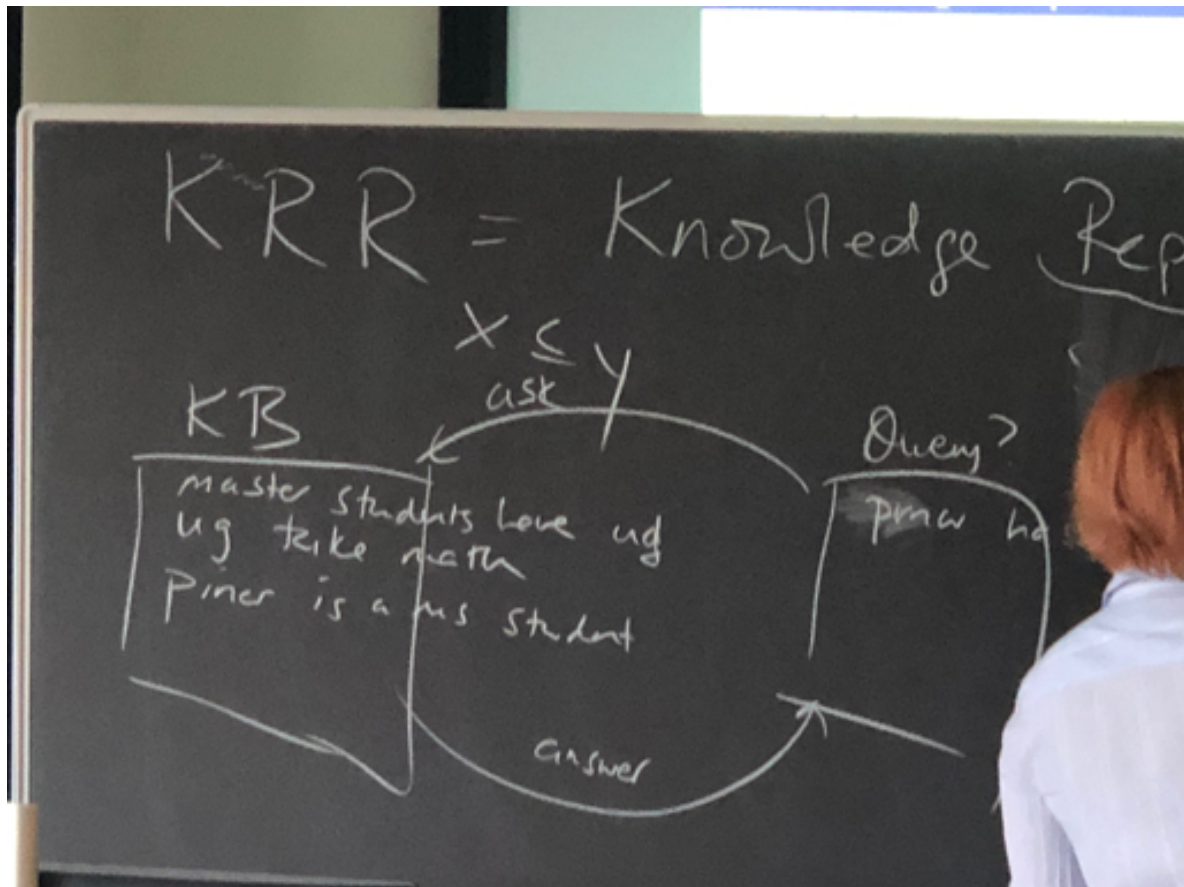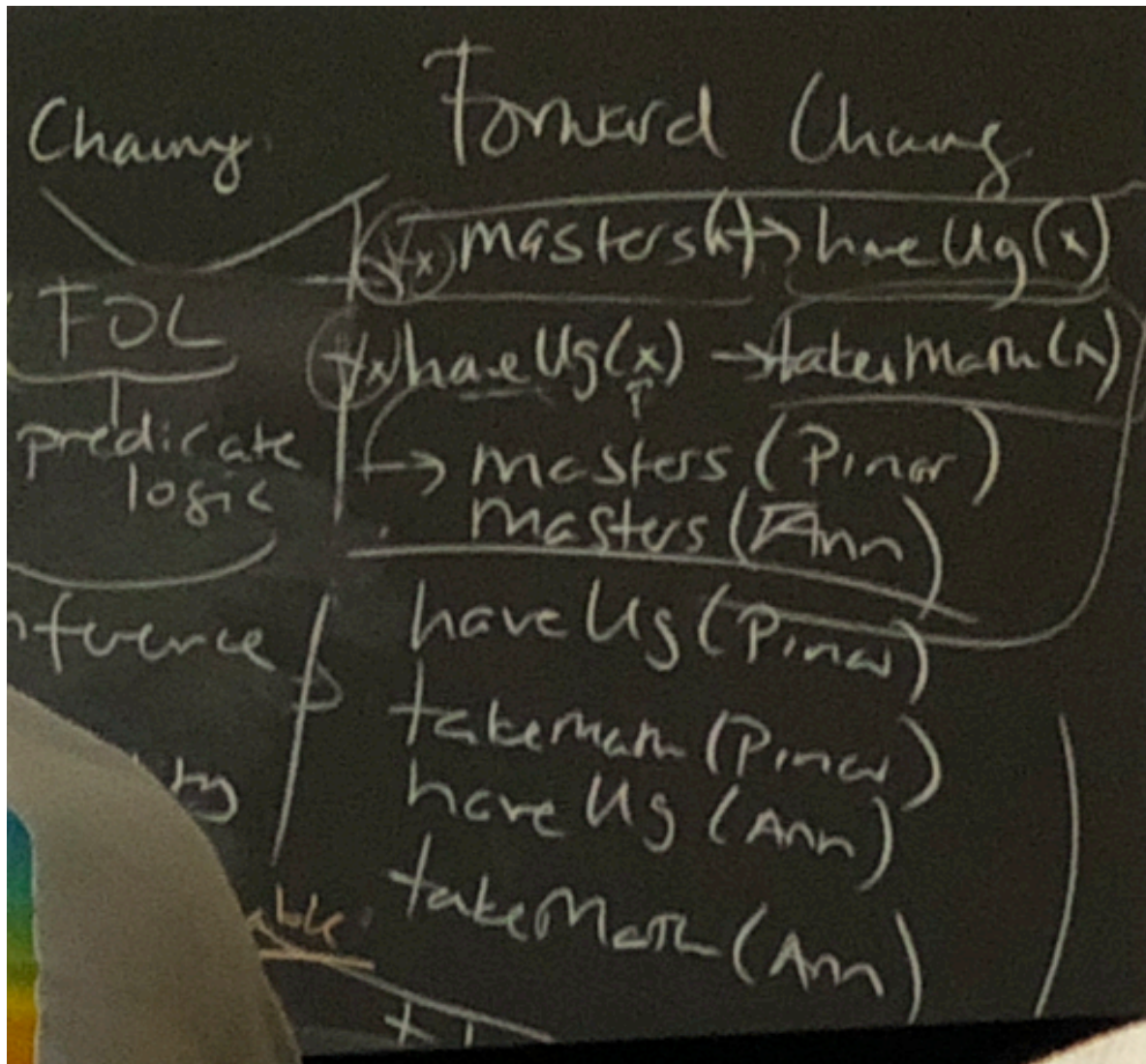# L2 Knowledge Representation (KRR)

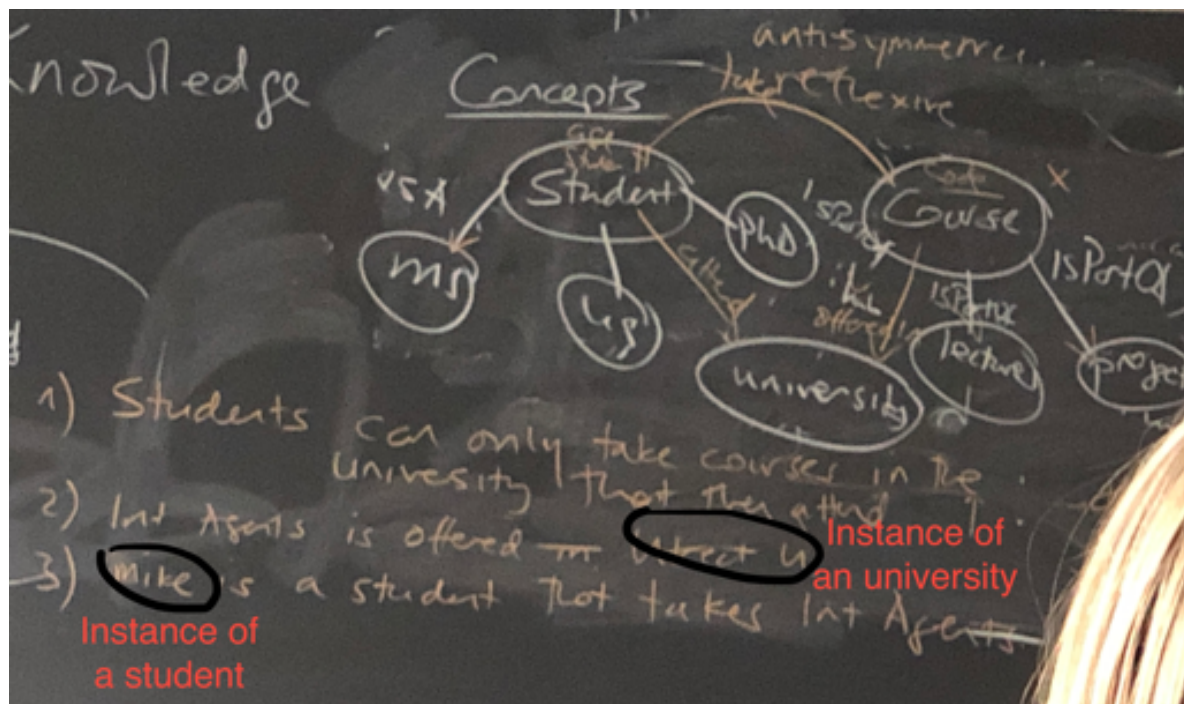- We have used propositional logic in the example.

First Order of Logic (FOL)
- very representing language (think of language constructs)
- making an inference is undecidable (query might not get an answer)
- we can describe the world

Chaing   Forward Chaing

FOL

predicate
logic

inference

by

$\forall x\ \text{masters}(x) \rightarrow \text{have Ug}(x)$

$\forall x\ \text{have Ug}(x) \rightarrow \text{taken exam}(x)$

→ masters(Pinar)
masters(Ann)

have Ug(Pinar)
taken exam(Pinar)
have Ug(Ann)
taken exam(Ann)

Concepts
 – As in methodology, you define concepts
 – For an agent to make sense of what it's doing
 – Like inheritance relation (isA)
 – Like part-whole relation (isPartOf)
 – Are related to each other (otherwise it would be like a catalogue of
   unrelated information)
    – Those relations might have restrictions
    – With restrictions, you can make inferences
    – We can not infer that Mike goes to UU:

Ontology
  – The method for explaining the world
  – Check out https://wiki.dbpedia.org/services-resources/ontology
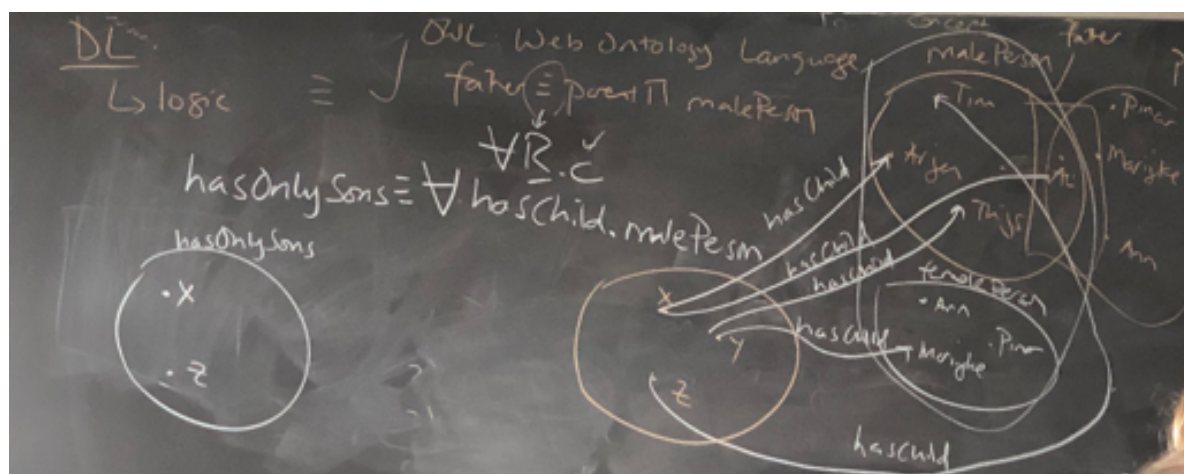 – Check out https://www.bbc.co.uk/ontologies

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Description Logic (DL)
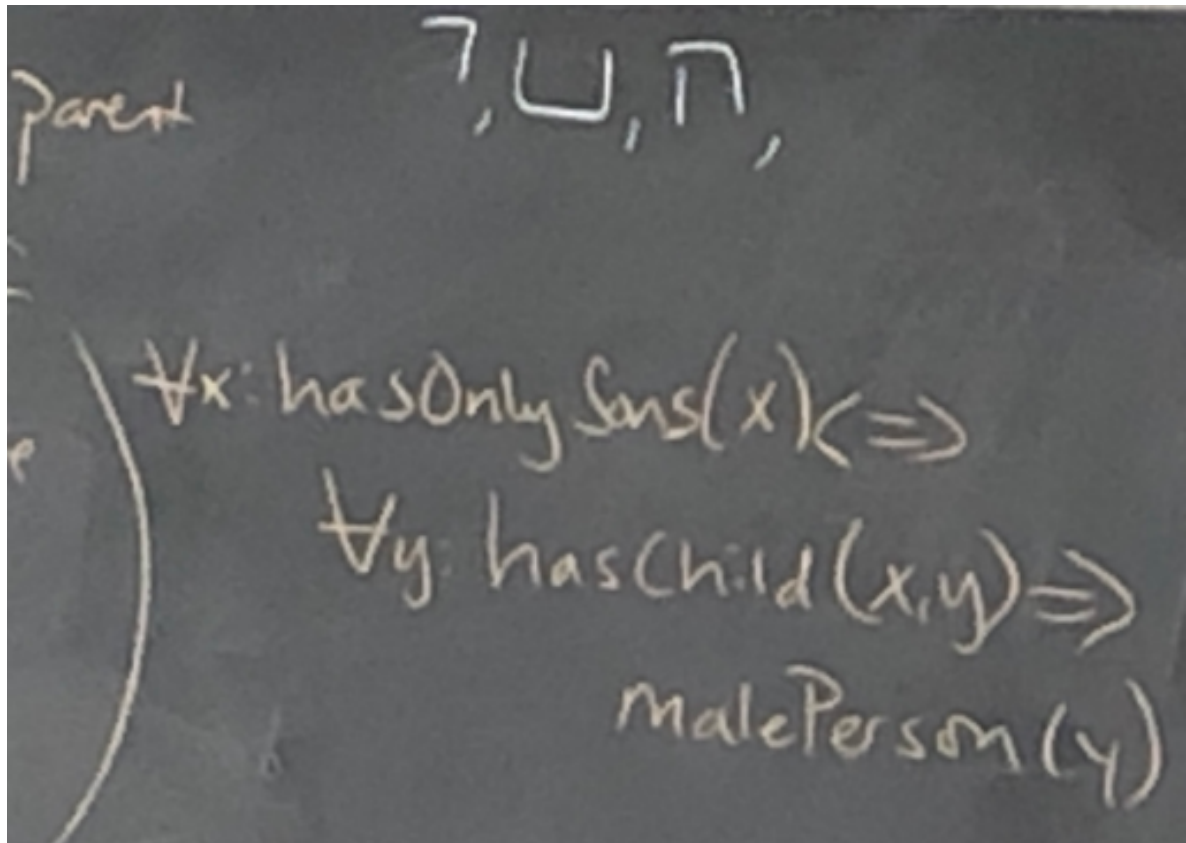 – subset of FOL
  – it is a family of logics; you can expand on it

    logic
    - OWL Web Ontology language
    - every concept is a set

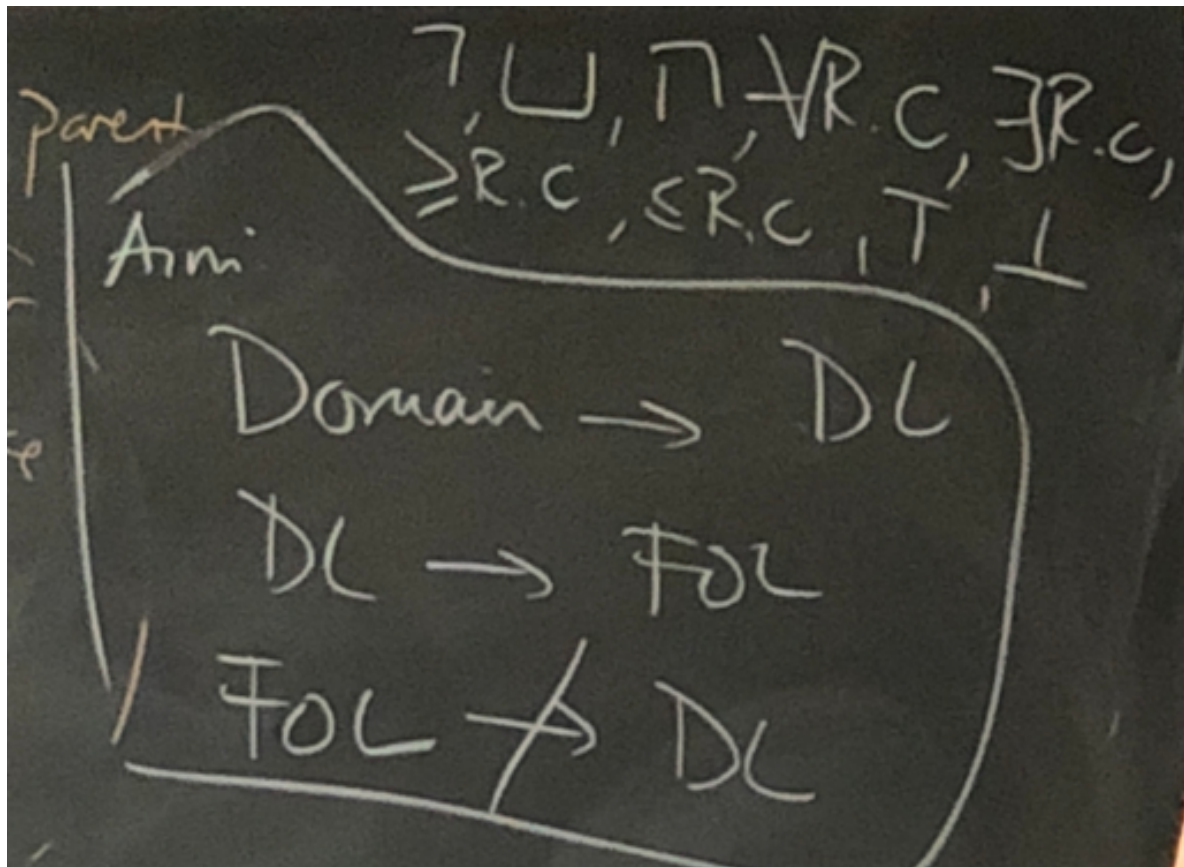Example of sets and restrictions

The same thing from above in FOL:

parent $\neg, \sqcup, \sqcap,$

$\forall x: hasOnlySons(x) \iff$
$\forall y: hasChild(x,y) \implies$
$malePerson(y)$

_____
_____

I should be able to write these:
Domain -> DL
DL -> FOL
FOL !-> DL

parent

Aim:

$$\neg, \sqcup, \sqcap, \forall R.C, \exists R.C, \geq R.C, \leq R.C, \top, \bot$$
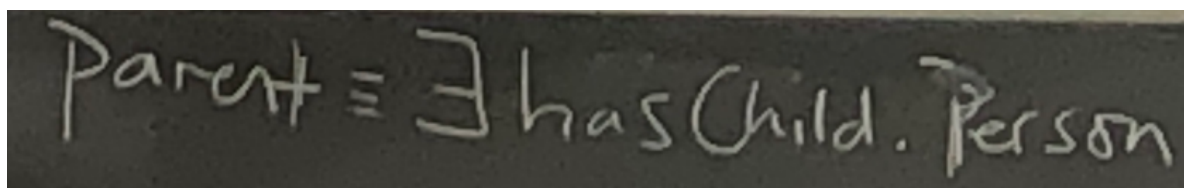
Domain → DL

DL → FOL

FOL ↛ DL

_____
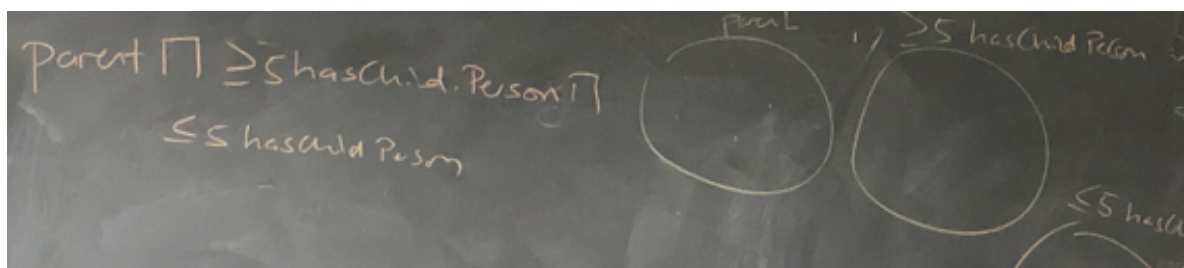
Exercise

Given person, hasChild, hasFriend, malePerson, happyPerson, femalePerson, define the following:
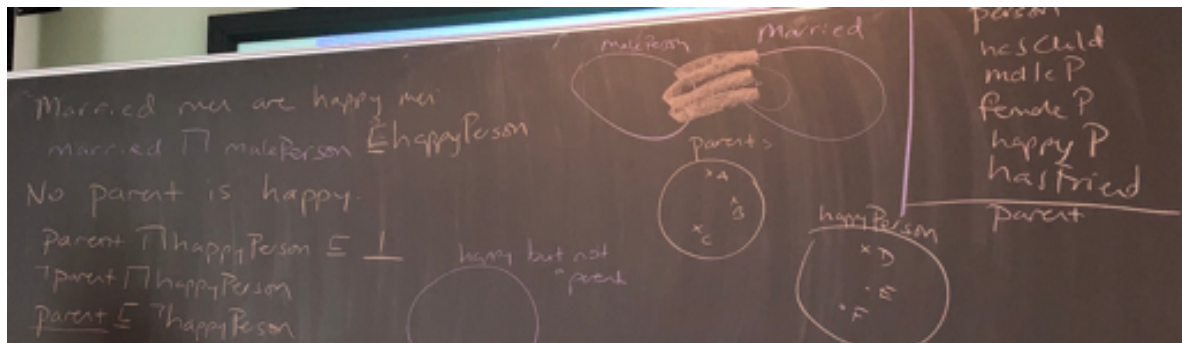- parent has a child

$$Parent \equiv \exists hasChild.Person$$

- parents have at least one child

(See above)
- parents with exactly five children

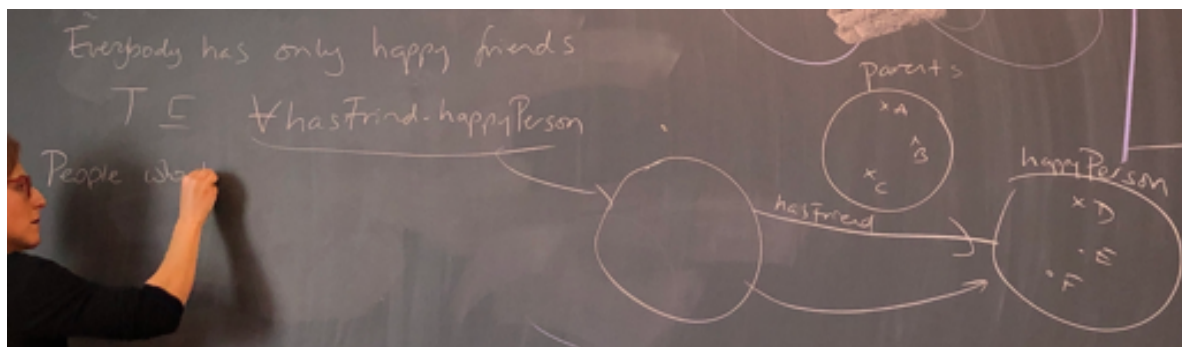$$Parent \sqcap \geq 5\, hasChild.Person \sqcap \leq 5\, hasChild.Person$$
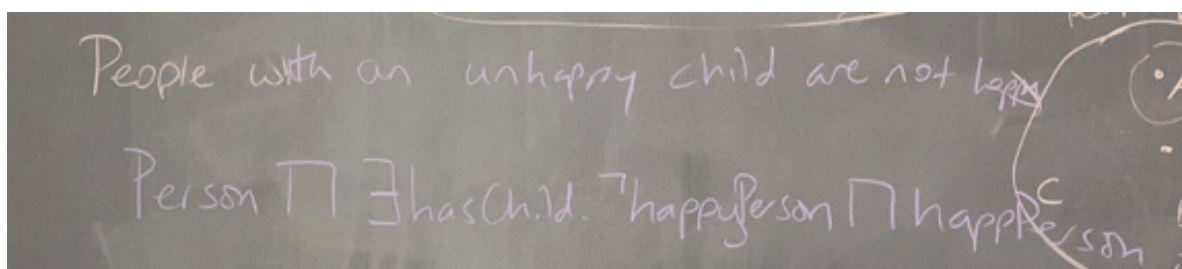
- married men are happy people

- no parent is happy

- everybody has only happy friends

- people who have the same friends are happy

You cant express this in description logic (but you can write it in FOL).

- people with an unhappy child are not happy

Use the slide "Various Syntax" (#22) later on:

https://uu.blackboard.com/bbcswebdav/pid-3298378-dt-content-rid-29262919_2/courses/BETA-2019-1-GS-INFOIAG-V/ontology-dl-lecture%281%29.pdf