Semantics in RDF and SPARQL
Some Considerations

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Center for Semantic Web Research
http://ciws.cl

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I. URI (today IRI)
Distributed creation and management of resources and vocabulary.
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II. Graph Structure
Distributed population and linking of distributed data
Semantics of RDF: Summary

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Plus inconsistencies with SPARQL
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Plus inconsistencies with SPARQL

IV. Complex Logic
Even for RDFS
The relational core of SPARQL

**SPARQL 1.1**
SELECT, FILTER, AND, UNION, and EXCEPT

**Multiset Relational Algebra (MRA)**
$\pi$, $\sigma$, $\bowtie$, $\cup$ and $\setminus$

**Multiset nr-Datalog**

**SQL**
SELECT, WHERE, NATURAL JOIN, UNION ALL, and EXCEPT
The relational core of SPARQL

Equivalences (hold even under multiset semantics)

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<tr>
<th>SPARQL</th>
<th>Multiset Rel. Algebra</th>
<th>nr-Datalog⁻</th>
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<tbody>
<tr>
<td>SELECT X</td>
<td>$\pi_X(...)$</td>
<td>$L \leftarrow L_1,..,L_n$</td>
<td>SELECT X ...</td>
</tr>
<tr>
<td>P FILTER C</td>
<td>$\sigma_C(p)$</td>
<td>$L \leftarrow L_p, C$</td>
<td>FROM p WHERE C</td>
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<tr>
<td>P . Q</td>
<td>$p \bowtie q$</td>
<td>$L \leftarrow L_p,L_q$</td>
<td>p NAT JOIN q</td>
</tr>
<tr>
<td>P UNION Q</td>
<td>$p \uplus q$</td>
<td>$L \leftarrow L_p$</td>
<td>p UNION ALL q</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$L \leftarrow L_q$</td>
<td></td>
</tr>
<tr>
<td>P EXCEPT Q</td>
<td>$p \setminus q$</td>
<td>$L \leftarrow L_p,\neg L_q$</td>
<td>p EXCEPT q</td>
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Semantic extensions of the SPARQL core

I. Bags

Bag semantics is the default

II. Incomplete information

Blanks and generation of unbounds (e.g. OPTIONAL)

III. Paths

Property Paths

IV. Subqueries

(sub)

SELECT and its consequences

V. Delegation features

FROM NAMED, GRAPH, SERVICE
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Logical reasoning
RDFS, OWL, etc.
OWA versus CWA
and its relation with RDF and SPARQL
Several protocols
Update, etc.
Who knows what else

God protects us...

– Semantics RDF and SPARQL
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Two morals and a suggestion

Fact
SPARQL is an extremely complex language

Warning
It is not evident that the semantics of each extension behaves well when interacting with the other parts.
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**Suggestion**
To study the themes of federation work with the core