PRE $aEntity \in Entity \land$
$aName \in STRING \land$
$\{(aEntity \mapsto aName)\} \subseteq Entity\_name$

THEN
$Entity\_name := Entity\_name - \{(aEntity \mapsto aName)\}$
END;

Annotation_RemoveAnnotationValue($aAnnotation$,$aAnnotationValue$) =
PRE $aAnnotation \in Annotation \land$
$aAnnotationValue \in STRING \land$
$\{(aAnnotation \mapsto aAnnotationValue)\} \subseteq Annotation\_annotationValue$

THEN
$Annotation\_annotationValue := Annotation\_annotationValue - \{(aAnnotation \mapsto aAnnotationValue)\}$
END
END