

Mapping *SHOIN* to FOL

A (atomic concept)	$A(x)$
\top	\top
\perp	\perp
$C \sqcap D$	$tr(C) \wedge tr(D)$
$C \sqcup D$	$tr(C) \vee tr(D)$
$\neg C$	$\neg tr(C)$
$\forall R.C$	$\forall y : R(x, y) \rightarrow tr(C, y)$
$\exists R.C$	$\exists y : R(x, y) \wedge tr(C, y)$
$\{o_1, \dots, o_n\}$	$x = o_1 \vee \dots \vee x = o_n$
$\exists R.\{o\}$	$R(x, o)$
$\geq nR$	$\exists y_1, \dots, y_n : \bigwedge R(x, y_i) \wedge \bigwedge y_i \neq y_j$
$\leq nR$	$\forall y_1, \dots, y_{n+1} : \bigwedge R(x, y_i) \rightarrow \bigvee y_i = y_j$

1 / 1

Mapping *SHOIN* to FOL

$a \in A$	$A(a)$
$\langle a, b \rangle \in R$	$R(a, b)$
$C \sqsubseteq D$	$\forall x : tr(C, x) \rightarrow tr(D, x)$
$C \equiv D$	$\forall x : tr(C, x) \leftrightarrow tr(D, x)$
$Q \sqsubseteq R$	$\forall x, y : Q(x, y) \rightarrow R(x, y)$
$R \equiv Q^-$	$\forall x, y : R(x, y) \leftrightarrow Q(y, x)$
$R^+ \sqsubseteq R$	$\forall x, y, z : R(x, y) \wedge R(y, z) \rightarrow R(x, z)$

2 / 1

RDF Axiomatic triples

$\langle \text{rdf:type}, \text{rdf:type}, \text{rdf:Property} \rangle$
 $\langle \text{rdf:subject}, \text{rdf:type}, \text{rdf:Property} \rangle$
 $\langle \text{rdf:predicate}, \text{rdf:type}, \text{rdf:Property} \rangle$
 $\langle \text{rdf:object}, \text{rdf:type}, \text{rdf:Property} \rangle$
 $\langle \text{rdf:first}, \text{rdf:type}, \text{rdf:Property} \rangle$
 $\langle \text{rdf:rest}, \text{rdf:type}, \text{rdf:Property} \rangle$
 $\langle \text{rdf:value}, \text{rdf:type}, \text{rdf:Property} \rangle$
 $\langle \text{rdf:..1}, \text{rdf:type}, \text{rdf:Property} \rangle$
 $\langle \text{rdf:..2}, \text{rdf:type}, \text{rdf:Property} \rangle$
...
 $\langle \text{rdf:nil}, \text{rdf:type}, \text{rdf:List} \rangle$

3 / 1

RDFS Axiomatic triples I

$\langle \text{rdf:type}, \text{rdfs:domain}, \text{rdfs:Resource} \rangle$
 $\langle \text{rdfs:domain}, \text{rdfs:domain}, \text{rdf:Property} \rangle$
 $\langle \text{rdfs:range}, \text{rdfs:domain}, \text{rdf:Property} \rangle$
 $\langle \text{rdfs:subPropertyOf}, \text{rdfs:domain}, \text{rdf:Property} \rangle$
 $\langle \text{rdfs:subClassOf}, \text{rdfs:domain}, \text{rdfs:Class} \rangle$
 $\langle \text{rdf:subject}, \text{rdfs:domain}, \text{rdf:Statement} \rangle$
 $\langle \text{rdf:predicate}, \text{rdfs:domain}, \text{rdf:Statement} \rangle$
 $\langle \text{rdf:object}, \text{rdfs:domain}, \text{rdf:Statement} \rangle$
 $\langle \text{rdfs:member}, \text{rdfs:domain}, \text{rdfs:Resource} \rangle$
 $\langle \text{rdf:first}, \text{rdfs:domain}, \text{rdf:List} \rangle$
 $\langle \text{rdf:rest}, \text{rdfs:domain}, \text{rdf:List} \rangle$
 $\langle \text{rdfs:seeAlso}, \text{rdfs:domain}, \text{rdfs:Resource} \rangle$
 $\langle \text{rdfs:isDefinedBy}, \text{rdfs:domain}, \text{rdfs:Resource} \rangle$
 $\langle \text{rdfs:comment}, \text{rdfs:domain}, \text{rdfs:Resource} \rangle$
 $\langle \text{rdfs:label}, \text{rdfs:domain}, \text{rdfs:Resource} \rangle$

4 / 1

RDFS Axiomatic triples II

$\langle \text{rdf:value}, \text{rdfs:domain}, \text{rdfs:Resource} \rangle$
 $\langle \text{rdf:type}, \text{rdfs:range}, \text{rdfs:Class} \rangle$
 $\langle \text{rdfs:domain}, \text{rdfs:range}, \text{rdfs:Class} \rangle$
 $\langle \text{rdfs:range}, \text{rdfs:range}, \text{rdfs:Class} \rangle$
 $\langle \text{rdfs:subPropertyOf}, \text{rdfs:range}, \text{rdf:Property} \rangle$
 $\langle \text{rdfs:subClassOf}, \text{rdfs:range}, \text{rdfs:Class} \rangle$
 $\langle \text{rdf:subject}, \text{rdfs:range}, \text{rdfs:Resource} \rangle$
 $\langle \text{rdf:predicate}, \text{rdfs:range}, \text{rdfs:Resource} \rangle$
 $\langle \text{rdf:object}, \text{rdfs:range}, \text{rdfs:Resource} \rangle$
 $\langle \text{rdfs:member}, \text{rdfs:range}, \text{rdfs:Resource} \rangle$
 $\langle \text{rdf:first}, \text{rdfs:range}, \text{rdfs:Resource} \rangle$
 $\langle \text{rdf:rest}, \text{rdfs:range}, \text{rdf:List} \rangle$
 $\langle \text{rdfs:seeAlso}, \text{rdfs:range}, \text{rdfs:Resource} \rangle$
 $\langle \text{rdfs:isDefinedBy}, \text{rdfs:range}, \text{rdfs:Resource} \rangle$
 $\langle \text{rdfs:comment}, \text{rdfs:range}, \text{rdfs:Literal} \rangle$

5 / 1

RDFS Axiomatic triples III

$\langle \text{rdfs:label}, \text{rdfs:range}, \text{rdfs:Literal} \rangle$
 $\langle \text{rdf:value}, \text{rdfs:range}, \text{rdfs:Resource} \rangle$
 $\langle \text{rdf:Alt}, \text{rdfs:subClassOf}, \text{rdfs:Container} \rangle$
 $\langle \text{rdf:Bag}, \text{rdfs:subClassOf}, \text{rdfs:Container} \rangle$
 $\langle \text{rdf:Seq}, \text{rdfs:subClassOf}, \text{rdfs:Container} \rangle$
 $\langle \text{rdfs:ContainerMembershipProperty}, \text{rdfs:subClassOf}, \text{rdf:Property} \rangle$
 $\langle \text{rdfs:isDefinedBy}, \text{rdfs:subPropertyOf}, \text{rdfs:seeAlso} \rangle$
 $\langle \text{rdf:XMLLiteral}, \text{rdf:type}, \text{rdfs:Datatype} \rangle$
 $\langle \text{rdf:XMLLiteral}, \text{rdfs:subClassOf}, \text{rdfs:Literal} \rangle$
 $\langle \text{rdfs:Datatype}, \text{rdfs:subClassOf}, \text{rdfs:Class} \rangle$
 $\langle \text{rdf:..1}, \text{rdf:type}, \text{rdfs:ContainerMembershipProperty} \rangle$
 $\langle \text{rdf:..1}, \text{rdfs:domain}, \text{rdfs:Resource} \rangle$
 $\langle \text{rdf:..1}, \text{rdfs:range}, \text{rdfs:Resource} \rangle$

6 / 1

RDFS Axiomatic triples IV

```
<rdf:.2, rdf:type, rdfs:ContainerMembershipProperty>
<rdf:.2, rdfs:domain, rdfs:Resource>
<rdf:.2, rdfs:range, rdfs:Resource>
...
```

7 / 1

RDFS Entailment I

if E contains $\langle A, B, C \rangle$ then add $\langle B, \text{rdf:type}, \text{rdf:Property} \rangle$

if E contains $\langle A, B, I \rangle$ (I is a valid XML literal) then add $\langle _ : X, \text{rdf:type}, \text{rdf:XMLLiteral} \rangle$
everything in the subject is a resource:
if E contains $\langle A, B, C \rangle$ then add $\langle A, \text{rdf:type}, \text{rdfs:Resource} \rangle$

every non-literal in the object is a resource:
if E contains $\langle A, B, C \rangle$ (C is not a literal) then add $\langle C, \text{rdf:type}, \text{rdfs:Resource} \rangle$

every class is subclass of `rdfs:Resource`:
if E contains $\langle A, \text{rdf:type}, \text{rdfs:Class} \rangle$ then add $\langle A, \text{rdfs:subClassOf}, \text{rdfs:Resource} \rangle$

8 / 1

RDFS Entailment II

inheritance: **if E contains $\langle A, \text{rdf:type}, B \rangle, \langle B, \text{rdfs:subClassOf}, C \rangle$ then add $\langle A, \text{rdf:type}, C \rangle$**

`rdfs:subClassOf` is transitive:
if E contains $\langle A, \text{rdfs:subClassOf}, B \rangle, \langle B, \text{rdfs:subClassOf}, C \rangle$ then add $\langle A, \text{rdfs:subClassOf}, C \rangle$

`rdfs:subClassOf` is reflexive:
if E contains $\langle A, \text{rdf:type}, \text{rdfs:Class} \rangle$ then add $\langle A, \text{rdfs:subClassOf}, A \rangle$

`rdfs:subPropertyOf` is transitive:
if E contains $\langle A, \text{rdfs:subPropertyOf}, B \rangle, \langle B, \text{rdfs:subPropertyOf}, C \rangle$ then add $\langle A, \text{rdfs:subPropertyOf}, C \rangle$

`rdfs:subPropertyOf` is reflexive:
if E contains $\langle P, \text{rdf:type}, \text{rdf:Property} \rangle$ then add $\langle P, \text{rdfs:subPropertyOf}, P \rangle$

9 / 1

RDFS Entailment III

domain of properties:
if E contains $\langle P, \text{rdfs:domain}, C \rangle, \langle A, P, B \rangle$ then add $\langle A, \text{rdf:type}, C \rangle$

range of properties:
if E contains $\langle P, \text{rdfs:range}, C \rangle, \langle A, P, B \rangle$ then add $\langle B, \text{rdf:type}, C \rangle$

every literal is a member of `rdfs:Literal`:
if E contains $\langle A, B, I \rangle$ (I is a plain literal) then add $\langle _ : X, \text{rdf:type}, \text{rdfs:Literal} \rangle$

every datatype is subclass of `rdfs:Literal`:
if E contains $\langle A, \text{rdf:type}, \text{rdfs:Datatype} \rangle$ then add $\langle A, \text{rdfs:subClassOf}, \text{rdfs:Literal} \rangle$

10 / 1

More on literals

Recall:

if E contains $\langle A, B, I \rangle$ (I is a valid XML literal) then add $\langle _ : X, \text{rdf:type}, \text{rdf:XMLLiteral} \rangle$

every literal is a member of `rdfs:Literal`:
if E contains $\langle A, B, I \rangle$ (I is a plain literal) then add $\langle _ : X, \text{rdf:type}, \text{rdfs:Literal} \rangle$

allocating blank nodes to literals:
if E contains $\langle A, B, _ : n \rangle$ (I is a literal) then add $\langle A, B, _ : n \rangle$
 $_ : n$ is allocated to I

“dereferencing” blank nodes:
if E contains $\langle A, B, _ : n \rangle$ ($_ : n$ is allocated to a literal I) then add $\langle A, B, I \rangle$

11 / 1