As you just saw...

Logic-based Knowledge Representation & Reasoning

• at the heart of
  – COMP60332
    ▪ how to do reasoning
  – COMP62342
    ▪ how to use reasoning (on the web)

• at the heart **Symbolic Artificial Intelligence**, i.e., AI
  – based on high-level symbolic (human-readable) representations of knowledge
  – with (automated) reasoning for (generic) problem solving
COMP60332: how to model and use these models

Your Symbolic Domain Model, e.g., about Medicine

Automated Theorem Prover Reasoner
Vampire, iProver, Fact++, …

COMP62342: how to build these

Implicit Information Entailments Explanation Clever Query Answering
The Web

• A network of interlinked computers, protocols, software and applications

• A socio-cultural phenomenon

• Changed society over the last 20 years
  – work, trade, education, science, entertainment, culture…. 

• Rapidly evolving
  – underlying technologies
  – usage

• Huge
  – 50 Billion pages indexed by Google

1 http://www.worldwidewebsize.com/
“I have a dream for the Web [in which computers] become capable of analyzing all the data on the Web – the content, links, and transactions between people and computers. A Semantic Web, which makes this possible, has yet to emerge, but when it does, the day-to-day mechanisms of trade, bureaucracy and our daily lives will be handled by machines talking to machines. The "intelligent agents" people have touted for ages will finally materialize.”

Tim Berners-Lee, 1999
COMP62342: Ontology Engineering for the SW

An **Ontology** is a representation of the
- shared background knowledge
- for a community to
- provide the intended meaning of a
- (formal, machine processable) **vocabulary** that
- captures a **conceptualisation** of objects in a
- domain of interest

- **automated reasoning** to deploy knowledge captured
- e.g. **medicinology**
- at least ‘is-a’, often more

**Knowledge Representation!**
COMP62342: Ontology Engineering for the SW

• Knowledge Representation and Ontologies
  – Increasing role in applications
  – W3C’s OWL and SKOS established standards

• Key Technologies in realising the
  – Semantic Web and
  – Web of Data

• This course unit provides Foundations and Practice of understanding, developing and using OWL ontologies
  – Develop an understanding of the underlying languages and the tradeoffs in their design.
  – Acquire practical experience of ontology modelling and using in applications
COMP62342: Ontology Engineering for the SW

Theory
- Foundations
- Description Logics
- Reasoning
- Methodologies

Practice
- Knowledge Acquisition
- Ontology Development
- Applications
- Comment/critique

Tableaux Rules for ALC

\[
\begin{align*}
\text{add} & \quad \frac{\pi \vdash \phi}{\pi \cup \{\phi\}} \\
\text{ord} & \quad \frac{\pi \vdash \phi \land \pi \vdash \psi}{\pi \vdash \phi \land \psi} \\
\text{eq} & \quad \frac{\pi \vdash R.C} {\pi \cup \{\phi \land \pi \vdash \phi\} \\ & \quad \vdash \phi} \\
\text{inv} & \quad \frac{\pi \vdash R.C} {\pi \vdash \phi \land \pi \vdash R.C} \\
\text{path} & \quad \frac{\pi \vdash R.C} {\pi \vdash \phi \land \pi \vdash R.C} \\
\text{sub} & \quad \frac{\pi \vdash C \cup \{\phi\}} {\pi \vdash \phi} \\
\text{gen} & \quad \frac{\pi \vdash C \cup \{\phi\}} {\pi \vdash \phi} \\
\text{inst} & \quad \frac{\pi \vdash \phi \land \pi \vdash \phi} {\pi \vdash \phi} \\
\text{equiv} & \quad \frac{\pi \vdash \phi \land \pi \vdash \psi} {\pi \vdash \phi \land \psi} \\
\text{ally} & \quad \frac{\pi \vdash \phi \land \pi \vdash \phi} {\pi \vdash \phi \land \psi} \\
\text{prop} & \quad \frac{\pi \vdash \phi \land \pi \vdash \phi} {\pi \vdash \phi \land \psi} \\
\end{align*}
\]
COMP60411 Modelling Data on the Web
• various aspects of modelling data (on the web)
COMP62342
• various aspects of modelling knowledge (on the web)
COMP62342: Ontology Engineering for the SW

Assessment

• 50% Exam
  – Electronic/On-line

• 50% Coursework
  – Weekly short questions/tests
  – Practical exercises
    ▪ Knowledge Acquisition
    ▪ Modelling
    ▪ Ontology Critique
    ▪ Use of tools
    ▪ Application Development
Research Related to this Course Unit

- UoM is a Leading Research Centre in Ontology Engineering, Language Design and Semantic Applications
- Instrumental in W3C Standardization
  - Web Ontology Language OWL
  - Simple Knowledge Organisation Systems SKOS
  - SPARQL Query language
- Tool Development
  - OWL API, Protégé, FaCT++, SWOOP
- Applications
  - Life Sciences, eScience
Is it for me?

This unit is not for those who...
- just want to build web pages
- don’t like to “get their hands dirty”
- don’t like to read around the subject

This unit is for those who...
- are seeking a deeper understanding of the technologies that are being used to support the continuing evolution of the Web
- like modelling, logic, and AI
- like understanding, discussing, weighing up trade-offs