

CS548 - Homework 8

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"I, Apurv Upasani, declare that the submitted work is original and adheres to all University policies and acknowledge the consequences that may result from a violation of those rules"

Please find the part 1a , part 2a and 2b on the next page.

Part 1: OWL ontology

- 1) $\text{Employee} \sqsubseteq \text{Personal}$
 $\text{Student} \sqsubseteq \text{Personal}$
 $\text{Employee} \sqcup \text{Student} \sqsubseteq \text{Personal}$
- 2) $\text{Professor} \sqsubseteq \text{Employee}$
 $\text{Admin-staff} \sqsubseteq \text{Employee}$
 $\text{Professor} \sqcup \text{Admin-staff} \sqsubseteq \text{Employee}$
- 3) $\text{Director} \sqsubseteq \text{Admin-staff}$
 $\text{Chair} \sqsubseteq \text{Admin-staff}$
 $\text{Dean} \sqsubseteq \text{Admin-staff}$
 $\text{Clerical-staff} \sqsubseteq \text{Admin-staff}$
 $\text{Director} \sqcup \text{Chair} \sqcup \text{Dean} \sqcup \text{Clerical-staff} \sqsubseteq \text{Admin-staff}$
- 4) $\text{Assistant} \equiv \text{Employee} \sqcap \text{Student}$
- 5) $\text{Dean} \sqsubseteq \text{Professor}$
 $\text{Chair} \sqsubseteq \text{Professor}$
- 6) $[\text{Univ} \sqsubseteq \leq 1 \text{ hasProgram} . \text{Program}] \sqsubseteq \perp$
- 7) $\text{Professor} \sqcap \forall \text{worker} . \text{Professor} \sqsubseteq \text{Professor}$
 $\text{worker} \equiv \text{worker}^-$
- 8) $[\text{Student} \sqcup \exists \text{ advisedBy} . \text{Professor}] \sqsubseteq \text{Student}$
- 9) $\text{advisedBy} \equiv \text{advise}^-$
- 10) $\text{Undergraduate} \sqsubseteq \text{Student}$
 $\text{Graduate} \sqsubseteq \text{Student}$
 $\text{Undergraduate} \sqcap \text{Graduate} \sqsubseteq \perp$
- 11) $[s' \sqsubseteq \geq 1 \text{ enrolledIn} . \text{Program}] \sqcap$
 $[s'' \sqsubseteq < 3 \text{ enrolledIn} . \text{Program}] \equiv \text{Student}$

Part 2a

- 1) Conjunction - Undergraduate \sqcap Graduate (10)
- 2) Disjunction - Employee \sqcup Student (1)
- 3) Existential Restriction - \exists advisedBy. Professor (8)
- 4) Universal Restriction - \forall worker. Professor (7)

Part 2b. Types of inferences

1) \sqcap rule :-

Assume, triple store has following triples:

$$A = \left\{ \begin{array}{l} a : \text{Assistant} \\ a : [\text{Employee} \sqcap \text{Student}] \end{array} \right\} \dots \text{from (4)}$$

By \sqcap rule, we can infer the following:

$$A_1 = \left\{ \begin{array}{l} a : \text{Assistant}, \\ a : \text{Employee} \sqcap \text{Student}, \\ a : \text{Employee}, a : \text{Student} \end{array} \right\} \dots (\text{new triples})$$

2) \exists rule :-

Assume, triple store has following triples:

$$A = \left\{ a : \exists \text{ advisedBy. Professor}, e : \text{Professor} \right\}$$

By \exists rule, we can infer that there must be a s of type Student who is advised by e .

$$\therefore A_1 = \left\{ \begin{array}{l} a : \exists \text{ advisedBy. Professor}, e : \text{Professor}, \\ \langle s, e \rangle : \text{advisedBy}, s : \text{Student} \end{array} \right\} \dots (\text{new triples})$$

3) \forall rule :-

Assume triple store has following triples:

$$A_1 = \left\{ e : \forall \text{ worker. Professor}, \langle p, e \rangle : \text{worker} \right\}$$

ie. there exists a Professor, e , who adheres to OWL rule and there exists a triple of form, $p \text{ worker } e$, then by \forall rule,

$$A_1 = \left\{ \begin{array}{l} e : \forall \text{ worker. Professor}, \langle p, e \rangle : \text{worker} \\ p : \text{Program} \end{array} \right\}$$

we infer that p is of type Program.

iv) inverse inference

Assume, following is present in triple store:

$$A = \{ a : \text{advisedBy} \equiv \text{advise}^{-}, \langle a, P \rangle : \text{advisedBy} \}$$

then by inverse relationship, we can infer

$$A_1 = \left\{ \begin{array}{l} a : \text{advisedBy} \equiv \text{advise}^{-}, \langle a, P \rangle : \text{advisedBy} \\ \langle P, a \rangle : \text{advise} \quad \dots \text{ (new triple)} \end{array} \right\}$$