Concepts and Buzzwords

BSc: DB + SQL lab
ER model — conceptual model
Rel. model — (logical) data model
Rel. algebra — set-oriented declarative (functional) ...
SQL — ... query language (=API)
Data+Querying — polynomial

Logics
there are many different logics
polynomial ...
... exponential ...
... undecidable

BSc:
- Formal Systems
- Artificial Intelligence

⇒ First-Order Logic (FOL)
$\mathcal{S} \models \psi$ — $\mathcal{S}$ satisfies ψ
$\varphi \models \psi$ — φ entails ψ
entailment undecidable

MSc Lecture
Semistructured Data & XML:
XML (tree) — (logical) data model and abstract datatype
DOM — low-level API
XPath/ — set-oriented declarative ...
XQuery — ... (functional) ... ... query language (API)
query part — polynomial
as fct.prg.lg.* — Turing-complete
XSLT — ... transformation lang. (API)
. . . just another (tree-based) data model
. . . for data *and* documents,
- schema/structure can be queried,
- underlying algebraic basis

Rel. Calculus — polynomial
(FOL without function symbols)
no reasoning,
"simple" algebraic evaluation
on a DB (=single interpretation)

Knowledge Bases:
Data+Knowledge
Reasoning

Model Theory

Querying

Classical Databases:
Closed World Semantics
Non-facts = Negation
Negation as default
the "minimal" model
SELECT ... FROM ...
WHERE NOT EXISTS...
"nonmonotonic reasoning"

Classical Logic:
Open World Semantics
Non-facts = unknown.
incomplete knowledge
all possible models
Safely provable formulas:
$\varphi \models_{\text{FOL}} \psi$
"monotonic reasoning"

Linked Data
RDF — (logical) data model
SPARQL — set-oriented declarative
mixed functional/logic/rule-based
... query language (API)
. . . just another (graph) data model
. . . for data *and* metadata
. . . algebraic, declarative language

Datalog
set-oriented declarative
(logic/matching-based)
query+rule language
knowledge representation
in different variants
... polynomial:
"minimal model",
"stratified model",
"well-founded model",
... exponential
"stable models",
"Answer-Set Programming",
... e.g., Sudokus

Ontologies/ Semantic Web
Description Logics
Web Ontology Language (OWL)
... polynomial
... exponential
... undecidable
knowledge repr. for RDF data

*: XQuery as a whole is a Turing-complete functional programming language whose underlying data model is XML.